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Patterns of Engagement: How States Negotiate International Water Agreements

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Abstract

Conflicts over transboundary freshwater resources arise, to a large degree, because property rights are not clearly defined. International water law provides only hints and suggestions as to how states should resolve their water disputes—legal principles and clauses are rather ambiguous and contradictory. But conflict creates the need for cooperation, achieved by means of negotiations, and the specific outcome of negotiations is almost always codified in an international treaty. While this work discusses and analyzes the broader aspects of conflict and cooperation over international fresh water, it specifically investigates bilateral water agreements for rivers with specific geographical configurations and aims to answer a fundamental question: how and why bilateral treaties vary in their design? In fact, by considering actual treaties, one can "back out" the implicit property right. (For example, if a downstream state pays an upstream state to reduce its pollution, it can be said that the *no harm* principle does not stand). This paper will examine international freshwater treaties to deduce the nature of treaty remedies used for resolving conflict for rivers shared by two countries. Geography and economics are the main variables used to explore treaty design. This work is important not only because it investigates how particular variables determine different outcomes (by means of hypotheses testing). It will also tell us how international legal principles and property right conflicts are expressed and negotiated in practice and will therefore have implications for the resolution of ongoing or future interstate conflicts over a given river.

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About the Author

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Patterns of Engagement: How States Negotiate International Water Agreements

Shlomi Dinar

1.Introduction

Of all the transboundary environmental problems that might be studied empirically, freshwater is unique in that the same kinds of problems occur throughout the world. There is only one ozone depletion game, and just a single climate change observation, but there are many international freshwater problems that have similar features. To be sure, each such problem is unique in the details. For example, some river basins are made up of rich upstream states and poor downstream states, which may add to the complexity of the hydropolitical situation. However, many are similar enough that the outcomes associated with them can be compared. In particular, there are currently over 200 documented international river basins, 176 of which are shared by only two states (Wolf, Natharius, Danielson, Ward and Pender, 1999: 424).

When rivers and other water bodies transverse or divide countries, transboundary externalities often arise, creating conflict. The source of the conflict is not just that one country harms another but, more importantly, that international water law defines property rights and responsibilities only vaguely and does not provide states with specific guidelines for negotiation. At the same time, conflict creates the need for cooperation, and cooperation is almost always codified in an international treaty. The following work is an inquiry into the nature of the conflict that can arise, and of the treaty remedies used for resolving conflict, for rivers shared by two countries. Since international water law provides only broad guidelines as to how states should resolve their water disputes and differing utilization plans for a given river, this analysis is interested in investigating actual negotiations between states over shared water resources, exploring the intricacies of the water treaties states negotiate.

The agreements analyzed by this paper were ascertained from different international depositories and were taken from a number of sources including: Oregon State's Treaties

Database[1], League of Nations Treaty Series, United Nations Treaty Series, United Nations Treaty Website[2], The Consolidated Treaty Series[3], United States Treaties in Force (Treaties and Other International Agreements)[4], Food and Agriculture Organization Treaty Index (FAOLEX)[5], United Nations Economic Commission for Europe[6], Ministry of Foreign Affairs, French Treaty Website[7], Repetorio Cronologico de Legislacion—Spain, Department of Civil Engineering of the University of Texas[8], and the World Treaty Index[9]. Other treaties were collected through respective governments. In the case of the World Treaty Index and the United States Treaties in Force, for example, the treaty title was identified yet the text of the agreement was obtained elsewhere.

Specifically, the work is interested in exploring if the observed variation in treaty outcomes can be explained by differences in geography and economics. In particular I shall test hypotheses regarding cost-sharing patterns and the transfer of side-payments between parties to ameliorate pollution problems and resolve disputes over flood control, hydropower and water allocation. Side-payments provide perhaps the clearest means by which to evaluate agreements as they are quite often visibly specified in an agreement. In fact, while I have investigated over 250[10] agreements corresponding to different rivers, I am only interested in specific agreements that refer to a particular conflict addressed by the agreement. By looking at specific agreements, I will show that side-payments do not conform to the extreme legal principles so often advocated—rather compromises are often negotiated. And yet the allocation is not random. Regularities emerge in the data. The location of the riparians is especially important, though it is not the only important determinant of side-payments. This research is, thus, not only important in its own right, showing how international agreements have resolved water conflicts in the past. It will also suggest precedent for the resolution of pending and future conflicts.

As I alluded to above, the main interest of this research is to investigate the relationship between the geographical configuration of a given river shared between two states and

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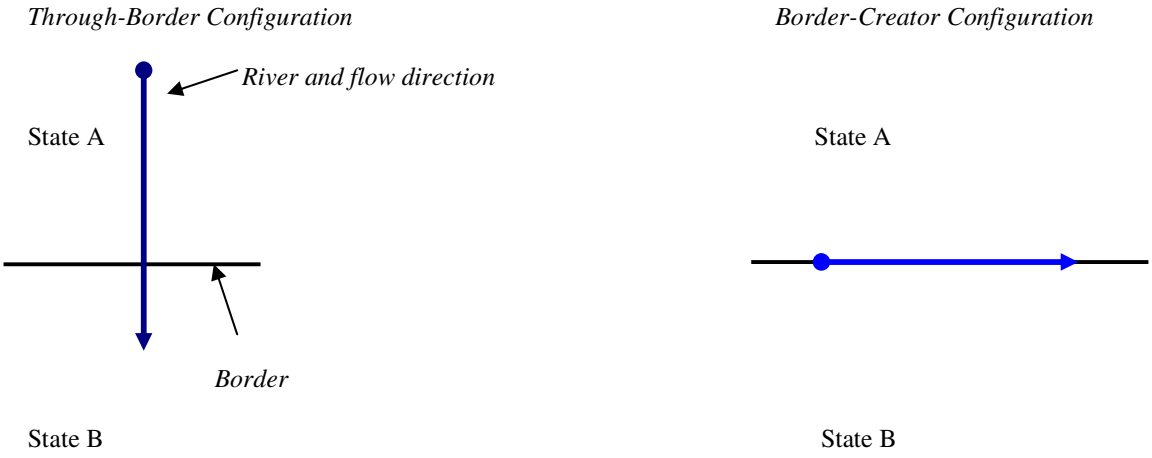
[1] http://www.transboundarywaters.orst.edu/projects/internationalDB.html
[2] http://untreaty.un.org; but also special thanks to the UN Treaty Department and Andri Kolomoets (Database Consultant) who provided all the bilateral water agreements registered with the United Nations.
[3] Parry, C. (Ed.) *The Consolidated Treaty Series*, (Dobbs Ferry, NY: Oceana Publications, 1969).
[4] United States Department of State, Treaties in Force: A list of Treaties and Other International Agreements of the US in Force on January 1, 2001.
[5] http://faolex.fao.org/faolex/
[6] UNECE, *Transboundary Water Cooperation in the Newly Independent States*, Moscow-Geneva, 2003.
[7] http://www.doc.diplomatie.gouv.fr/BASIS/pacte/webext/bilat/sf
[8] http://www.ce.utexas.edu/prof/mckinney/papers/aral/central_asia_regional_water.htm
[9] Rohn, P.H., *World Treaty Index*, 2nd edition (ABC-Clio Information Services, Santa Barbara, California and Oxford, 1984).

differences in treaty design. As Mark Giordano has argued: "the commons problem is in many respects geographic in nature, in that the phenomenon is predicated on the relationship between the spatial domains of resources and resource users." (Giordano, 2003: 365). It is therefore the goal of this research to investigate if the location of state on a river and the geographical configuration of the river—the most rudimentary elements of the relationship between a resource and the resource users—result in different commons regimes.

A quick survey of the past literature reveals that the conventional model of a transboundary river has an upstream and a downstream state. As such, the literature has only focused on a subset of rivers. But rivers flow in many different forms. From the 176 documented river basins that are shared by two states (Wolf, Natharius, Danielson, Ward and Pender, 1999: 424) and only two states, this study has thus far identified 226 rivers (the study has also identified other rivers not documented by the above source) and thirteen types of geographical configurations or configurations (see Appendix A). My research, however, focuses on only two extreme types: the *through-border* river that flows from one country into another, crossing the border only once, and the *border-creator* river, which divides countries without ever crossing their territorial boundary.[11] The two configurations are diagramed below in Figure 1.

Figure 1: Two Pure Configurations



[10] Some of these agreements were counted according to the number of rivers they referred to. So the actual number of individual agreements may be a bit smaller.

[11] Not necessarily referring to the border creating and border crossing bilateral river configurations described here, Frey (1993: 55) draws a distinction between international and transnational river systems. The former refers to rivers that form the boundaries between two or more nations (Rio Grande, Shatt al-Arab) and the latter to rivers that flow across international boundaries (Euphrates River), creating upstream and downstream riparians. For a rigorous investigation of the non-pure configurations see Dinar (2004).

The reasons for choosing the two configurations are twofold. First, I want to test differences between river geographies. A geographically asymmetric relationship exists in the *through-border* configuration. (The working assumption is that upstream country A can harm downstream country B's part of the river but not vice versa.)[12] A geographically symmetric relationship exists in the *border-creator* configuration. (Any state that engages in a harming activity may harm not only the other state but also itself. Also, harm can be reciprocated). Given that the two configurations are different, testing corresponding hypotheses can be undertaken in a relatively methodical and systematic manner and multiple observations can be used for the same type of configuration. Second, all rivers share features of the "pure" geographical configurations. Thus, while mother-nature does not create all rivers as *through-border* or *border-creator*, as Appendix A clearly demonstrates, all shared rivers have properties of each of these distinct configurations. I will expound on the differences between these two configurations and their implications throughout the paper.

Below I will consider the more general issue of conflict and cooperation over international water in the scope of international relations, emphasizing the role of scarcity in fostering both interstate conflict and cooperation. I also argue how strategic tools such as side-payments, issue-linkage, and reciprocity may be incorporated in fostering cooperation. While this discussion does not constitute the main thrust of this paper, it is important for understanding the more basic notion of why treaties are negotiated at all and provides the appropriate setting for discussing the issue of treaty design.

As such, in the proceeding section I will consider the role of side-payments in the context of treaty design and property right conflicts and develop testable hypotheses. I will then review the results obtained from an analysis of thirty-nine specific treaties corresponding to the *through-border* configuration and nine specific agreements corresponding to the *border-creator* configuration in testing the theory and hypotheses. I also apply the theory and hypothesis to the outlying data—the non-pure configurations—about 50 specific agreements.

[12] This is a prototyipical case. But there are instances where dams built downstream cause inundation or environmental damage upstream. I note this phenomenon later in the paper.

2. Conflict and Cooperation Over International Rivers: An IR and Hydropolitical Perspective

2.1. Water Scarcity: Driving Conflict but also Cooperation

According to Elhance, hydropolitics is the systematic study of conflict and cooperation between states over water resources that transcend international borders (1999:3). The hydrology of an international river basin links all the riparian states sharing it in a complex network of environmental, economic, political and security interdependencies, in the process creating the potential for interstate conflict as well as opportunities for cooperation among the states (Elhance, 1999: 13).

In arid regions, especially, countries may utilize the waters of their shared rivers for domestic water consumption. Water scarcity is therefore reflected in the water shortages felt by a given country intensified by the conflicting uses that may ensue among countries vis-à-vis the shared body of water. Falkenmark has argued that environmental stress develops when the population grows large in relation to the water supplied from the global water cycle. As such, conflicts may easily be generated when users are competing for a limited amount of water to supply the domestic, industrial and agricultural sectors (Falkenmark, 1992: 279-280). Falkenmark has also argued that 1,000 cubic meters of water per capita per year constitutes the minimum necessary for an adequate quality of life in a moderately developed country (1986: 192-200). When water availability drops below this figure, scarcity problems become intense. As water scarcity, and environmental scarcity in general, become more acute, violent conflict becomes more probable. The link transcends such issues as constrained agricultural and economic activity, migration, greater segmentation of society, and disruption of institutions (Homer-Dixon, 1999: 80). A multitude of conflicts can develop, ranging from the individual level to the country level (Falkenmark, 1992: 292).

Similarly, whether in arid or non-arid regions, countries may also want to utilize their shared waters for the creation of hydroelectricity, flood control or pollution abatement benefits. In pollution cases, for example, the cost of water pollution is often borne by the downstream riparians, contributing to a renewed lack of international cooperation (Kratz, 1996: 26). All in all, countries may suffer from scarcity in water supply, energy, flood prevention facilities or pollution control and are, therefore, apt to utilize and exploit an international river creating conflict between the riparians. Choucri and North (1975) have further argued that countries

facing high resource demands and limited resource availability would seek the needed resources through trade or conquest. According to the authors' *lateral pressure theory*, when national capabilities (including resources) cannot be attained at a reasonable cost within national boundaries, they may be sought beyond (Choucri and North, 1975: 16). This argument is also related to the water-war thesis, which argues that water disputes, driven by water scarcity and resource capture between states are likely to lead to interstate war (Cooley, 1984; Starr, 1991).

That said, for the same reasons that scarcity can lead to interstate conflict, it can also lead to cooperation. Attempting to ameliorate scarcity or to exploit a given river so as to satiate a particular need, whether it is water quantity or hydroelectricity, can drive states to cooperate for their mutual benefit. As Deudney has argued, resource scarcity based on environmental degradation tends to encourage joint efforts to halt the degradation (1991:10).

With regards to the water-war thesis, Wolf (1998) has documented the results of a systematic searching for interstate violence that involved water specifically as a scarce and/or consumable resource and found only one true water war—4500 years ago—along with only seven cases of acute water-related violence. As Wolf and Hamner have noted in a survey of hundreds of non-navigational water treaties: "…the more valuable lesson of international water is as a resource whose characteristics tend to induce cooperation." (Wolf and Hamner, 2000:66). Homer Dixon (1999: 141) has likewise argued that historic and contemporary evidence shows that violent conflict related to river water is almost always internal rather than international.

As such international water issues seldom turn violent, yet this is not to say that international disputes do not take place over water. However, just as water may be an impetus for disputes among states, it is often a catalyst for international cooperation. As even Choucri and North claim in articulating their lateral pressure theory, one method of increasing capabilities (including resources) is to secure favorable alliances. Alliances, treaties, and other international compacts are frequently concluded to end or moderate conflicts of interest. Such bonds usually imply the pooling of some capabilities for the maintenance of shared interests (1975:21, 219). In short environmental disparities modify the meaning of ecological interdependence whereby "states and groups of states will try to seek alliances as they try to exploit or to escape these disparities."(Brock, 1992:99) As Dokken argues, in some cases such environmental scarcities and environmental problems may be considered the starting points for cooperation (Dokken, 1997).

2.2. Realism, Neo-Realism, Liberalism and Neo-Liberal Institutionalism: Understanding the Larger Context of Conflict and Cooperation

The dilemma between conflict and cooperation so common in international river basins may be understood in the larger context of several international relations theories, which offer alternative explanations as to why states may elect to cooperate in some instances and not others.

