

“Governance Mechanisms to Address Conflict in Environmental
Agreements: the case of transboundary water treaties”

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Abstract

Transboundary river basins are of immense economic and environmental importance but their management constitutes a vexing international problem. While supply is constant, human activity and changing environmental conditions lead to the decline of global water availability. Scarcity and changes in resource accessibility are likely to spur conflict between partners to a shared system. Therefore, international institutions and agreements, able to adapt to changing circumstances will prove to be essential. Regarding the flexibility of international water agreements, mechanisms to address conflict (CRM) have been defined as particularly important by numerous scholars in the field. But despite the fact that a better understanding of CRM-use could provide key insights about costs and benefits, there has been no systematic study of CRM appearance in international treaties or the conditions that affect their choice.

This study therefore analyzes the content of a large number of water treaties and examines which mechanisms are adopted under what conditions. First, we distinguish 4 types of conflict resolution (“negotiation”, “mediation”, “arbitration” and “adjudication”). Consequently we build up a theoretical framework covering the expected relations between the transaction costs of CRM, the proxies to assess them (independent variables) and conflict resolution adoption (dependent variables). Eventually, a multivariate regression of the available data will allow us to draw conclusions about the appearance of CRM in international water agreements. So far, our results indicate that, although conflict resolution is considered important, still 45 per cent of the sampled treaties lack such provision. Multilateral agreements, however, are more likely to contain CRM. Most agreements do not specify the activation procedure of the mechanism or how to bear the cost of its use. By means of this research we aim to offer policy makers a guide for negotiating environmental agreements.

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1. Introduction

Transboundary river basins are of immense global economic and environmental importance but their protection and management constitutes a vexing international problem. Global water availability is in decline due to growing demand (Hayton & Utton, 1989; Falkenmark, 1990; Yoffe et al, 1993; Fuwa, 2003; UNDP, 2006; Dinar et al. 2007; Bernauer & Kalbhenn, 2010), unsustainable water management practices (Bernauer&Kalbhenn, 2010) and changing environmental conditions (Eea, 2007; IPCC, 2007; IWMI, 2006; Gleick 1993; UNDP, 2006; TEC, 2007; World Bank, 2009). Increased pressure on global water supply, together with new water uses and allocation patterns can easily induce friction over this scarce resource (Homer-Dixon, 1991). The more, considering the fact that the majority of the world's countries have some portion of their territory in an international basin (UNDP, 2006; Conca, 2006), while a growing percentage of the human population directly depends upon water that originates outside of their borders (Ohlsson, 1995; Falkenmark and Lundqvist, 1995; Frederick, 1996; UNESCO, 2005), it is obvious that withdrawals from one country can drain life-giving water from a neighbouring country and as such become a source of interstate conflict (Hayton & Utton, 1989; Homer Dixon & Percival; 1997; Toset et al., 2000; PCCP, 2002; Nordas et al., 2007).

This continuous pressure on water resources poses exceptional institutional and collective action problems, especially because freshwater systems ignore political, administrative and legal boundaries Gerlak et al., 2010). Bernauer and Kalbhenn (2010) found that growing water scarcity combined with weak institutional arrangements and the absence of international water treaties are key-factors for spurring conflict. The design of more appropriate interstate treaties could therefore be

an effective way of trying to avoid future disputes between states (Ohlsson, 1995; Swain, 2001; Postel & Wolf, 2001; Hensel et al., 2006; Conca, 2006). As the FAO index of international water agreements indicates, in the past countries already resorted to treaties in an attempt to address uncertainty about the value and utilization of shared resources (Ohlsson, 1995; PCCP, 2002; Bernauer, 2002; Espey and Towfique, 2004; Bernauer & Kalbhenn, 2010). The agreement may be watercourse specific (e.g. the 1961 Columbia River Treaty), an umbrella agreement regulating regional waters (e.g. 1992 Helsinki Convention on Transboundary Watercourses) or an instrument for conflict resolution of the “friendly relations between neighboring states” (PCCP, 2002).

However, treaties, as they exist today, may prove to be inept to address future conflicts if water becomes scarce (IPCC, 2001; Nordas, 2007). While it may form the basis for the initial watercourse regime, issues related to its implementation, such as changed water supply or demand, may lead to conflict (PCCP, 2002; Ostrom, 2005). Hence, numerous scholars acknowledged conflict resolution mechanisms (CRM)³ as particularly important elements to water treaties (Rogers and Hall, 2003; Conca, 2006; Wolf, 2007; Bernauer and Kalbhenn, 2008; Dinar et al., 2008; Gerlak et al. 2010). Yet, even after repeated demands for more detailed dispute resolution procedures in the past (Caldwell, 1984; Hayton & Utton, 1989; UNEP, 2002), little progress has been made so far (Pacific Institute, 2009).

Besides the worrying fact that conflict resolution in transboundary water agreements is either absent or unsophisticated (Goldenman, 1990, Hamner & Wolf, 1998;

³ Conflict resolution mechanisms, hereafter often referred to as CRM

Fischhendler, 2004; Boockmann & Thurner 2006, Drieschova et al., 2008), no systematic efforts have been undertaken to identify the mechanisms that are available and the ones that are actually adopted. While there is a considerable amount of literature on the subject of conflict and cooperation in international water management, conflict resolution as a concept has so far only been defined vaguely by Durth (1996), Marty (2001) or Wolf (1997) (Bernauer, 2002). The more, the subject has generally been considered as a single issue in the past (Koppel, 2009), although we know that a variety of such mechanisms exist.

Our study aims to partially fill this gap by addressing key questions about conflict resolution and its appearance in international agreements. First, we identify the main categories of such mechanisms, based on review of the available literature on the subject. However, a gap between the mechanisms available and the ones actually adopted leads us to the assumption that conflict resolution comes at a cost, we will take a closer look at the phenomenon of transaction costs. After briefly lining out the methodology, we therefore take a closer look at the phenomenon of transaction costs and aim to build up a theoretical framework capturing the expected relations between costs, the proxies to assess them and their influence on the adoption and appearance of CRM. Finally, a multivariate regression and analysis of the data will provide the results of our research. Through this work we hope to gain a better understanding of what affects the use of conflict resolution in international water agreements.

It should be noted that this paper summarises an ongoing research project and is therefore a piece of work in progress. This implies that much of the data still needs to be collected. Accordingly, the result section is rather meant to illustrate some of the implications of the theoretical framework.

2. The CRM available

The distinction of CRM in our study is based upon the literature which usually identifies four main types of conflict resolution ranging from soft law to hard law mechanisms (Wolf, 1997; Foley, 2007; Emerson et al., 2003). This includes negotiation, mediation, arbitration and adjudication. Each of these mechanisms is characterized by a different **nature** and **role of a third party**.

“Nature” implies that conflict resolution can either be “*competitive*” and rights-based or “*cooperative*” and interest-based. A competitive mechanism is generally adversarial and induces win-lose situations, while cooperative mechanisms tend to stimulate direct communication and generate win-win outcomes (Deutsch, 1983; Schellenberg, 1996; Brown&Marriot, 1999; Liebman, 2000; Goldberg, 2003; Leb, 2003; Spangler, 2003). The **role of a third party** implies the intervention of mediators, joint commissions, arbitrators or judicial courts in the process. Along the line of Oran Young’s study (1972), we distinguish between “*passive and informal*” third parties, with limited intervening power and “*active and formal*” third parties, with the authority to issue formal statements or impose solutions.