Realists and neo-realists argue that the anarchical nature of the international system implores states to care for their survival (Morgenthau, 1967; Greico, 1990: 38). States are also preoccupied with the gains of other states relative to their own gains in addition to their concerns about survival (Greico, 1990: 28; Waltz, 1979: 105). States often fail to cooperate even when they have common interests (Gilpin, 1975: 34 and 26). Thus, scarcity may provide additional impetus for conflict. If cooperation does emerge it is often a reflection of the distribution of power among states (Greico, 1990: 47; Mearsheimer, 1994/1995: 7). States cooperate when cooperation serves the interests of the most powerful state that takes the initiative in formulating a cooperative regime. Otherwise known as *hegemonic stability theory*, the theory predicts that cooperation will take place only in the presence of a hegemon and only if that hegemon chooses to formulate a cooperative regime.

Opposite the realist and neo-realist schools, is a less glum view of the emergence of cooperation—the liberal and neo-liberal institutionalist schools. According to these schools, states are rational egoists and will therefore cooperate if they stand to gain from cooperation and have mutual interests. Scarcity or the need to exploit a shared river may provide the impetus for this coordination of efforts. Furthermore, it is the prospects of cheating and not the relative gains dilemma that often curtails cooperation. In fact, cooperation and attempts at mitigating cheating often depend on the creation of institutional arrangements among states. Therefore, the emergence of cooperation among parties is possible when compliance problems and mistrust among parties are mitigated with the assistance of institutions that generate information, lower transaction costs, increase transparency and reduce uncertainty (Keohane, 1982: 338). According to neo-liberal institutionalists not only will cooperation ensue once mistrust and cheating is alleviated but states will also not be deterred by relative gains, as their main concern is with absolute gains (Axelrod, 1984: 14; Lipson, 1984: 2 and 5; Stein, 1990: 46).

2.2.1. Strategic Interaction: Side-payments, Reciprocity, and Issue-linkage

Acknowledging the realist assumptions—self-interest and sovereignty—that would otherwise impede cooperation, but arguing from a neo-liberal standpoint that unilateralism often fails to

sustain a mutually satisfying outcome and that cheating often curtails cooperation, Barrett (2003) has claimed that the key to cooperation and treaty formation (regimes and institutions) is self-enforcement. In a way Barrett has attempted to operationalize institutions and cooperative arrangements, explaining not only how these agreements may come about but also how they may prove to be successful, by including a strategic-interaction approach to cooperation and treaty making. Perhaps most instructive about Barrett's theory in terms of cooperation is that for an international treaty to be self-enforcing and successful it must be able to restructure incentives in order to succeed in altering the behavior of the parties. According to Barrett, strategy has many means of effecting behavior, one of them being altering incentives of the parties to cooperate through the use of side-payments. In fact, side-payments may be most compelling with regards to cooperation among asymmetric countries (Barrett, 2003: xv, 338-340, 351).

Concern about the future, or the shadow of the future, also helps to promote cooperation and altering payoffs (Axelrod and Keohane, 1985: 232; Oye, 1986:12-18). This is especially true in iterated games as opposed to single-play games (Jervis, 1977:5). In the absence of continuing interaction between the parties, defection would emerge as the dominant strategy. Retaliation targeted at the defecting party can't be employed in the single-play game given that no other opportunities for interaction are expected. Iterated games also permit the parties to resort to the strategy of reciprocity whereby a promise to respond to present cooperation with future cooperation and a threat to respond to present defection with future defection can improve the prospects for cooperation (Oye, 1986: 15; Axelrod, 1984:13-31).

Issue linkage is another strategy that may be used in fostering cooperation and altering payoffs (Victor, Raustiala, and Skolnikoff, 1998:12). Issue linkage involves attempts to gain bargaining leverage on a given issue contingent on the other party's actions towards another perhaps unrelated issue (Haas, 1980: 372). Parties' resources may differ, so that it makes sense to trade one for another. Referred to as 'issue aggregation' by Hopmann, this process entails linking asymmetric issues among parties such that one country has intense feelings for one issue while another party has intense feelings for the other issue, providing a ripe environment for tradeoffs (1998:81).

Although issue-linkage and reciprocity are important strategies for fostering cooperation along international rivers, and will be discussed in some detail below, the main interest of this paper is the use of side-payments in affecting behavior.

2.3. Conflict and Cooperation: The Hydropolitical Context

Despite realist and neo-realist concerns, cooperation in the international arena is not an anomaly. One need only consider the example of international rivers, to realize that cooperation takes place between states.

In fact as the section below will argue, 1) states will cooperate if it is in their mutual benefit, 2) states are concerned with maximizing their benefits and will cooperate if regimes and/or agreements are self-enforcing or if cooperation can provide for mutual gains, and finally 3) cooperation does not depend on hegemony but rather on voluntary contracting among states; yet if a hegemon is part of the negotiations it is seldom a coercive actor.

In fact, as the discussion below will argue, given the nature of international rivers states will elect to cooperate when they can realize immediate or future mutual gains from cooperation (given scarcity or the need to exploit a shared river) and when the treaties they negotiate are able to restructure the incentives to cooperate. The literature on strategic interaction is therefore instrumental in understanding why agreements and regimes take shape on international river basins. Specifically, one need delve even deeper into the hydropolitical context to explore the incentives and disincentives to cooperation.

2.3.1. Geography of a River

The basic starting point for contemplating the hydropolitical cooperation dilemma often rests in the river itself. The imposition of political boundaries on rivers creates different geographical relationships between basin countries, which often provide different incentives for cooperation. Following the main thrust of this work, and as introduced earlier, it is possible to divide international rivers into two pure and extreme configurations: the *through-border* configuration and the *border-creator* configuration.

Juxtaposing the *through-border* configuration against the *border-creator* configuration may be very informative in assessing the potential for cooperation over international rivers given that they are opposite configurations. In fact, the hydropolitical literature has consistently pointed to geography and especially the geographic discrepancies between upstream and downstream states as to why particular water conflicts have not been solved (Gottmann, 1951: 159; Falkenmark, 1990: 184). It is by no means certain that conflict in the use of *border-creator* rivers can be avoided (Falkenmark, 1986: 96), but the geography of *border-creator* rivers helps by facilitating retaliation and reciprocity.

LeMarquand (1977) presents perhaps the first analysis that speculates about different river geographies specific to the potential for conflict and cooperation over a shared water body. According to LeMarquand (1977:8) successive rivers (upstream/downstream situations) and contiguous rivers (where the river creates the boundary between the countries) create different incentives or disincentives for cooperation. While LeMarquand does not necessarily distinguish between the pure *through-border* and *border-creator* configurations, which I investigate, he makes two distinct conclusions about possible outcomes for conflict and cooperation based on the two river geographies. According to LeMarquand, there is significant incentive for cooperation when the river is contiguous—the incentive to reach agreement is to avoid the "tragedy of the commons" (LeMarquand, 1977:9). Alternatively, there is no incentive for cooperation when the upstream country uses the river water to the detriment of the downstream country and that country has no reciprocal power over the upstream country (LeMarquand, 1977:10).

2.3.2. Geography and Aggregate Power

If we follow LeMarquand's (1977) geographical argument to its logical conclusion, we would not expect an upstream country that may be using an international river to the detriment of the downstream state to cooperate at all in utilizing the international river. To be fair, LeMarquand does argue that a downstream state will need to utilize some reciprocal power to sway the upstream state to cooperate which motivates the following discussion about aggregate power (military and economic power) that can be used to offset the geographical advantage of upstream states. In fact, if we incorporate some element of aggregate power into the hydropolitical equation we are then able to better understand how cooperation may ensue in upstream-downstream situations.

Although imbalances in power relationships among states have been argued by some in the hydropolitics literature to impede cooperation (Just and Netanyahu, 1998:9; Hijri and Grey, 1998:89), a variant of *hegemonic stability theory* has been regularly applied in the hydropolitics literature to explain cooperation over shared waters. Lowi (1993) has been the main advocate of this implication. According to Lowi, the interest of the hegemonic state along a river is often a prerequisite to cooperation. But cooperation is more likely to ensue if the hegemon is located in a strategically inferior position—downstream—and if the hegemon's relationship to the water resources is that of critical need. Conversely, cooperation will not be forthcoming if the hegemon is upstream since it holds the strategic geographical position.

Lowi's (1993) hydropolitical variant of *hegemonic stability theory* suggests, therefore, that an upstream hegemon will have little incentive to cooperate on an international river. It also suggests that hegemonic downstream powers may be able to impose certain arrangements on weaker riparians or not require their consent in formulating these arrangements.

The example of the 1973 Colorado River Treaty (not discussed by Lowi) challenges Lowi's contention. The United States was both the hegemonic state and upstream and should have had no incentive to cooperate with Mexico or come to an agreement over their shared river. Contrary to the predictions of Lowi's variant of *hegemonic stability theory*, the United States not only entered into an agreement with Mexico but also paid for the costs of desalinating the waters of the Colorado flowing into Mexico. Given the Colorado River example, we must therefore conclude that cooperation in international rivers requires explanations that go beyond pure strategic local, power politics and economic incentives. In short, hegemonic and similar realist explanations do not take into account strategic interactions between states that espouse such concepts as issue-linkage, reciprocity and the role of side-payments in altering a state's payoffs, making it more inclined to cooperate.

2.3.3. Reciprocity and Issue Linkage

States, while obviously in a position to do so, do not always exploit their strategic location on a river or their aggregate power to the detriment of the downstream state by electing not to cooperate. There are several reasons that explain this phenomenon; the main one being Elhance's (1999) and the neo-liberal contention that unilateralism often fails to sustain a satisfying outcome. Geography may play a role too but, as discussed above, cooperation may also be a product of reciprocity and issue linkage. For, example countries may share more than one river with another country. As such, a country would not want its strategic behavior on one river to be reciprocated with strategic behavior by the other country on another river.

Foreign policy considerations may also help to promote cooperation when otherwise not expected, offsetting the temptation of upstream states to reject cooperation. LeMarquand has made this specific argument in the context of the Colorado River (1977:12-14). According to LeMarquand, the economic incentives to remove the salt from the waters of the Colorado River delivered to Mexico were considered uneconomical for the United States. However, not only did the United States not want to be considered a belligerent bully in the eyes of its southern neighbor and the rest of Latin America by rejecting cooperation but also considered cooperation on the water issue as a form of gaining cooperation and support on other fronts (LeMarquand,

1977: 46). By cooperating, the United States was hoping to build a 'reservoir of goodwill,' which would be reciprocated by Mexico in some fashion.

2.3.4. The Role of Side-Payments in Inducing Cooperation

Upstream states don't only cooperate with downstream states because they are concerned about their national image or share a spectrum of issues with the downstream country, which generate a level of reciprocity and issue linkage. States will cooperate when taking the unilateral route over the cooperative route provides no or little benefits.

But a related motivation for the upstream country to reach agreement on projects such as hydropower and flood control with a downstream country, which provide benefits to both countries, is derived from the notion that regulation of the river will generally provide external benefits downstream to which the upstream country will not receive compensation if an agreement is not negotiated (LeMarquand, 1977: 9).

Weaker and smaller upstream states can be even more handsomely rewarded by more powerful and larger downstream states that wish to exploit the river basin. While the weaker upstream country may not have the sufficient needs or capabilities to exploit the river basin to its advantage, the more powerful downstream state does. Where regulation of the river for flood control and hydropower purposes is sought and the majority of the facilities need be built upstream, upstream states may take advantage of the situation agreeing to cooperate in exchange for some kind of compensation whether it be side-payments or in-kind (through projects that will be of immense benefit but will be largely funded by the downstream country). The upstream state will therefore incur little if any capital costs for the project but will gain particular benefits as a prerequisite for providing its territory for the project.

Negative externality problems created upstream and felt far downstream from where they originated are naturally exacerbated in the *through-border* configuration. An upstream state may have little incentive to cooperate in abating the pollution since it is strategically located, the source of the pollution, and given that the externality is not reciprocal but rather unidirectional in the downstream direction. Besides issue-linkage, side-payments may also figure into this geographically asymmetric relationship, as downstream states will need to provide some sort of incentive for the upstream state to abate the pollution.

A final scenario where an upstream state is likely to cooperate concerns a cooperative agreement over a project that is built mostly for the benefit of the downstream state in the upstream states' territory or a project that is built in the downstream country but causes harm

upstream. Like in the above cases, cooperation will only be forthcoming when compensation is given from the downstream states to the upstream state (LeMarquand, 1977: 10).

That said, Appendix B provides a game-theoretic representation of a dispute between two states sharing an international river and a second representation of how side-payments may induce parties along a *through-border* river to cooperate.

With the larger context now set I pursue the notion of side-payments not only in relation to cooperation but also with regards to property right disputes.

3. Treaties, Property Right Conflicts, and International Water Law

In this section I am interested in explaining how treaties differ in their design. That is, I am interested in how conflicting interests and uses on international watercourses are negotiated between states. International water law is vague and general, providing states with no clear rules of how to solve property right conflicts. It is therefore by analyzing the actual treaties that one is able to "back out" the negotiated outcome and the impending property right solution.

As I will argue in this section, some of the same variables that were discussed above—namely side-payments—which provide the necessary incentives to make cooperation possible, will also be instrumental in guiding the analysis on how treaties differ in their design. As Barrett has marked, side-payments 'ratchet up' the cooperation problem by inducing states that may have otherwise not cooperated to cooperate. In addition, "side-payments may reflect an implicit agreement about property rights." (Barrett, 2003:357). Considering the side-payment arrangement negotiated in an international agreement will tell us which state has the property right do what and how extreme legal principles are reconciled. For example, if a downstream state pays an upstream state to abate pollution, we can back out from this agreement that the *no harm* principle does not stand. Side-payments are also the most direct and easiest way to detect how property right conflicts are resolved because they can be ascertained by reading the agreement. This section will also consider the cost–sharing patterns negotiated among the parties.

Below I begin with a short discussion on property rights and discuss the role of international water law in resolving water disputes. In line with the main theme of this paper, I then delve deeper into the relationship between the geographical configuration of a given river and the side-payment and cost-sharing game played between states as they conclude a set agreement and resolve a property right conflict. As I argue, however, while geography is an important variable for explaining how property right conflicts are resolved, economic differences between the states also play a role in this determination.

3.1. Property Rights and International Water Law: Poorly Defined and Unclear

3.1.1. Coase Theorem

The Coase theorem tells us that, given any initial allocation of rights, no transaction costs, and the ability of countries to negotiate and enforce redistributions of rights, final allocations of resources will be efficient (Coase, 1960). The location of the state is unimportant to the Coase theorem. Whether the upstream state has the right to pollute or the downstream state has the right not to be harmed, the final allocation will be the same—that is if the victim had the right to a clean environment then the polluter would pay the victim to accept that level of pollution at a point where the marginal benefit to the polluter of an additional increment of production would equal the marginal cost to the victim of an additional increment of pollution. Conversely, if the polluter had a right to pollute then the victim would have to pay the polluter to abate the pollution at a point where the marginal benefit of another increment of cleanliness would equal the marginal costs of the foregone production (Coase, 1960:2-8). As I shall argue location plays an important role in who pays for the abatement of pollution in international rivers.

The Coase theorem is not really relevant to international rivers given other considerations. For example, the Coase theorem takes as given an initial allocation of rights. Similarly, Coase presumed the existence of judges and governments (basically a domestic setting) being able to assign and reassign property rights, which assumes some kind of central authority. In the international arena, this is not the case, as no central authority exists to enforce international contracts. Similarly transaction costs are often greater than zero.

3.1.2. International Water Law

The above discussion reinforces the idea that conflict on international watercourses arises because property rights are not clearly defined. For example, if the property right belonged to the upstream state, it could do what it wants regardless of harm to the downstream state—in the water lingo this is known as the principle of *absolute territorial sovereignty*. Conversely, if the property right belonged to the downstream state, it would have a right not to be harmed by the upstream state—the principle of *absolute territorial integrity*.

Both Principle 21 of the 1972 Stockholm Declaration on the Human Environment and Principle 2 of the 1992 Rio Declaration on Environment and Development recognize this conflict but do little to resolve it. Even if it is agreed that both the Stockholm and Rio Declarations

support a compromise by juxtaposing both extreme principles against one another, one is still struck by the vagueness of this compromise.

Over the years there has been an attempt to Draft a convention solely pertaining to the non-navigational utilization of international watercourses. In 1997 the United Nations adopted the Law of the Non-Navigational Uses of International Watercourses. The Convention is a general framework agreement containing numerous articles developed for use by states in resolving their common water disputes. The Convention, however, was never "ratified, accepted, approved or acceded to" by a sufficient number of states and never entered into force. As of August 2002, only 12 out of 35 countries needed for the Convention to enter into force have ratified. The deadline for ratification has long passed.

The Convention nonetheless emphasizes two main principles. The first, Article 5, promotes the *equitable and reasonable utilization* principle—the so-called compromise principle between the two extreme principles discussed above. The second, Article 7, is the *obligation not to cause significant harm* principle.

Since the Convention was adopted in 1997, international legal scholars have argued that Article 5 takes priority over Article 7 (McCaffrey, 2001: 308-310). As McCaffery has argued, "..in the field of international water courses it is not the causing of significant harm *per se*, but the unreasonable causing of such harm that is prohibited." (McCaffrey, 2001: 370-371). Yet as implied above, the emphasis on *equitable and reasonable utilization* has not meant a lot for states in conflict over an international river. It only suggests increased support for reconciling the various interests of river basin states in the development of their shared waters (Wouters, 1997:xxiv). At the same time, *equitable and reasonable utilization* must also contend with the *obligation not to cause significant harm*.

To be fair, although the Convention has stirred some controversy among states, which may favor one article over another, it does not attempt to provide countries with specific guidelines for dispute resolution. Rather the Convention attempts to codify customary law in the most general terms. It is an umbrella convention and does not pretend to replace individual agreements negotiated between countries over specific disputes. As Barrett has observed, custom gives expression to this need for restraint and treaties impose further constraints and apply them with greater specificity." (Barrett, 2003: 110) It is in existing agreements, therefore, that we may detect how states specifically go about reconciling conflicting interests in developing water resources or solving transboundary pollution problems. *Equitable and reasonable utilization* and the *obligation not to cause significant harm* are not fixed or assigned but rather negotiated.

3.2. The Variables

3.2.1. The Geographic Imperative

Recall that the goal of this paper is to explore the relationship between the geography of a water body and the terms of the agreement aimed at resolving conflict—that is to see if the observed variation in treaty outcomes can be explained by differences in geography. Surely, some of the differences are due to factors unrelated to spatial characteristics and geography, yet it seems reasonable to assume that part of the expected variation exists because different geographic forms of the commons are better governed under some regimes rather than others (Giordano Mark, 2003: 371-372).

3.2.1.1. Broader Context: Geography and Bargaining Power

According to the realist school of international relations, state power is largely made up of military capabilities (Claude, 1962: 6). Neo-realists also confirm that the ability to use force is a key to state power. Survival is the ultimate concern of states and military might the essence for achieving it. Similarly, the use of force is the ultimate means to influence the policies of other states (Waltz, 1979: 104, 113, 126 and 209). Even the classic negotiation school concurs, arguing that "power tends to rigidity in international negotiations, and total power tends to total rigidity" (Lall, 1966: 338).

The more recent negotiation literature, however, disagrees. It considers the importance of issue-specific structural power (Habeeb, 1988: 18 and 145; Hopmann, 1998: 107). "Whereas aggregate structural power is concerned with an actor's capabilities and position vis-à-vis the external environment as a whole, issue-specific structural power is concerned with an actor's capabilities and position vis-à-vis another actor in terms of a specific mutual issue" (Habeeb, 1988:18). In the context of negotiations over a shared river, upstream states may hold particular bargaining power not available to downstream states (Clarke, 1991: 94; Nunn, 1996: 173).

This analysis is most compelling when an asymmetric power relationship exists between a militarily and economically powerful downstream country and a weaker upstream country as in the case of Lowi's (1993) variant of *hegemonic stability theory*. The strong downstream country may have the military and economic power and may use it to influence and bully the upstream country yet the weaker upstream country is strategically located at the source of the river and may use its locational power accordingly in the bargaining process.

As Zartman and Rubin argue, the weaker state has something that the stronger state values but that the stronger state chooses not to take by stealth or force but rather by the give and take of negotiations. Alternatively, the stronger side is not strong enough {or does not deem efficient} to take what it wants by force and can do better by giving a sense of equality to the weaker side (Zartman and Rubin, 2000: 289). Therefore, while a downstream hegemon may play a role in the formulation of a cooperative regime, that hegemon, strong as it may be in terms of aggregate power, may not always be able to impose its will on other states in the formation of institutional arrangements (Zartman and Rubin, 2000: 2; Young, 1994: 128; Zartman, 1991: 66). As Young has observed: "those countries in possession of structural power will often find that they can achieve more by using their power to make promises and offer rewards than they can by relying on threats and punishments" (Young, 1994:135). The notion that a powerful country may have a greater need to develop a shared river but less of a need to negotiate a dispute with a weaker country affected by its development (Murphy and Sabadell, 1986:143) is, therefore, challenged.

3.2.1.2. Geography, a State's Interest in Negotiations, and Side-Payments

Geography sets the context for bargaining (Waterbury, 1994: 40). The unidirectional feature of some rivers means that resolution of basin conflicts through mutual control of external effects that work reciprocally (as in the *border-creator* geography) is generally ruled out (Rogers, 1993:118). Conversely, reciprocal externalities are the hallmark of common property resources (Dasgupta, Maler, and Vercelli, 1997:2) such as a *border-creator* river. It is because all parties do not necessarily have to bear the full economic consequences of their actions that the *through-border* configuration confers certain powers on the upstream country (Durth, 1996: 62). Reciprocal externalities differ from unidirectional externalities in that there exists a direct means by which one party may punish or reward the other's behavior, though not necessarily substantially (Barrett, 1994: 28).

Given these two different geographical configurations, the incentives for cooperation may also be different. As Fox and LeMarquand (1979) have argued: "the potential uses for which a river can be managed and the location of developmental and use activities in relation to the location of political boundaries influence in a significant way what the incidence of benefits and costs will tend to be, and determine the kinds of arrangements that will be necessary to achieve what will be mutually regarded as an acceptable sharing of such benefits and costs." (1979: 11)

Considering pollution problems may be especially instructive, when comparing the incentives for negotiation between *through-border* and *border-creator* rivers. A downstream nation will likely ask for strict controls of water pollution caused by its upstream nation. In turn, upstream states may be far less inclined to take the problem seriously let alone to bear responsibility for devising an appropriate solution, than the downstream interest (Faure and Rubin, 1993: 22-23). In a situation of geographical asymmetry, those who want to change the status quo do not have the means to provide incentives to those interested in maintaining the status quo (Linnerooth, 1990: 641-643). To change the incentives, the downstream (the victim country) state may have to offer side-payments to the upstream state.

The situation in a *border-creator* river is different. Pollution through wastewater effluents, for example, also affects the banks and territory of the country, which engages in pollution just as it affects the neighboring state. The incentive to abate pollution or prevent it before it is emitted into the water is thus intrinsic to the geography of the river. For this reason, pollution may be less of a problem for this kind of geography. In fact, side-payments need not be provided for abating pollution given that the problem is one of a reciprocal nature and not of a unidirectional nature—the externalities are at least partially internalized given the river geography. The geographically symmetrical relationship between the actors, at least in comparison to the *through-border* configuration, will also imply that development of the joint river will require the equal participation of both countries. In the *border-creator* case the incentive to reach agreement is to avoid the 'tragedy of the commons' and the development of the river will not require one party having to entice the other.

More can be said about property rights by considering the side-payment game. LeMarquand has argued, that while the polluter pays principle (PPP) has been acknowledged by the legal community as the morally accepted principle, the polluting state has a strong incentive to reject this principle since it would require the polluting country to abate its discharges at its own expense for its neighbor's benefit (LeMarquand, 1977). In fact, the literature tells us that where upstream countries are degrading the river for use by the downstream countries, the downstream countries—contrary to prevailing opinion regarding the PPP—may have to pay for the cost of stopping the damaging activity (Fox and LeMarquand, 1979: 18; Faure and Rubin, 1993: 23; Giordano Mark, 2003: 371).

But tackling the geographically induced asymmetry is critical (Haftendorn, 2000: 52, 62 and 68) in all domains of water use such as hydropower, flood control and even access to water. Side-payments are again used to overcome the implicit geographical advantage and induce the

political will of upstream states (LeMarquand, 1981: 147-148; Rogers, 1993: 118). The aim here is to create a situation whereby the advantaged state may be compensated for giving up its relatively advantaged position (Haftendorn, 2000:64). The property right conflict, intrinsic to how the river shall be developed, will thus be resolved in the form of side-payments to upstream states in return for 'downstream benefits'. The same may hold for projects that solely benefit downstream states but affect upstream states. To gain the accession of upstream states for the project, side-payments shall again be provided to the upstream state. The downstream state may, therefore, have the property right to construct the project but it must provide compensation to seal the deal, thus recognizing the upstream state's property right to the river too. The compromise is again expressed in the form of side-payments.

3.2.1.3. Concluding Remarks for Geography Section

The analysis and literature review presented above provides a case for the role a river configuration may play in facilitating conflict or cooperation. In negotiations over an international river, the upstream state may therefore possess issue-specific structural power given that it controls the source of the river and the sights where most of the necessary projects can be built. This issue-specific structural power may be especially instrumental when the downstream state is more powerful in military and economic terms but would rather negotiate with the upstream state given its advantageous physical position along the river. In any case, side-payments may often have to factor into this geographically asymmetric situation.

As also noted in the section above, international law doesn't assign rights to shared resources unambiguously. By looking at the final allocations agreed to in a treaty, however, we can "back out" the implicit initial allocation. For example, if the downstream state pays the upstream state for all pollution control upstream, then the upstream state is essentially recognized as having the right to pollute. Similarly, the direction of side-payments will also tell us not only how cooperation may be fostered given the two configurations but how conflicting uses or even integrative uses, such as a joint project, of a given river are reconciled, provided that both states may have different visions for its utilization.

Yet if only geography mattered, then treaty outcomes should be consistent between the *through-border* and *border-creator* configurations and treaty designs consistent between upstream and downstream states. That is, if only geography mattered, it would not be important that asymmetries characterized the relationship between basin states and the downstream state were richer or poorer than the upstream state. But this may not be the case. Environmental

problems are often characterized by large asymmetries across countries; both in terms of benefits received from abating and the cost of abating (Botteon and Carraro, 1997: 27). While the work here tries to distinguish itself from other work in the field by elaborating on the role of geography in negotiations over water and by focusing on two extreme geographical configurations, economic factors should also play explanatory roles.

3.2.2. The Economic-Political Imperative

3.2.2.1. Economic Asymmetry as a Bargaining Tactic: The Side-Payment Game

The deficiencies of *hegemonic stability theory* in explaining cooperation, does not deny "the existence of asymmetries among parties in a given issue area both with respect to the intensity of their interest in the problem and with respect to the usable bargaining strength" (Young, 1989:354).

The literature on asymmetrical environmental negotiation deals with the limited resources and assets a poor nation can bring to bear relative to a richer nation. The premise is that an asymmetrical relationship may actually favor the poor state. Cooperation from the poorer country will ensue if the richer country provides economic and financial incentives (Sjostedt and Spector, 1993: 311-312). While the more asymmetric the power relationship, the more unequal the distribution of gains, it does not follow that the asymmetries of gains will always favor the stronger state—the malign view of the hegemon as a coercer. Indeed the opposite may be true more of the time—the benign view of hegemony (Milner, 1992:470). In this case the small member will gain proportionately far more benefit from the big member's exertions than vice versa—the traditional view of hegemony in the international system is thus turned on its head (Snidal, 1985:581).

The stronger state is, therefore, quite often able to provide weaker states benefits or compensation to induce their cooperation (Milner, 1992: 480). In the case of public goods, or reciprocal externalities, the big member may also find it worthwhile to provide all of the good regardless of whether the others contribute anything (Olson and Zeckhauser, 1966; Russett and Sullivan, 1971: 853). The burdens borne and the sacrifice are, therefore, disproportionate. To be fair the stronger party still gains, yet it is not necessarily taken advantage of by the weaker parties or able to exercise its power over other states to its sole advantage. Instead, the relationship between weak and strong states, with asymmetric preferences for a normal good or with geographical discrepancies among them, should be considered as a relationship where the

strong states need entice the weaker state, or at least attain explicit consent from participants, to cooperate rather than forcefully compel them and impose a cooperative agreement (Young, 1982:283).

3.2.2.2. Differing Income Levels/Pollution Standards, Bargaining and Side-Payments

Unlike the more optimistic discussion regarding the *border-creator* configuration above, others have argued that the combination of non-excludability and rivalness in consumption means that there is rather a stronger individual incentive to exploit common pool resources (Barkin and Shambaugh, 1999: 6). This is especially the case when the two states have different conceptions of time horizons vis-à-vis the resource (Barkin and Shambaugh 1999: 13 and 178). Of course, a state's discount rate regarding a resource and its preferences for the environment, (which can be reflected in its pollution standards), is also a function of its economic well-being (Botteon and Carraro, 1997: 27). Poor countries may have more of a propensity to pollute to the detriment of wealthier countries with higher pollution standards. Conversely, positive links exist between income and environmental quality, being that there is an increased demand for environmental protection at higher incomes (Dasgupta and Maler, 1994: 4-5).