2.1 A classification of the available conflict resolution mechanisms

A first type of conflict resolution is **negotiation**, a process through which disputants voluntarily work out an agreement between themselves, while aiming to satisfy the interests of each of the factions involved (McCool, 1993; Schellenberg, 1996). Negotiation can be direct between parties or representative through agents, diplomats or experts. However, it never assumes a third party (Merills, 1984; Stewart, 1989). Direct negotiation is referred to as *consultation*, while representative negotiation

refers to a joint and institutionalised *commission*. Importantly, such a commission does not dispose of any formal decision-making power, for in so having, it would be assuming an arbitral function (Probst, 1989). An example is the 1909 International Joint Commission between Canada and the U.S (Alpher & Monahan, 1986). In some cases, the treaty does not specify in which form negotiation should take place.

The second mechanism is **mediation**, which prescribes the intervention of an independent third party. It is a cooperative and interest-based process in the sense that disputants as well as third parties try to look for common grounds and a compromising solution (Young, 1972; Stewart, 1998; Liebman, 2000). We distinguish two types, according to the level of authority disputants wish to assign to a third party: the practice of *good offices* is hardly interventionist and merely offers a temporary and alternative gateway for communication (Merills, 1984) while *conciliation* is semi-institutionalised. The latter normally assumes the assignment of long-term experts or commissions that are required to intervene every time a dispute arises (Probst, 1989). None of the above procedures have the power to issue binding solutions. However, as with negotiation, it can be that the form of mediation is left unspecified by the treaty.

Yet, even experienced diplomats and mediators know that also institutionalised best efforts to contain disagreement may eventually fail (Hayton & Utton, 1989), creating the need for more rigorous and formal conflict resolution such as arbitration and adjudication. **Arbitration** is fundamentally competitive and rights-based since a third party determines directly the winner and loser in relation to the rights and wrongs of a dispute. A decision issued by an arbitral tribunal can therefore be binding. The

process contains some of the same elements as adjudication, however, while the latter takes place in an established court, arbitration requires the parties themselves to set up the machinery for handling a dispute or a series of disputes (Merills, 1984; Stewart, 1998, Goldberg et al., 2003). Finally, **adjudication** or litigation indicates a process where a dispute is settled in court, according to legal statutes and with advocates presenting evidence on behalf of the parties (Liebman, 2000). The process is adversarial and rights-based and can take place on a domestic or international level (Stewart, 1998; Spangler, 2003; Chatterjee and Lefcovitch, 2008). States can agree by treaty to delegate some decision-making power over water related issues to *domestic courts*, yet, referring disputes, upon consensus, to the *International Court of Justice (ICJ)* is the more common practice in the field. Both types of court decisions can be binding, although in the case of the ICJ, no enforcement mechanisms exist to back up the court’s decisions (Wolf, 1997).

Table 1 presents the differentiation of mechanisms.

Table 1: Conflict resolution mechanisms

Conflict Resolution Mechanism	Sub-Mechanism	Nature	Third Party
Negotiation	Consultation	Cooperative	Absent
	Joint Commission of Representatives	Cooperative	Absent
	Unspecified	Cooperative	Absent
Mediation	Good Offices	Cooperative	Passive and informal
	Conciliation	Cooperative	Passive and informal
	Independent Commission	Cooperative	Passive and informal
	Unspecified	Cooperative	Passive and informal
Arbitration	Not permanent tribunal or board	Competitive	Active and formal
	Permanent arbitration	Competitive	Active and formal
Adjudication	Domestic Court	Competitive	Active and formal
	International Court of Justice	Competitive	Active and formal

3. Methodology

To ascertain whether and how conflict resolution is applied in water treaties, we conducted a content analysis of the available transboundary water treaties. The unit

of analysis is the treaty⁴ for which the most comprehensive source is the recently expanded Transboundary Freshwater Dispute Database (TFDD), listing a total of 679 agreements. The treaties were selected randomly and included only primary agreements, substitutes of former (primary) agreements, exchanges of notes, conventions and protocols to agreements, all of which full or substantial text is available. All were written in - or translated into - English or French⁵. The first agreement in the sample dates from 1857 while the last was signed in 2004. Only two of the hundred treaties in the sample were general conventions rather than basin specific treaties. In a first stage we run a trial of 100 treaties, which allows us to test and adjust our theoretical framework. In a second stage we review all the agreements that respond to the above requirements and that are available in the TFDD.