As Hopmann has observed with regards to the outcomes of asymmetrical negotiations, the party that incurs the least losses associated with being left at the status quo point of no agreement will often be the favored party in the bargaining game (Hopmann, 1978: 162-163 and 176). The country with the longer shadow of the future has a strong incentive to behave in a concessionary manner vis-à-vis the country with the shorter shadow of the future to secure an agreement (Barkin and Shambaugh, 1999:13). For developed countries, therefore, gaining the participation of developing states in international agreements has often required paying their participatory cost (Raustiala and Victor, 1998:696).

According to Scott (1974: 842), states with a shorter shadow of the future for the resource have more bargaining power relative to those states with a longer shadow of the future vis-à-vis the resource and side-payments may often figure into to such a relationship. Negotiations among states with homogeneous preferences, such as the weight states give environmental issues, requires smaller transfers. Conversely, when constraints are imposed on transfers, mutually beneficial agreements may not exist, in particular if state preferences are very heterogeneous (Compte and Jehiel, 1997: 64). As such the ability to withstand losses, in this case a shorter shadow of the future, is a crucial element of bargaining power (Schelling, 1960: 22-23).

3.2.2.3. Economic Asymmetries, Pollution Standards, and 'Good Will'

Financial capacities and prosperity enable wealthy governments to finance water quality projects in neighboring countries (Shmueli, 1999: 439). As the above section argued, poorer countries may also have different and perhaps weaker pollution standards than richer countries. As Linerooth has observed: "..the more developed upper riparian nations may wish to create 'good will' with their neighbors by contributing more to pollution control while benefiting less" (Linnerooth, 1990: 643). That is, financial aid and technological benefits can be transferred to remedy the environmental deficiencies emanating from underdevelopment. From a negotiating point of view, the rich country is willing to pay more even when it is upstream. This relationship between economically asymmetric countries may also transcend itself to other issues beyond pollution abatement.

3.2.2.4. Concluding Remarks for Economic Section

While the geography of a given river and the location of the riparian states along the river are important for explaining conflict and cooperation over international rivers and property right outcomes, they are not sufficient. If that was the case then variations in outcomes should not be different for cases with rich and poor riparians. Compared to less rich states, a richer nation not only has a higher willingness to pay for particular projects but, in cases of pollution, will have a lower threshold for accepting pollution. This reality should either reinforce the outcomes predicted by the geographic theory—given a richer downstream state, or perhaps even provide an opposite outcome to that predicted by the geographic theory—given a richer upstream state.

A similar scenario holds for economically asymmetric riparians situated along a river with a *border-creator* configuration. The richer nation may be able to take on the majority of the costs of a joint project or provide incentives to the poorer state for abating pollution. Despite the harm the poor state causes itself by polluting on a *border-creator* river, its threshold for accepting pollution is much higher than that of the richer state, given its shorter shadow of the future.

4. Testable Hypotheses and Results for Treaty Design Investigation

The above theoretical discussion allows for four testable hypotheses:

Ho(1): All else being equal, in the *through-border* configuration side-payments will be provided by the downstream state to the upstream state.

Ho(2): All else being equal, in the *border-creator* configuration side-payments will not be provided and costs will be shared equally.

Ho(3): All else being equal, for the *through-border* configuration, the richer is the upstream state relative to the downstream state, the smaller will be the side-payment paid by the downstream state. Instead, the upstream state may even provide side-payments to the downstream state.

Ho(4): All else being equal, for the *border-creator* configuration, the richer state will provide side-payments to the poorer state, or bear a larger fraction of the joint costs of river development.

I will test these hypotheses across the expanded set of treaty observations I have obtained and report the results in the next section.

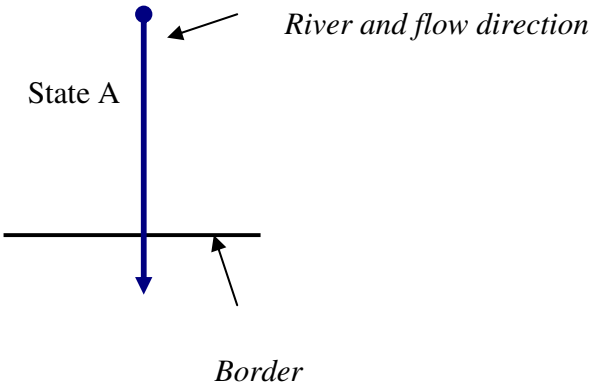
Among the 257 agreements obtained, assessed and catalogued, 95[13] specific agreements were thoroughly analyzed for their content. Recall that it was only the specific agreements that spoke of particular actions to be taken by the states, which reflected on the issue of property right conflicts and their subsequent resolution, that are the main interest of this research. Table 1 provides the number of specific agreements and total agreements analyzed for each configuration.

Table 1: Treaties Collected According to Configuration

Configuration	Number of Specific Treaties	Number of Treaties
Through-border	38	109
Border-creator	9	15
Mixed	20	54
Partial border-creator	20	53
Border-creator but enters state	2	9
*Through-border * 2*	3	13
Partial border-creator but returns	1	3
Mixed zig zag	1	1

[13] The 1931 Agreement on the Cunene River, albeit a specific agreement, was removed from the count because the text has not be identified and no clear actions or obligations are provided by the description of the treaty. So in reality 94 specific agreements are considered for this portion of the study.

4.1. Through-Border Configuration



I start with some descriptive statistics for the agreements pertaining to the *through-border* configuration. They are provided in Table 2.

Table 2: Descriptive Statistics for Through-Border Configuration

Number of Specific Treaties	Number of Specific Treaties without Side-payments	Number of Specific Treaties with Side-payments from Downstream State to Upstream State	Number of Specific Treaties with Side-payments from Upstream State to Downstream State
38	11 (29%)	25 (66%)	2 (5%)

As is obvious from Table 2 side-payments are a common strategic tool used in rivers of the *through-border* configuration. Perhaps even more interesting is that side-payment regimes are even more salient once the agreements are organized according to issue area. In fact the majority of agreements that pertain to water quantity—that is the division of water or rights to the water between the two states—do not evince side-payments from the downstream state to the upstream state. Below I divide the agreements according to issue area. Table 3 includes water quantity agreements. Table 4 includes agreements that pertain to hydropower, flood control, facility use, dam construction, and monitoring. Table 5 includes agreements that pertain to pollution issues. Each table also indicates which country is richer or if the economic relationship between the countries is symmetric[14]. In each entry the year of the agreement is provided,

[14] I use the Penn World Table 6.1 to determine GDP per capita. When the Penn World Table 6.1 does not provide the appropriate data I use the Penn World Table 5.6 for both parties. For data before 1950 (which both Penn World Tables do not cover) I use

followed by the respective river, and followed by the upstream and then downstream country. The side-payment regime is also indicated. An analysis follows these three tables.

Table 3: Water Quantity Agreements

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Side-payments		
	Upstream Richer	Downstream Richer	No	DN to UP[15]	UP to DN[16]
1909; St. Mary; US and Canada			X		
1914; Roya; France and Italy			X		
		1925/1951; Gash; Eritrea (IT) and Sudan (UK)		X[17]	
		1957; Isonzo (Mrzlek Springs), Yugoslavia and Italy		X	
1967; Roya; France and Italy					X
1968; Lima; Spain and Portugal			X		
		1973; Helmand; Afghanistan and Iran		*X*	
1975; Gangir; Iraq and Iran			X		
1975; Kanjan Cham; Iraq and Iran			X		
1975; Tib (Mehmeh); Iraq and Iran			X		

Maddison, A., *Monitoring the World Economy: 1820-1992*, (OECD: Paris, 1995). In cases where the above three sources do not provide any data, I refer to the United Nations Statistical Databases, National Accounts Main Aggregates. For consistent comparisons within each country pair, GDP per capita for each pair is derived from the same source

A relationship is considered asymmetric when the economic difference between the parties is at least two times. To obtain this threshold I began by rounding the GDP ratios for each year for all the observations considered. I round the ratio to obtain a better estimation of the GDP differences during the time when the treaty was negotiated rather than just appoint figure. In running a descriptive statistics test for all the ratio values obtained (raw values) I come up with a mean of 2.143—indicating that choosing 2 times (after rounding) as the threshold for economic asymmetry is justifiable. For additional statistical assurance, I hypothesized that the raw and rounded values do not defer statistically. The results that the two samples do not differ statistically. Finally, I am able to show statistically not only that two times the difference is the appropriate threshold for establishing asymmetry but also that two times the difference is most significant among all the other ratios beyond two times. Using two times the difference for referring to a relationship as asymmetric is therefore the best estimation. Using three times the difference or four times is not superior to using two times the difference. As Figure 5.1 demonstrates, the significance level drops as the possible thresholds increase beyond two times, becoming the least significant at five times the difference.

[15] Side-payments from the downstream state to the upstream state.

[16] Side-payments from the upstream state to the downstream state.

[17] Payments were discontinued when the UK took over Eritrea in 1941.

Table 4: Hydropower, Flood Control, Facility Use, Dam Construction, and Monitoring Agreements

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Side-payments		
	Upstream Richer	Downstream Richer	No	DN to UP	UP to DN
		1949; Reno di Lei; Italy and Switzerland		X	
1951; Naatamojoki; Finland and Norway				X	
1952; Orawa; Poland and Czechoslovakia				X	
1954/1966; Kosi; Nepal and India				X	
1955; Mont Cenis; France and Italy				X	
	1958; Carol; France and Spain		X		
1960; Mont Cenis; France and Italy				X	
1961/1964; Columbia, Canada and US				X	
1963; Garona; Spain and France				X	
1967; Skagit; Canada and US				X	
	1972; Vuoksi; Finland and USSR			X	
		1974; Wangchu; Bhutan and India		X	
1984; Skagit; Canada and US				X	
1988; Red; US and Canada				X	
	1989; Vuoksi; Finland and USSR		X		
1995;Kurichhu; Bhutan and India				X	
1996; Wangchu, Bhutan and India				X	
1955, Sarisu; Turkey and Iran			X		
	1960; Witka/Smeda; Czechoslovakia and Poland			X	
	1963; Allaine; Switzerland and France				X
		2000; Talas; Kyrgyzstan and Kazakhstan		X	

Table 5: Pollution Agreements

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Side-payments		
	Upstream Richer	Downstream Richer	No	DN to UP	UP to DN
		1985; Tijuana; Mexico and US	X		
		1990; Tijuana; Mexico and US		X	
		1997; Tijuana; Mexico and US		X	
		1997; Tijuana; Mexico and US		X	
		1980; New; Mexico and US	X		
		1987; New; Mexico and US		X	
		1995; New; Mexico and US		X	

Specifically, I hypothesized that treaties corresponding to the *through-border* configuration shall evince side-payments from the downstream country to the upstream country so as to encourage cooperation or resolve a property right dispute (hypothesis 1). Side-payments are used to offset the geographical asymmetries between upstream and downstream states. This is the case in specific agreements, where the parties agree to a particular action or project such as pollution abatement, hydropower, flood control and even water allocation. For pollution issues, in particular, a richer downstream state, which has a lower propensity to accept pollution relative to a poorer upstream state's ability to abate pollution, would have to provide side-payments to encourage cooperation. Side-payments from the downstream country to the upstream country would also be forthcoming when a project downstream is built mostly for the benefit of the downstream country yet affects the territory of the upstream country. Conversely, and given the geographical advantages bestowed on the upstream state, there shall be no immediate economic incentive for that state to internalize an externality flowing in the downstream direction. However, I hypothesized that the 'willingness to pay' of a richer state enables it to internalize the costs of abatement or of taking action that benefits a downstream state, when the economic incentive to do so are otherwise not clear—hypothesis 3. These economic discrepancies can explain outcomes that do not abide by the geographical hypothesis—specifically when an upstream country provides side-payments to the downstream country or undertakes actions on its behalf without a side-payment.

I was able to analyze thirty-eight specific agreements of the *through-border* configuration. 66% of these agreements incorporated side-payments from the downstream state to the upstream state.

The majority of agreements that pertained to water quantity and allocation did not incorporate side-payments from the downstream to the upstream state—these are not highlighted in Table 3. Only three agreements out of a total of ten agreements (30%) incorporated side-payments from the downstream to the upstream country—these are highlighted in dark gray in Table 3. Thus, while several agreements incorporated side-payments for water allocation, the majority of agreements provided evidence to the contrary; illustrating that utilizing side-payments to solve water allocation disputes is not too common. This phenomenon is not out of line with some other findings and claims about the notion of payment for water allocations (Wolf 1999; McCaffrey, 2001: 264). In addition, in two cases, one with side-payment transfers from the downstream country to the upstream country (1957 Agreement on the Izonzo) and another with the opposite side-payment regime (1967 Agreement on the Roya, which is highlighted in light gray in Table 3), the agreements are water allocation treaties between specific towns. The agreements are therefore, not water allocation treaties between countries *per se* (such as the 1925/1951 Agreement on the Gash and the 1973 Agreement on the Helmand). More salient evidence for the side-payment phenomenon, however, is provided in the other treaty issue areas.

In the agreements that pertained to hydropower, flood control, monitoring, facility use, and pollution issues (ignoring the water allocation agreements), twenty-two out of twenty-eight agreements (79%) evinced side-payments from the downstream country to the upstream country. These are highlighted in dark gray in Tables 4 and 5. One agreement (3%) evinced side-payments from the upstream to the downstream country (the 1963 Agreement pertaining to the Allaine River, which is highlighted in light gray in Table 4), while five other agreements (18%) evinced no side-payments at all—not highlighted in Tables 4 and 5.

Of the twenty-two agreements that incorporated side-payments, six agreements pertained to works undertaken downstream for the main benefit of the downstream state yet which harmed the territory of the upstream state in some fashion. In all of these cases a side-payment is provided to ameliorate the harm upstream and to promote the acquiescence of the upstream state for the project. In two of these cases, the relatively richer country is also upstream, yet a side-payment is still forthcoming. This phenomenon signifies that despite the economic asymmetry in favor of the upstream country, the geographic asymmetry between the two countries is better suited in explaining the outcome and the solution to the property right conflict on issues that relate to projects downstream, which harm the upstream state—hypothesis 1. Thus, even when a downstream state is relatively poorer, compared to its upstream riparian, a side-payment is still forthcoming—hypothesis 3, of course, does not deny this possibility.

The remaining sixteen agreements pertain either to works or actions undertaken upstream which also benefit the downstream state or the use of the upstream state's strategic local for the construction of works that benefit both countries. The side-payment transfer in all these cases from the downstream state to the upstream state, again, suggests how divergent uses on a river are resolved and coordinated and how cooperation is facilitated in geographically asymmetric situations—hypothesis 1. While the majority of these agreements embody an economically symmetric relationship between the parties, seven of these agreements embody an asymmetric relationship between the parties. The downstream country is always the richer country. In fact, five of these agreements pertain solely to pollution abatement between the United States and Mexico. These five agreements signify that while the downstream state has a right not be harmed from pollution the upstream state has right to utilize its part of the river. Yet as is tangibly demonstrated in the outcomes of these agreements, the compromise is expressed through side-payments in the upstream direction so as to facilitate the abatement. The economically superior downstream state, the United States, must provide a side-payment for abating pollution upstream since her tolerance for accepting pollution is much lower than Mexico, the upstream state.