Consequently, the treaty content was read and analyzed first for reference to conflict resolution, second for the type of mechanism used. A theoretical framework combining the proxies for cost-assessment with the dependent variables allows us to formulate a set of hypotheses. Finally, a multivariate regression analysis will provide us with the results of our research.

4. Dependent Variables

Our main dependent variable throughout the research is the **type and number of conflict resolution mechanisms** in a treaty. Others include the **place of the mechanism in the treaty** (“*the preamble*”, “*the treaty body*”, “*the annexes*” or “*more parts*”), the **condition in which it is supposed to be used** (when there is a “*breach*”

⁴ Defined in accordance with the Vienna Convention of the Law of Treaties of 1969 as “*an international agreement concluded between states in written form and governed by international law, whether embodied in a single instrument or in two or more related instruments and whatever its particular designation*” (Vienna Convention, 1969, Art.2).

⁵ With two or three exceptions of treaties in Italian and Dutch

of the agreement, when there is an argument about the “*interpretation or application*” of the treaty terms, by “*periodical review*”, because of a “*change in physical conditions*” and finally under “*other*” or “*unspecified*” circumstances), the **activation procedure** (“*unilaterally*”, “*consensus*”, “*voting*”, “*majority vote*”, “*issue is ignored*”) and the **cost sharing method** (the treaty applies the “*polluter pays*”-principle, the costs are “*equally divided*” or covered by a “*third party*”, the “*beneficiary pays*” or the issue is left “*ignored*”). Another important aspect we looked at is the **issue area** to which the mechanism applies and whether the scope of the CRM was specified. Consequently we examined whether the mechanism applied to all issues of the treaty or to one in specific, for example, navigation. The different issue areas are taken from the TFDD and include: border issues, economic development, fishing, flood control, hydropower, infrastructure/development, irrigation, joint management, navigation, technical cooperation, territorial issues, water quality and water quantity.

Finally, two additional dependent variables relating to the **institutionalisation** and the **maturity** of a CRM were composed. Institutionalised conflict resolution includes a commission (negotiation or mediation), a permanent tribunal (arbitration), domestic courts and the International Court of Justice (ICJ) (adjudication). Maturity is captured by five of the variables mentioned above (the condition of mechanism use, the activation procedure, the cost sharing method, the issue area and institutionalisation). Depending on whether the specific values of these variables are expected to enhance or decrease mechanism maturity we codified them either “0” or “1”, the latter representing a higher level of maturity. An average of the codes finally determines mechanism maturity. Each treaty in our sample will be read, categorised and codified according to the table below.

Table 2: Dependent variables

Variables	Values
1. Type of CRM	Negotiation (consultation, commission of representatives, unspecified), Mediation (good offices, conciliation, independent commission, unspecified), Arbitration (not permanent, permanent) Adjudication (domestic court, ICJ)
2. Number of CRM	Lower number of CRM: {0, 1} Higher number of CRM: {2, 3-4, +4}
3. Place of the CRM in the treaty	Preamble, treaty body, annex
4. Condition of use	Breach, interpretation/application, periodical review, change in physical conditions, failure of a previous mechanism, issue ignored
5. Activation procedure	Unilaterally, majority, consensus, issue ignored
6. Cost-Sharing method	Polluter pays, equally divided, third party, beneficiary pays, issue ignored
7. Issue Area	Single issue, Multiple issues
8. Institutionalisation	Institutionalised (Joint commission of representatives, Independent commission, permanent arbitration, domestic court, ICJ), Not Institutionalised (consultation, unspecified form of negotiation, good offices, unspecified form of mediation, no permanent arbitration)
9. Maturity	Averaged value of: a) Condition of use: issue ignored (0), other categories: (1) b) Activation procedure: unilaterally, issue ignored (0), other categories (1) c) Cost sharing: issue ignored (0), other categories (1) d) Issue area: single issue (0), multiple issues (1) e) Institutionalisation: not institutionalised (0), institutionalised (1) → $\{a+b+c+d+e\} / 5 = \text{value between 0-1 with:}$ Immature CRM: 0.00-0.49 Mature CRM: 0.50-1.00