Three agreements provide interesting insight and validation for hypothesis 3. The first, the 1963 Allaine River Agreement provides for side-payments from the upstream country to the downstream country. The final two agreements, the 1958 Carol River Agreement and the 1989 Vuoksi River Agreement, do not provide for direct side-payments from the upstream country to the downstream country, but call on the upstream state to take action in favor of the downstream country—in a way a side-payment. As hypothesis 3, and the theory behind it, suggests, the outcome is a function of the upstream state's ability to internalize the costs of its actions that affect or favor mostly the downstream state. In all these cases, the economic discrepancies between the two countries are twice the difference. Thus, hypothesis 3 can explain the instances where side-payment transfers take place from the upstream to the downstream state or where the upstream state takes actions that favor the downstream state without compensation.

Two of the other agreements that do not incorporate side-payments are actually two additional pollution abatement agreements between the United States and Mexico. If considered in isolation of the five pollution agreements mentioned above, they would suggest that Mexico had an obligation to abate the pollution it was creating in favor of the United States given that this was the purpose of the two treaties—substantiating the PPP. Yet, when these two agreements are considered an integral part of the five above agreements, it can be ascertained that while Mexico was recognized as being the source of pollution on the Tijuana and New Rivers, the

United States had to be forthcoming with monetary incentives so as to assist Mexico in abating the pollution—confirming the VPP—a function of hypotheses 1. The last agreement (1955 Agreement on the Sarisu) does not to incorporate any side-payments and calls on each of the parties to partake in their own monitoring activities—no actions are taken by one country that favor the other country. The agreement asserts that both countries shall establish monitoring stations on their own side of the border.

4.2. Border-Creator Configuration

State A

State B

I start with some descriptive statistics for the agreements pertaining to the *border-creator* configuration. They are provided in Table 6.

Table 6: Descriptive Statistics for Border-Creator Configuration

Number of Specific Treaties	Number of Specific Treaties without Side-payments	Number of Specific Treaties with Equal Cost-sharing	Number of Specific Treaties without Cost-sharing
9	9 (100%)	6 (66%)	3 (33%)

All the agreements that correspond to the *border-creator* configuration do not incorporate side-payments. Similarly, the majority of the agreements embody an equal cost sharing regime among the parties. Given the small number of treaties, I do not divide the agreements into separate tables according to issue-area, as was the case in the *through-border* configuration section.

Table 7 provides the agreements, the side-payment and cost-sharing regime. The economic relationship between the parties is also indicated. An analysis follows the table.

Table 7: Agreements for Border-Creator Configuration

Symmetric Relationship	Asymmetric Relationship	Side-payments			Cost-sharing								
										BENEFIT			
		N[18]	R to P[19]	P to R[20]	N[21]	EQ[22]	NSI[23]	R MR[24]	P MR[25]	EQ[26]	NSI[27]	R MR[28]	P MR[29]
1909; Niagara; US and Canada		X			X								
1941; Niagara; US and Canada		X			X								
1997; Curaim, Brazil and Uruguay		X			X								
1941; Niagara; US and Canada		X				X							
1950; Niagara; US and Canada		X				X							
2000; An Nahr El Khabir; Syria and Lebanon		X				X							
1969; Niagara; US and Canada		X								X[30]			
1977; Yaguaron; Brazil and Uruguay		X				X							
1955; Karasu; Turkey and Iran		X				X							

The geographical hypothesis pertaining to the *border-creator* configuration, argued that given the geographical symmetry between the states, no side-payments would be required to

[18] No side-payments
[19] Side-payments from rich country to poor country
[20] Side-payments from poor country to rich country
[21] No cost-sharing regime negotiated
[22] Equal cost-sharing regime negotiated
[23] Cost-sharing regime not specifically indicated
[24] Rich country pays more of cost-burden
[25] Poor country pays more of cost burden
[26] Benefits accrued to each party determine cost of project—equal sharing.
[27] Benefits accrued to each party determine cost of project—not specifically indicated
[28] Benefits accrued to each party determine cost of project—rich pays more
[29] Benefits accrued to each party determine cost of project—poor pays more
[30] Two companies, one from Canada and the other from the United States, shall be entitled to half of the hydropower potential produced by the dam's diversions. As such, they shall also contribute to the costs of the dam in equal shares. It is not indicated however, how the US and Canada will divide the costs of the dam between themselves.

encourage cooperation or solve-property right disputes. Instead, integrated projects would be taken on jointly and their associated costs equally shared—hypothesis 2. Similarly, pollution issues would be less of a problem given the retaliation and reciprocity embedded in the *border-creator* configuration. Side-payments would also not have to be incorporated into the negotiations so as to encourage abatement. However, I hypothesized that exceptions to the outcomes predicted by the geographical hypothesis would be more likely when the respective states were economically asymmetric. That is, richer states not only have a higher 'willingness to pay' but, as suggested in the *through-border* case, also have a lower tolerance for accepting pollution relative to the capacity of the poorer state to pollute. Therefore, a richer state may have to provide a side-payment to the poorer state for abating pollution or perhaps take on a larger portion of the costs for the joint project—hypothesis 4.

For the *border-creator* configuration I was able to analyze 9 specific agreements. All nine of the agreements (100%) did not incorporate side-payments between the parties—hypothesis 2. All the parties to the agreements were also economically symmetric suggesting that cooperation and joint development of a *border-creator* river often requires the equal participation of both countries. However, given the symmetric relationship between the parties, the salience of hypothesis 4 could not be rigorously tested.

The geographic symmetry between the parties also implies that side-payments did not have to factor in to the negotiations to encourage cooperation or solve property right conflicts since strategic local is immaterial. In fact, of the nine agreements, six agreements (66%) pertained to a joint project whose costs were divided equally between the parties—they are highlighted in gray in Table 7. In essence for all the agreements that pertained to joint projects costs were always divided equally. The other three agreements were water allocation treaties and did not require any additional works or expenses—they are not highlighted in Table 7.

It is noteworthy that in one of the agreements—1969 Agreement on the Niagara, it was specifically mentioned that the hydropower created by a joint dam would be equally divided between the two companies representing each country. It was also agreed that the costs these two companies would contribute would be equal—suggesting that the equal division of benefits determines the cost-sharing regime. But just as it seems that the division of equal benefits is the sole deciding factor in determining the cost-sharing regime of a joint project, it is important to heed the other agreements that do not speak at all to the benefits accrued to either party. In fact, it is sometimes quite difficult to determine how the benefits are divided. To ascertain the benefits derived from a project one would need to have information on the benefits derived from the

project in addition to the costs incurred from the project, an exercise that remains quite difficult especially when these measures are not specifically indicated. In addition, it is especially important to take note of the 2000 Agreement between Syria and Lebanon, where the water was divided unequally between the two states yet the costs of the respective project equally divided. Thus, even when benefits are divided unequally, the costs of a project on a *border-creator* river may still be divided equally—it as if the geography of a *border-creator* configuration provides a focal point for the parties. Joint and integrated exploitation of the part of the river that flows along the common border necessitates the equal participation of both parties and the costs for that project are more often divided equally.

Below I provide the results for the non-pure configurations.

4.3. Other Configurations

Although the theory and hypotheses presented above were based largely on the two pure configurations, the non-pure configurations embody physical characteristics of the pure configurations. As such testing the theory and hypotheses along the outlying data should provide comparable results, especially since stretches of the river of the non-pure configurations resemble the pure configurations. Thus, while the pure configuration and the non-pure configurations are technically different they share many similarities. Thus, while the pure configurations constitute the general model of which the other non-pure configurations are variations, comparing the characteristics intrinsic in each configuration can be very instructive and telling.

Take for example the *mixed* and *partial border-creator* configurations in Appendix A. Like the *through-border* configuration, the *mixed* configuration constitutes a clear upstream country that has the geographic and strategic upper hand. However, like the *border-creator* configuration the mixed configuration constitutes a stretch of the river the forms the border between both countries. The *partial border-creator* configuration also constitutes a clear upstream country that has the geographic and strategic upper hand, albeit both countries are downstream. However, like the *border-creator* configuration, the two states also share a stretch of the border where projects may require bi-national participation. The other nine configurations share similar attributes, constituting either a country with the strategic upper hand, an upstream country, or a situation where the river forms the border between both countries.

It is therefore appropriate to divide the agreements and the corresponding rivers according to the stretch of the river that resembles most closely the physical phenomenon of each of the pure configurations and to further observe if the side-payment and cost-sharing regimes fall under similar patterns.

There are about 50 specific agreements that fall under the non-pure configurations, which are assessed in Table 8.

Table 8: Non-pure Configurations: Economic Asymmetries and Associated Side-Payment and Cost-Sharing Regimes

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Treaty-Border				Side-payments			Cost-sharing								
	Upstream Richer	Downstream Richer	Y [31]	N [32]	MX [33]	NC [34]	N [35]	DN to UP [36]	UP to DN [37]	N [38]	EQ [39]	NSI [40]	DN MR [41]	UP MR [42]	BENEFIT			
															EQ [43]	NSI [44]	DN MR[45]	UP MR[46]
	1912; Duoro; Spain and Portugal					X	X			X								
	1912; Guadania; Spain and Portugal					X	X			X								
	1912; Tagus; Spain and Portugal					X	X			X								
1935; Artibonite; Dominican Republic and Haiti						X	X			X								
	1944; Colorado; United States and Mexico			X				X		X								

[31] Treaty pertains to the part of the river that flows along the border
[32] Treaty does not pertain to the part of the river that flows along the border—part of the river wholly in the territory of the upstream country.
[33] Treaty pertains to the part of the river that flows along the border and a part of the river wholly in the territory of the upstream country.
[34] Treaty does not make it clear which part of the river the agreement applies to.
[35] No side-payments
[36] Side-payments from downstream country to upstream country
[37] Side-payments from upstream country to downstream country
[38] No cost-sharing
[39] Equal cost-sharing regime
[40] Cost-sharing not specifically indicated
[41] Downstream pays more of the cost-sharing burden
[42] Upstream country pays more of the cost-sharing burden
[43] Cost-sharing is based on benefits received from the project; equal benefits therefore equal cost-sharing
[44] Benefits and costs are not specifically indicated
[45] Downstream country benefits more and pays more of the cost-burden share.
[46] Upstream country benefits more and pays more of the cost-burden share.

Non-pure Configurations Continued

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Treaty-Border				Side-payments			Cost-sharing								
	Upstream Richer	Downstream Richer	Y	N	MX	NC	N	DN to UP	UP to DN	N	EQ	NSI	DN MR	UP MR	BENEFIT			
															EQ	NSI	DN MR	UP MR
		1957; Spol; Italy and Switzerland			X			X[47]		X								
1959; Gandak; Nepal and India					X			X		X								
1964; Duoro; Spain and Portugal			X				X			X								
	1966; Colorado; United States and Mexico			X				X		X								
1968; Guadania; Spain and Portugal			X				X			X								
1968; Tagus; Spain and Portugal			X				X			X								

[47] The Spol River is by far the most complex case of all the cases investigated in this dissertation. The Spol River begins in Italy, creates the border for a short distance and then enters into Switzerland. The dam built to create the reservoir (Livigno Reservoir) was built on the part of the border along where the river flows. The Swiss (through a concessionary) are responsible for the construction of the dam. The subsequent reservoir mostly inundates Italian territory. The reservoir supplies a chain of hydroelectric plants solely in Swiss territory. While the agreement is named after the Spol River the waters accumulating in the Livignio Reservoir also originate in Switzerland and flow into the Reservoir. Thus while Italy is upstream on the Spol, Switzerland is upstream on other rivers flowing into the reservoir such as the Val Mora. Another river that collects into the Reservoir is the Ova dal Gal. The river originates in Italy. Before the reservoir was built, the river flowed from Italy up towards the border with Switzerland. It then flowed along the border between the two countries and finally into the part of the Spol that creates the border between the two countries. After the reservoir was built the Ova dal Gal flowed directly into the reservoir. The geographical issues associated with this agreement are therefore quite complex. The agreement recognizes that Italy contributes water to the Reservoir, which is used to produce hydroelectricity in Switzerland. Therefore, Italy is owed a set amount of hydropower from Switzerland (36.5 mil KW/y) for free. The agreement, however, is also made up of a second part. In this part of the agreement Italy is to build two reservoirs (San Giacomo and Cancano) and dams solely in its own territory for the creation of hydropower. However, 97 MCM/y of the waters flowing into the Livigno Reservoir that could have been used in Switzerland to create hydropower are diverted into the reservoirs. These waters are taken from the Ova dal Gal. For this reason Switzerland is entitled to a set amount of hydropower from Italy (128 million KWh/y). The balance of the energy owed to Italy and energy owed to Switzerland, however favors Switzerland. In fact, the inter-company agreement (agreement between the private companies exploiting the hydropower potential) has stated that Italy has a right to use the balance (given that it has the most need for it) for a payment. (Parts of this explanation are based on the 1957 Agreement; Interview, Schroter, 2004).

Non-pure Configurations Continued

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Treaty-Border				Side-payments			Cost-sharing								
	Upstream Richer	Downstream Richer	Y	N	MX	NC	N	DN to UP	UP to DN	N	EQ	NSI	DN MR	UP MR	BENEFIT			
															EQ	NSI	DN MR	UP MR
		1971; Puyango-Tumbes; Ecuador and Peru				X	X									X[48]		
1975; Duverij; Iran and Iraq						X	X			X								
1983; Teesta; India and Bangladesh						X	X			X								
	1994; Colorado; US and Mexico		X				X							X[49]				
		1995; Nestos; Bulgaria and Greece		X			X			X								
		2000; Chu; Kyrgyzstan and Kazakhstan		X				X		X								
1966; Saar; France and Germany			X				X				X							
	1970/1972; Torrente Breggia; Switzerland and Italy		X				X											X
	1972/1973; Colorado; US and Mexico			X			X			X								

[48] The agreement only states that depending on the water quantities and power allotted to each side, the costs of the project shall be allocated accordingly. The agreement also states that the bi-national Project consists of Ecuador exploiting 50,000 hectares and Peru exploiting 20,000 hectares. This does not include (which would then change the cost-sharing regime) more land that may be exploited by both parties (by Peru: an additional 16,000 hectares) as may be indicated by future studies; this also includes power that can be derived and provided to each party. So the costs are not indicated, yet it is obvious that the costs are divided according to the benefit derived.

[49] Each side will conduct the works on its own side of the border. The United States will also act to remove sediment in Mexico's jurisdiction.

Non-pure Configurations Continued

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Treaty-Border				Side-payments			Cost-sharing								
	Upstream Richer	Downstream Richer	Y	N	MX	NC	N	DN to UP	UP to DN	N	EQ	NSI	DN MR	UP MR	BENEFIT			
															EQ	NSI	DN MR	UP MR
	1906; Rio Grande; US and Mexico		X				X			X								
	1933; Rio Grande; US and Mexico		X				X											X
	1912; Chanza; Spain and Portugal					X	X			X								
	1912; Minho; Spain and Portugal					X	X			X								
		1926; Cunene; Angola (Portugal) and Namibia (South Africa)		X				X		X								
1938; Paz; Guatemala and El Salvador						X	X			X								
		1944, Zarumilla, Ecuador and Peru	X[50]					X		X								
	1944; Rio Grande; United States and Mexico		X				X									X[51]		
	1949; Prut; USSR and Romania		X				X				X							

[50] But this is a territorial agreement with reference to lands of the Zarumilla River.
[51] The costs of building the international storage dams and other joint works shall be prorated between the two governments in proportion to their allocations and benefits.

Non-pure Configurations Continued

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Treaty-Border				Side-payments			Cost-sharing								
	Upstream Richer	Downstream Richer	Y	N	MX	NC	N	DN to UP	UP to DN	N	EQ	NSI	DN MR	UP MR	BENEFIT			
															EQ	NSI	DN MR	UP MR
1957; Atrak; Iran and USSR			X				X			X[52]								
1957; Atrak; Iran and USSR			X				X				X							
1958; Timok; Yugoslavia and Bulgaria			X				X				X[53]							
		1959; Hermance; France and Switzerland			X		X						X[54]					
1968; Chanza; Spain and Portugal			X				X			X								
1968; Minho; Spain and Portugal			X				X											X
1969; Cunene; Angola (Portugal) and Namibia (South Africa)				X				X		X								
	1971; Prut; USSR and Romania		X				X				X[55]							
1986; Gander; Luxembourg and France			X				X											X[56]

[52] The parties only agree to divide the water and power of the part of the river that forms the border equally. Joint projects are considered but no division of costs for these projects are mentioned.
[53] Each party undertakes 50% of the joint project and uses its own funds to do so.
[54] Costs are not specifically indicated and neither are the benefits. According to the works undertaken it is possible to ascertain that richer Switzerland takes on a higher cost-sharing burden. France is only responsible for the works on the stretch of the river in her territory while Switzerland is responsible for all the works to be undertaken on the common stretch of the river. While both countries are to maintain the part of the river on their side of the border, Switzerland undertakes additional maintenance works on the part of the river that forms the border between the two states. Given that the emphasis of this treaty is on the part of the river the forms the border between the two states, I categorize this treaty with the agreements that pertain to works to be undertaken on the part of the river that forms the border.
[55] While the parties have agreed to divide the energy and regulated volume of water there is no indication of how each benefits from the flood control works.
[56] The project wholly benefits Luxembourg and her property and citizenry in France and this is why she pays the total costs.

Non-pure Configurations Continued

Symmetric Relationship (GDP/capita)	Asymmetric Relationship (GDP/capita)		Treaty-Border				Side-payments			Cost-sharing								
	Upstream Richer	Downstream Richer	Y	N	MX	NC	N	DN to UP	UP to DN	N	EQ	NSI	DN MR	UP MR	BENEFIT			
															EQ	NSI	DN MR	UP MR
1998; Zarumilla, Ecuador and Peru			X[57]				X				X							
	1956; Argun; USSR and China		X				X				X							
	1956; Amur; USSR and China		X				X				X							
		1958; Amu Darya; Afghanistan and USSR	X				X						X					
1961/1964; Kootenay; Canada and US				X				X										
1989; Souris River; Canada and US				X				X										
1930; Chut de Chatelot (Doubs River); France and Switzerland			X				X			X								
		1920; Mahakali; Nepal and India (Sarada)		X				X										
1992; Mahakali; Nepal and India (Tankapur)				X				X										
		1996; Mahakali; Nepal and India (Pencheshwar)	X					X								X		

[57] See http://www.fas.org/man/dod-101/ops/docs/98021713_lpo.html , http://www.landminesurvivors.org/documents/indicator_peru.pdf

The table is divided as follows. Those agreements not highlighted are either treaties that make no reference to side-payments or cost-sharing, such as water allocation agreements, or those that do not provide enough information on how the costs are to be divided among the parties.[58] Those agreements highlighted in light gray refer to treaties where the richer party takes on the heaviest burden of the cost allocation, for projects built on the common stretch of the river, or where the upstream country takes on specific actions in its own territory that benefit the downstream state—the richer state being upstream. Those agreements highlighted in dark gray refer to treaties where the project is built strictly in the territory of the upstream state or where the project mostly affects the strategic territory of the upstream state—side-payments are always provided from the downstream state to the upstream state. Finally, those agreement highlighted in the darkest shade of gray refer to treaties that divide the costs of the project equally among the parties. The project is built on the stretch of the river that creates the border between the two states.

Below, I provide some general statistics only for the agreements that clearly outline side-payment and cost-sharing patterns or that provide enough information to discern this relationship.[59] The information is categorized according to the stretch of the river where the agreed upon project or task is to be undertaken. The economic asymmetries between the parties are also considered. Twenty-eight agreements are relevant.

4.3.1. The Upstream State's Stretch of the River

In general, out of the twelve agreements[60] that refer to a project built on the stretch of the river flowing solely in the territory of the upstream state, or where the project affected mostly the territory of the upstream state (resembling the *through-border* configuration), 92% of these agreements evince side-payments from the downstream state to the upstream state. The outcome not only corresponds to the expectations of hypothesis 1 of the pure configurations but, as with the *through-border* configuration, the result also demonstrates that downstream benefits created by upstream works are often recognized (i.e., rewarded) through compensation and side-payments transferred upstream. The compromise to the property right

[58] Although not highlighted the 1968 Minho Agreement is part of the count below. It was not highlighted since it did match any of the clear shading categorizations. The 1986 Gander Agreement is not a joint project between the parties and is therefore nothighlighted—see footnote 56. The 1944 Zarumilla Agreement is also not highlighted—see footnote 50.

[59] Here I ignore the cost-benefit assessment outlined in a treaty, if one is indeed provided, and group all the agreements that pertain to the respective stretch of the river in the same category.

dispute and the coordination of the river's uses between the parties is expressed through side-payments. Two of the agreements within this category also posit an outcome whereby payments would be provided if the water deliveries made downstream were used for gain rather than just subsistence purposes. These two examples can be included among the rare, but not uncommon, occurrences of compensation for water allocation.

Among the cases under discussion, two treaty outcomes relevant to both hypotheses 1 and 3 should be noted. Recall that hypothesis 3 does not deny that a poor downstream state might need to provide a side-payment to a richer upstream state to offset a geographical asymmetry. In fact, both agreements illustrate the rich upstream state undertaking actions that benefited the downstream state, while the compensation owed the upstream state, was conditional. Thus, while side-payments from the downstream to the upstream state were certainly an element of the agreement, such payments were qualified and could be reduced or eliminated depending on specified circumstances.

However, only one agreement embodying a richer upstream state, out of a total of three agreements embodying a richer upstream riparian (33%), evinces an outcome where the upstream state took action in favor of the downstream state without compensation—a circumstance that might be regarded as a side-payment. Indeed, the countries were economically asymmetric, with the upstream state the richer riparian. As hypothesis 3 suggests, the higher 'willingness to pay' of the upstream state moderated its disincentives to cooperate. The costs of taking action despite the disincentives to do so were, therefore, internalized.

Interestingly, this tenth case, the 1973 Agreement on the Colorado River, is also a favored example of the issue-linkage literature, which analyzes the agreement by hypothesizing that other issues of interest provided the impetus for America's cooperative stance toward Mexico. No such information is available in the agreement itself. On the other hand, the economic asymmetry explanation (hypothesis 3) affords a better explanation of the outcome of that 1973 Agreement by referring to the treaty itself and the parties involved.

4.3.2. The Stretch of the River that Flows Along the Common Border

In terms of projects and tasks to be undertaken only on the part of the river that flows along the common border (and resembling the *border-creator* configuration), sixteen agreements

[60] I include the 1920 Sarada Agreement and the 1992 Agreement on the Tankapur Project as two separate

are relevant.[61] Specifically, eleven of these agreements embody two asymmetric riparians. Interestingly, 33% of these agreements provide for an equal cost-sharing regime while 63% provide that the larger cost-sharing burden is borne by the richer country. In one agreement the richer state also provides a side-payment to the poorer state. As expected, the majority of agreements pertaining to asymmetric parties evince a cost-sharing regime, which calls on the richer party to assume the bulk of the cost burden.

Among the five agreements that embody symmetric riparians, 80% of the agreements provide for an equal sharing of costs—hypothesis 2. The final agreement divides the costs unequally.[62]

For the most part, projects and tasks to be undertaken on the part of the river that flows along the common border require the equal participation of the parties. Side-payments are not required. Asymmetry between the states matters, however, with the richer country taking up the higher cost-sharing burden most of the time. To some extent, therefore, even in the non-pure configurations, the geography of the stretch of the river flowing along the border acts almost as a focal point for joint projects and the respective equal participation of each country.

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agreements, which are also part of the 1996 Mahakali Agreement.

[61] I ignore the following agreements (a brief explanation is provided in the parenthesis after the agreement): 1971 Puyango-Tumbes Agreement (no specific costs specified); 1944 Zarumilla Agreement (this is a border shift agreement); 1944 Rio Grande Agreement (costs are not specified); 1986 Gander Agreement (not a joint project); 1930 (Doubs River) Chut de Chatelot Agreement (agreement does not specify costs, responsibilities, or obligations).

[62] In general, I also ignore water allocation agreements that do not evince tasks or obligations, and thus costs or side-payments, from this general analysis: 1912 Duoro Agreement, 1912 Guadania Agreement, 1912 Tagus Agreement, 1935 Artibonite Agreement, 1964 Duoro Agreement, 1968 Guadania Agreement, 1968 Tagus Agreement, 1975 Duverij Agreement, 1983 Teesta Agreement, 1995 Nestos Agreement; 1912 Chanza Agreement, 1912 Minho Agreement, 1938 Paz Agreement, 1957 Atrak Agreement, and 1968 Chanza Agreement; 1909 Milk River Agreement.

5. Concluding Remarks and Policy Implications

The main aim of this paper was to demonstrate that the analysis of property right conflicts over shared international rivers is best accomplished by looking at the actual treaties states negotiate. Property rights are poorly defined and international water law only provides states with hints and suggestions as to how to coordinate uses of a shared river. Surely international water law does not aspire to prescribe specific guidelines, but its tenants are so vague that identifying patterns in negotiated treaties provide better insight as to how states actually negotiate their international water disputes.

The large number of agreements over water allows for such a systematic analysis. It also allows for hypotheses testing across a large set of observations. Principally, the side-payment or cost-sharing regime of each individual treaty was the main unit of analysis for ascertaining how the property right conflict is resolved and how cooperation ensues—the dependent variable of this paper. International agreements governing a river shared by only two states were the focus of the research.

This paper began with a short survey of conflict and cooperation in the context of hydropolitics and international relations. This discussion set the stage for understanding how side-payments make up an integral part of the strategic interaction approach of the hydropolitical cooperation game in addition to other elements, such as reciprocity and issue-linkage. Most importantly, I argued that while concerns for security and survival may play an inhibiting role vis-à-vis cooperation, mutuality of interest, fostered by scarcity, combined with the inadequacies of autonomous and unilateral strategies are the main underlying causes for cooperation. In addition, I argued and demonstrated that the realist contention that hegemony is often required for the emergence of cooperation is not the case for international rivers. Even an upstream state, which is the hegemon in the river basin may still elect to cooperate despite the disincentives to do so—strategic interaction may explain the reasons for cooperation. Similarly, and as the many treaties that were analyzed signaled, even symmetric[63] countries elect to cooperate and negotiate. Their impetus is to obtain joint gains. Yet, where geographic asymmetries exist, such as in the case of the *through-border* river, strategic-interaction, and specifically side-payment transfers from the geographically weaker downstream state to the geographically superior upstream state, may again explain the reasons for cooperation.

Finally, the brute power that may be used by a militarily superior riparian to sway or bully a militarily weaker country was also argued to be futile in negotiations over water. This may be especially salient in cases where the militarily superior country is downstream and is dependent on the geographically superior upstream state for the construction of specific projects. Issue-specific structural power, the advantageous geographical position, possessed by the upstream country is instrumental in negotiations over water. As such, militarily and economically superior countries may be better served by negotiating with weaker states, providing them a sense of equality, and providing promises and rewards rather than making threats and punishments.

The next section expounded on the role of side-payments and cost-sharing regimes in the investigation of treaty design differences. In all, the main thrust of the paper has been to test the geographic contention that property right regimes are commons related. That is, there should be a difference in the outcomes of treaties that govern rivers that fall under different physical configurations, mainly the *through-border* and *border-creator* configurations. However, given that richer states have different propensities to pay than poorer states, economic asymmetries among states should also matter. Therefore, geographical and economic-political consideration made up the independent variables of this study.

The analysis of the two pure configurations provided the basis for this research agenda. The great majority of agreements pertaining to the *through-border* configuration evince side-payments—indicating not only that property right disputes are often solved via side-payments from the downstream to the upstream country but that the coordination of uses along a river are subject to side-payments for benefits created downstream. In pollution cases, the compromise between the PPP and the VPP was also demonstrated in side-payments—the victim country had to pay to promote abatement.

Where the opposite side-payment scenario was evinced, the upstream state was always the richer party. Similarly, when actions taken upstream were conducted for the sole benefit of the downstream state without compensation, the upstream state was also richer. As the theory developed by this paper suggests, not only does a richer state have a higher willingness to pay but this willingness to pay also allows the richer state to internalize the costs of projects that benefit mostly the downstream state. The disincentives to cooperate are, therefore, mitigated.

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[63] Symmetry here is based on economic criteria.

Agreements corresponding to the *border-creator* configuration did not evince side-payments. Naturally, projects were always to be pursued on the parties' common border and equal participation was demonstrated in all cases—even when the benefits were not divided equally among the parties. Property right conflicts in the *border-creator* configuration are usually solved by equal participation by the parties and side-payments are less needed for inducing cooperation. In fact, even though the notion of costs and benefits (not rigorously pursued by this paper) often factor into determining how costs are shared, it was concluded that these calculations are often hard to ascertain, are not indicated by the agreement, or are not related to one another at all.

The geographical and economic hypotheses were also tested on the non-pure configurations. Most fascinating was that outcomes for an agreed upon task or project were guided by the corresponding stretch of the river where the project was to be undertaken and its relationship to the pure configurations. If the project was to be built in the upstream state's stretch of the river (or where the upstream state generally provided its strategic territory), the downstream benefits created upstream were always recognized by side-payments in the upstream direction. Economic differences also played an important role with the richer country paying the majority of the costs for projects undertaken on the stretch of the river that flows along the common border. In cases whereby projects were undertaken upstream in favor of the downstream state, without compensation, the upstream state was always richer.

By focusing on rivers shared by only two states this study has surely ignored the extensive number of rivers shared by more than two countries and has therefore restricted the scope of its direct application. However, it has done so in order to gain clarity. Focusing on rivers shared by only two states makes analysis methodologically simpler. Similarly, once initial broader conclusions and patterns can be formulated for the bilateral case, the analysis can then be extended in later research to take account of the qualities intrinsic in multilateral settings. That said, there is no reason that certain policy implications can't be relevant for rivers shared by more than two states as they are for rivers shared by only two states—especially in the case of upstream/downstream situations where geographical asymmetry is present.

5.1. Policy Implications

This study has attempted to formulate a theoretical basis for explaining how water treaties differ in their design and how agreements over shared rivers are negotiated and concluded. In this context, the work has also reflected on the larger issue of conflict and cooperation over shared international rivers. Extending beyond the theoretical foundation of this work, empirical applications and tests were also conducted across a large spectrum of data. Thus, despite the uniqueness of each water problem, patterns in international water treaties are discernable and these patterns can be studied systematically. The empirical testing of the theory provides some interesting policy implications for states currently in conflict over a specific shared river or for mediators (whether they be individuals or other states) attempting to foster cooperation among river riparians.

Perhaps the most compelling insights may be provided to states negotiating over a *through-border* river. Recall that it is by no means certain that conflict in the use of a *through-border* river is inevitable, but the geography of a *through-border* river helps by facilitating conflicts of interest, at least in comparison with the *border-creator* river. For this reason I will focus on the former river configuration in this discussion.

As past precedent has shown, in upstream-downstream situations side-payments are more likely to factor into negotiated agreements for the coordination of hydropower, flood-control uses, and pollution control of a given river. While not as common as the former three issue-areas, water quantity disputes and the subsequent resolution between upstream and downstream states may also require side-payments. Most importantly, it is located on the headwaters of the river and could, at least theoretically, block the flow of the river into the downstream country. All else being equal, the upstream state is geographically superior. It often owns the sites where flood control facilities can be built, where dams for hydropower generation can be located, where reservoirs for water collection can be placed, and where pollution control—given upstream pollution—can be instituted.

As such projects that take place in the upstream state's stretch of the river, including the construction of reservoirs and dams, or that require the territory of the upstream state, and which also benefit the downstream state, are often recognized through side-payments in the upstream direction. This phenomenon better coined as *compensation for downstream benefits created upstream* is true across different continents and between both developing and developed countries. Therefore, countries currently undergoing conflict over a shared

through-border river may find it most practical to institute side-payments so as to overcome the intrinsic asymmetry and come to an acceptable solution of their impending property right dispute.

Side-payment regimes may be deemed most instrumental for alleviating pollution disputes. Despite the normatively accepted PPP, downstream states may have to contribute to the abatement of pollution, which originates upstream. Given their superior geographical position and the unidirectional nature of the externality, upstream states will be less inclined to abate the pollution without appropriate incentives.

However, as this paper has demonstrated, the economic discrepancies between the states may make a difference. When a rich upstream state is negotiating with a poorer downstream state, the side-payment outcome may be reversed. In other cases no side-payments are provided at all yet the rich upstream state may take on actions that benefit mostly the downstream state and provide little benefit to it. The higher GDP per capita not only signals greater willingness to pay on the part of the rich country but also assuages its disincentives to cooperate when most of the benefits flow downstream as a function of its actions.

As demonstrated by the many cases analyzed in this study, side-payments are a most acceptable means for solving property right disputes in geographically asymmetric situations. Contrary to the claim that side-payments are rare because states perceive them as a bribe (Bennett, Ragland, and Yolles, 1998; Folmer, Mouche, and Ragland, 1993) or fear gaining the reputation of a weak negotiator (Maler, 1990:86), compensation is a common panacea for international river disputes.

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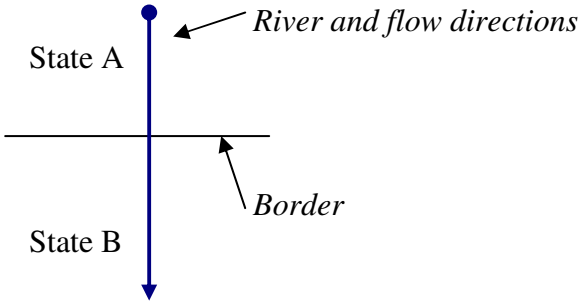
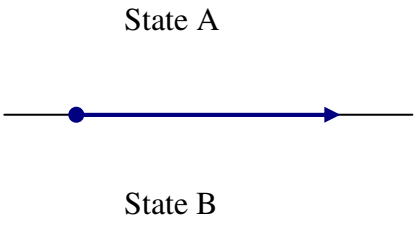
APPENDIX A: GEOGRAPHICAL CONFIGURATIONS FOR RIVERS SHARED BY TWO STATES

Below you will find the 13 configurations identified.

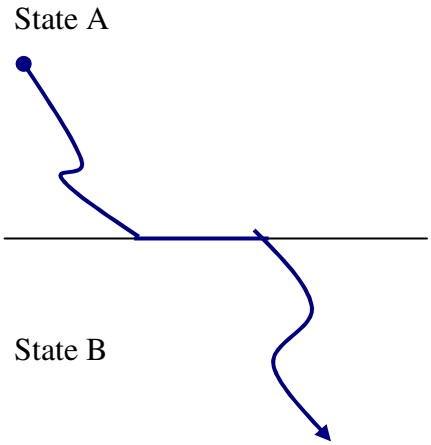
1. **Through-Border**



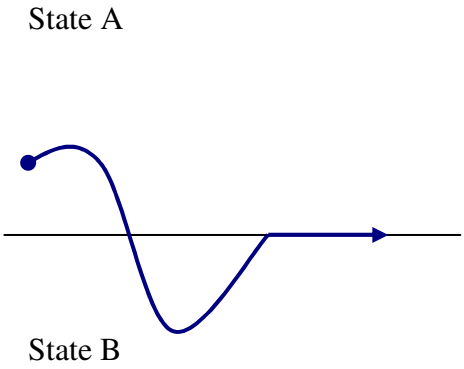
2. **Border-Creator**



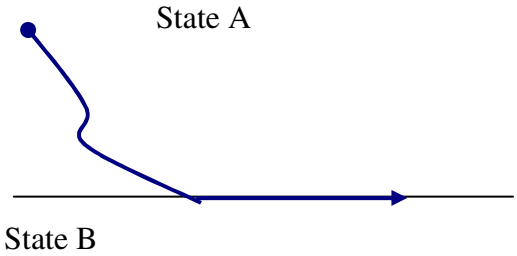
3. **Mixed**



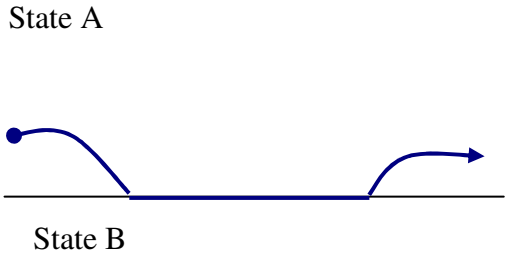
4. **Through-Border but Creates Border**



5. **Partial Border-Creator**

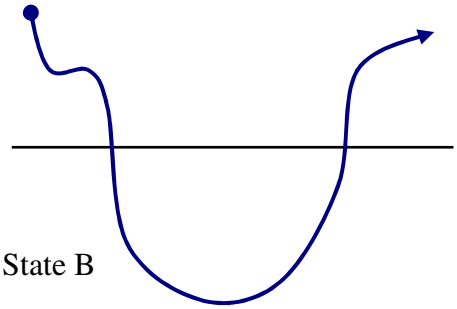


6. **Partial Border-Creator but Returns**



7. **Through-Border *2**

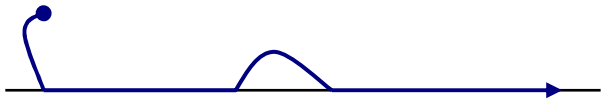
State A



State B

8. **Partial Border-Creator *2**

State A



State B

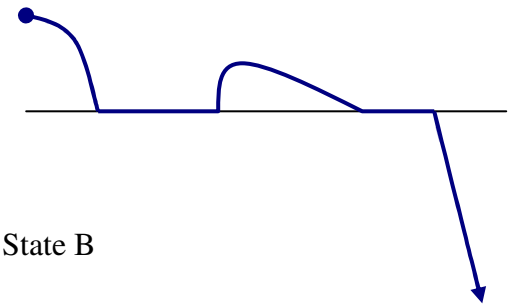
9. **Border-Creator but Enters State**

State A

State B

10. **Partial Border-Creator *2 But Enters State Second**

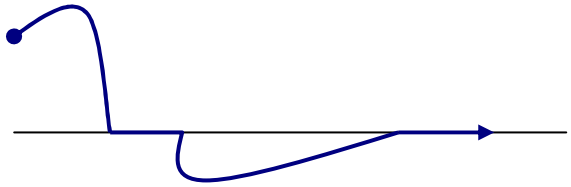
State A



State B

11. **Partial Border-Creator * 2 But Enters State First**

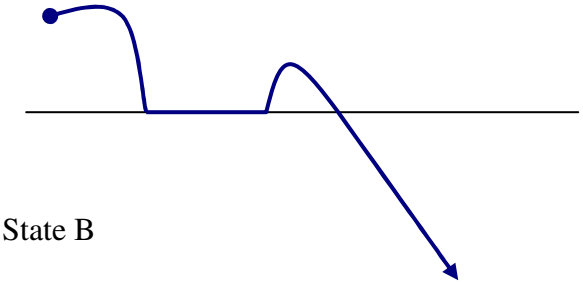
State A



State B

12. **Partial Border-Creator But Returns But Then enters Other State**

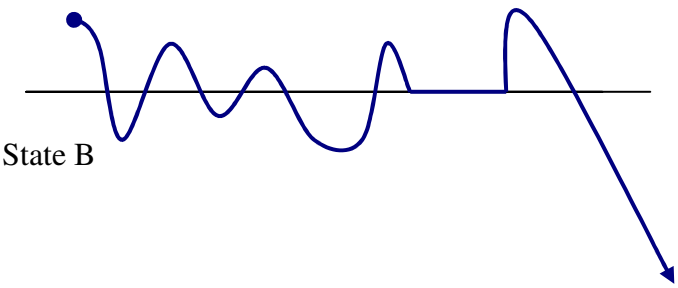
State A



State B

13. **Mixed Zig Zag**

State A



State B

APPENDIX B: A GAME THEORETIC PRESENTATION OF A CONFLICTVE GAME VIS-À-VIS AN INTERNATIONAL RIVER AND A SECOND GAME WHICH INCLUDES SIDE-PAYMENTS, PRODUCING A COOPERATIVE EQUILIBRIUM

Below I present two games with two players: State A and State B. The first game will point to a conflictive equilibrium. No side-payments are introduced as an option. The second game considers side-payments as an option for use by State B. The game points to two equilibria: a conflictive one and a cooperative one. While the assumptions made determine the equilibrium, the second game demonstrates that a cooperative outcome can come about given the side-payment option available to State B.

GAME 1: The Conflictive Nature of Water

	B1 Status Quo (SQ)	B2 Block Navigation (BN)
A1 Status Quo (SQ)	0 , 0	-E , F
A2 Dam River (D)	L , -K	**S , R**

Given a *through-border* configuration; State A is upstream and State B is downstream. State A thrives mostly on industry and industrial production. B thrives mostly on commerce and trade.

Assume that State A has two possible actions: status quo and damming the river so as to produce hydroelectricity for its industries.

Assume that State B has two possible actions: status quo and blocking State A from navigating the river so as to promote its own navigation fleet and reduce congestion on its part of the river.

If State A dams the river and State B does not block navigation State B is harmed because the dam is built not in coordination with State Bs concerns. It will therefore obtain a negative payoff. However, if State A dams the river and State B blocks navigation (say as retaliation) State B is harmed because the dam is not built in coordination with State Bs concerns. However, State B still gains a positive payoff because it mostly profits from navigation and now has a monopoly over the river's navigation. Of course this pay off is smaller compared to if State A does not dam the river and State B still blocks navigation.

If State B blocks navigation, and State A does not dam the river, State A is harmed because State A can't send its trading ships downstream. It will therefore gain a negative payoff. However, if State B blocks navigation and State A dams the river (say to produce hydroelectricity), State A is still harmed because it can't send its trading ships downstream but still gains a positive payoff given that it mostly profits from industrial production and can provide electricity to its factories given the new dam. Of course this pay off is smaller compared to if State B does not blocks navigation and State A still dams the river.

Process of the game; four possible scenarios in this game:

*(A1, B1)—State A and State B take no action to harm the other; hence payoffs of 0 , 0. These values are normalized for comparison with the other values in the matrix.

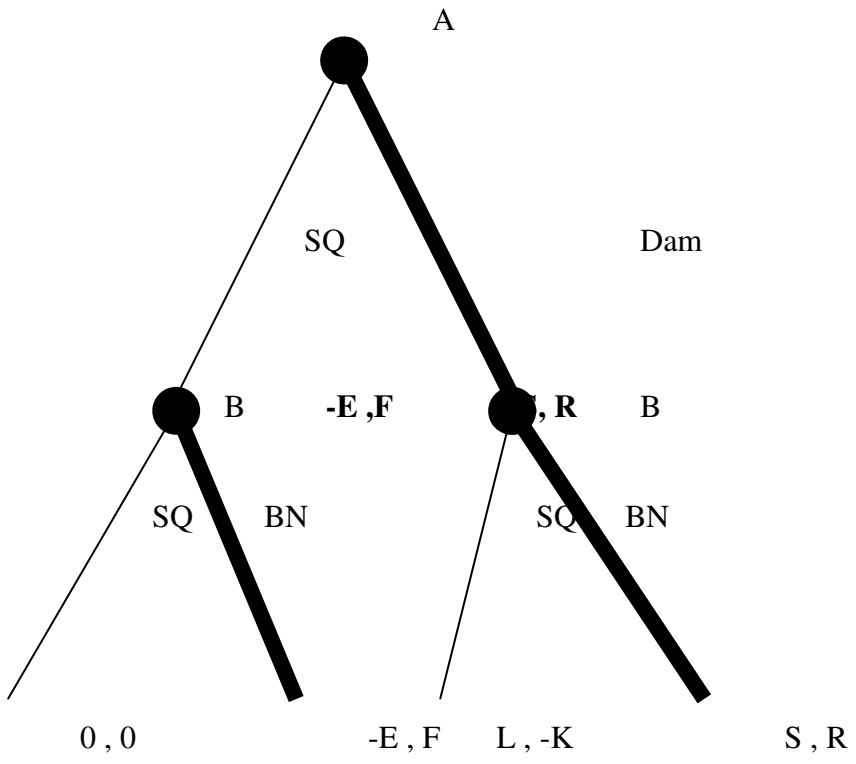
*(A1, B2)—if State A takes no action and State B blocks navigation; then A receives a negative payoff given that it can not send ships to the ocean and deliver goods by boat and because it does nothing to retaliate and make some gain ($E > 0$); B receives a positive payoff now because B has, say, a monopoly of the river and the specific trade route and also congestion of the river is stopped ($F > 0$).

*(A2, B1)—if A dams the river and B does nothing; then A receives hydroelectricity it can produce from the storage of the dam ($L > 0$); B receives a negative payoff given that the dam is built without coordination with B and it affects the flow of the river into B. Also B does nothing to retaliate and attain some gain ($K>0$).

*(A2, B2)—if A dams the river and B blocks navigation; then A still obtains a positive payoff because A relies less on navigation for trade (S>0); B also obtains a positive payoff because B relies more heavily on trade (R>0). However the payoffs are smaller compared to when one state does nothing and the other state proceeds with their action (damming the river or blocking navigation).

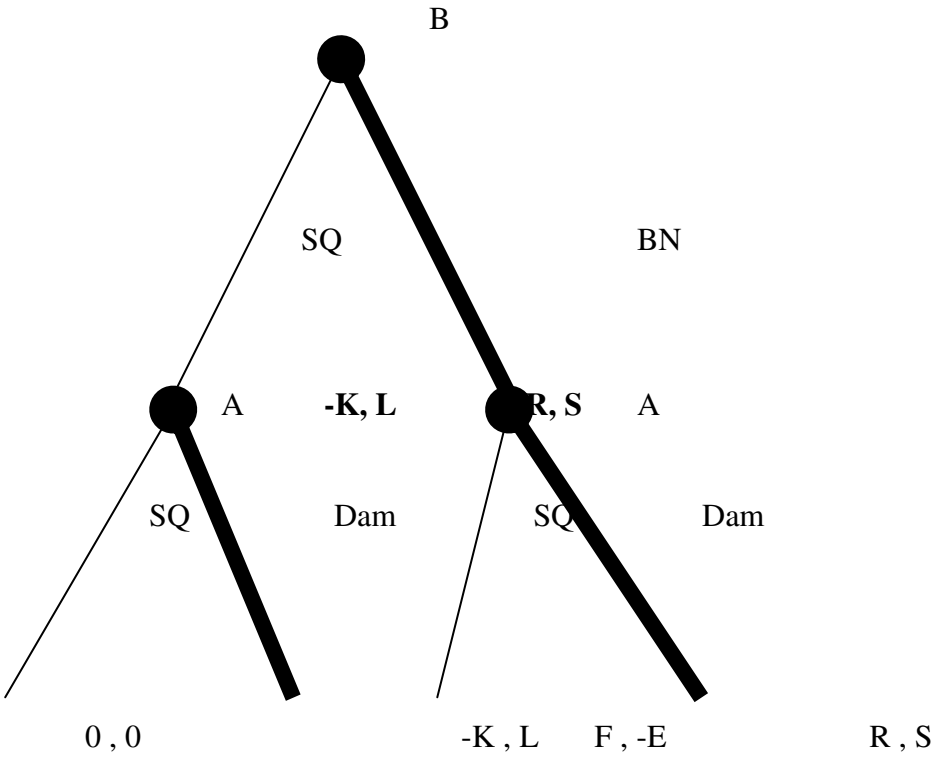
The Nash Equilibrium in pure strategies is **A2, B2 (where 0<R<F and 0<S<L)**. This is a classic conflict game where, given their possible actions, both countries do best by not cooperating. However, it is not of a prisoner's dilemma type, since they get more by not cooperating than in the status quo.

Now consider a game tree where A moves first. We shall fold the tree backwards and see what A's preferred strategy is given B's preferred strategy.



As also illustrated in this game tree by folding the tree backwards, A will dam the river and B Stop Navigation.

Now consider a game tree where B moves first. We shall fold the tree backwards and see what A's preferred strategy is given B's preferred strategy.



Even if State B moves first and State A moves second, the solution is still that State B will block navigation and State A dam the river.

GAME 2: The Side-Payment Game

Now consider a game where side-payments are introduced as a third option for State B to employ in dealing with upstream State A. Therefore, State A's options are the status quo and damming the river. State B's options are the status quo, blocking navigation, and providing side-payments so that the damming of the river is done in coordination with State B's desires (with the side-payment option State B also gains some hydroelectricity produced by the dam).

I will display this game only as an extended game rather than a normal form game. The reason is as follows. It is perfectly possible/logical that State B may want to provide a side-payment to State A for not building a dam and harming her. However, in the normal form game, where by definition both parties choose their strategies independently of each other, the game does not describe this option appropriately. It is, therefore, important to make this game an interactive one to include threats and promises. And for simplicity, I will keep the State B's option of side-payments limited only to State As decision to build the dam cooperatively.

Consider a game tree where State A moves first. I shall fold the tree backwards and see what State A's preferred strategy is given State B's preferred strategy. In this game I will add an interaction component by including a threat by State A to build a dam unilaterally for hydroelectricity purposes, inaction by State B given the threat, a retaliatory threat by State B to block the river's navigation, and an offer by State B to provide side-payments to State A so that the dam be built in coordination with State Bs concerns (and where State B will attain some hydroelectricity from the dam). Finally, additional choices will also be available to State A given the choices made by State B such as backing down from building the dam given State Bs threat to block navigation, damming the river despite State Bs threat to block navigation, accepting the offer of side-payments and building the dam in coordination with State B, and rejecting the offer of building the dam in coordination with State B. Of course, if State A rejects the offer of side-payments from State B, State B will block navigation.

Below I provide an illustration of two possible equilibria (a cooperative one and a conflictive one) given that under certain conditions some utilities may be greater than other utilities or smaller than these same utilities—this depends on how the states assesses their utilities. The utilities that become susceptible to different valuations by the states, and hence producing different equilibria, are utilities S and Y and R and U. Given that this game is

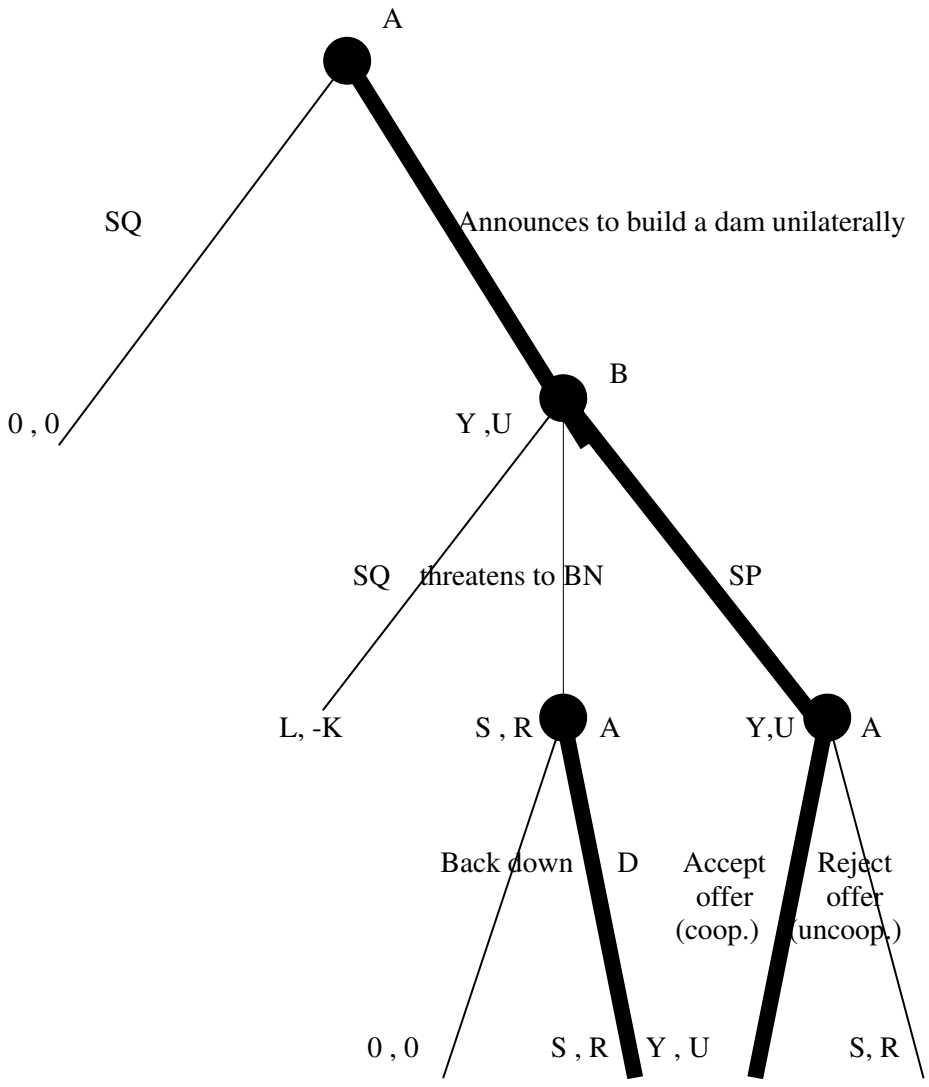
illustrative and intuitive, attempting to draw a broad picture of the situation, rather than tied to actual numbers of costs and benefits, it must acknowledge all possible outcomes.

Specifically, whether State A prefers utility Y to utility S depends on whether it sees the compromise of building a dam with State B's concerns in mind as trumping the option of building the dam without coordination with State B and having its ships blocked by State B.

In general utility U= 0+C-P (where 0 is not blocking navigation, C is State Bs value of the dam built cooperatively, and P is the side-payment provided to State A). Whether utility U is greater than or smaller than utility R depends on whether C-P is greater than or smaller than utility R.

Despite the two possible equilibria presented below this game demonstrates that with the side-payment option a cooperative outcome can be attained.

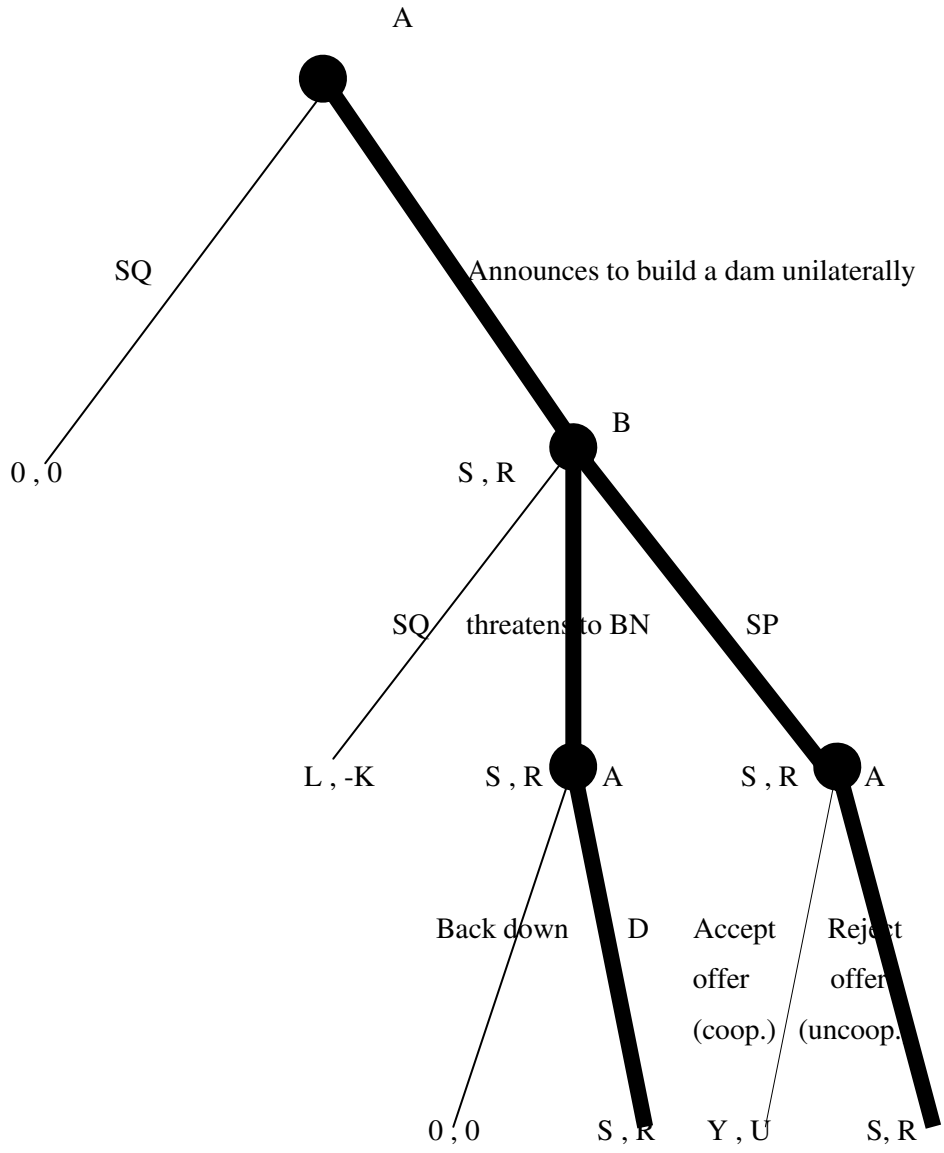
Equilibrium #1: Cooperative Outcome



As illustrated in this game tree by folding the tree backwards, the cooperative equilibrium is attainable. State A will accept the offer of side-payments from State B and dam the river in coordination with State B since Y>S. Y>S because State A is not harmed by the blocking of navigation, when accepting the side-payment offer, but rather attains side-payments and benefits from hydropower production. Folding the tree backwards, State B will provide side-payments to State A since the status quo option provides a negative payoff and U>R. U>R because State B obtains higher benefits given that the dam project built by State A is coordinated with State Bs desires and therefore the flow of the river water does not harm it or its navigation fleets. Folding the tree backwards one last time demonstrates that State A will dam the river since Y>0.

Below I will investigate the conflictive equilibrium.

Equilibrium #2: Conflictive Outcome



As illustrated here, another possible outcome is a conflictive one. Here State A dams the river and State B blocks navigation. Here S>Y because State A perceives the unilateral option of building the dam without taking account of State Bs concerns as the better alternative—also the river is blocked and State A can not send its ships downstream. Folding the tree backwards again, State B has no other option but to block navigation since it will not provide side-payments to State A for rejecting its offer of building the dam cooperatively.