5. What affects the choice of CRM: a transaction cost approach

In this section we review the expected costs of CRM and hypothesise how this potentially determines the adoption of conflict resolution.

The origins and application of the transaction cost (also TC) theorem are based mainly on the findings of Ronald Coase, a British economist who stated that:

“In order to carry out a transaction it is necessary to know what we are dealing with and on what terms, to conduct negotiations leading up to a bargain, to draw up a contract, to undertake the inspection needed to make sure the terms of the contract are being observed and so on.”

These actions, however, are potentially very costly and often sufficiently costly as to prevent a transaction of taking place (Coase, 1970; Kesting, 2007). When it comes to dispute resolution, the main question remains on how conflict can be solved in a low-cost way since lower costs are believed to stimulate the adoption of CRM (Libecap, 1995; Streit, 1998; Bernauer, 2002; Rao, 2003). Moreover, if transaction costs are too

high, parties will not even bother to negotiate (Gilligan, 2003)⁶.

Along the line of general distinctions made in transaction cost (TC) literature, we distinguish between **political costs** (ex ante) attached to the establishment of a mechanism on one hand, and **monitoring and enforcement costs** (ex post), brought about by the operation of a mechanism on the other (Coase, 1970; Williamson, 1985). In what follows below we discuss each of the different cost elements together with the proxies to assess them. A table at the end of this chapter summarises the entire theoretical framework. This paper does not allow for a detailed discussion of the costs' assessment, yet, more information on this issue can be requested from the author.

5.1 Political Costs

In this section we examine the main elements of the political cost. It is important to note that the two sets of cost elements (ex ante and ex post) are usually interdependent, hence an attempt to minimise one set of TC will have a corresponding effect on the entire cost frame (Rao, 2003). The following distinction is based upon earlier work of Coase (1937), Williamson (1985), Hodgson (1988), Levi (1988), Ostrom et al. (1993), Furubotn and Richter (2000) and Rao (2003) and lists respectively *uncertainty costs*, *bargaining costs*, *sovereignty costs*, and related to the issue of common pool resources, *resource availability costs*.

⁶ It needs to be stressed that the concern lies not with the absolute level of costs, which would hardly allow for absolute quantification, but rather with the relative differences between them (Gilligan, 2003; Kesting, 2007).

5.1.1 Uncertainty Costs

Negotiations usually take place under conditions of considerable complexity and uncertainty, and it is not economical for the parties to specify in advance how they ought to behave under every conceivable contingency (Schwartz and Sykes, 2002). In the line of game theory and based on Barrett's (2003) findings about the relation between a growing number of players and an enhanced risk of dispute, we identify the **number of signatories** as the main factor that fuels this cost. Consequently, a shift from bilateral to multilateral treaties is expected to increase the uncertainty and hence the transaction cost (Gilligan, 2003), what we expect to be addressed by a higher number of CRM per treaty.

However, uncertainty costs are also often associated with information costs. This concerns uncertainty about scientific knowledge (Ostrom et al. 1993), how this will affect parties' preferences (Hipel et al., 2004) and the context of the resource (Ostrom et al., 1993). Kasper and Streit (1998) argue that costs induced by the lack of information can be kept relatively low if there is a possibility to extrapolate from past experiences or analogue cases, thereby avoiding innovation (Hodgson, 1988). Following this reasoning, it is useful to organise parties under a same institutional umbrella as to increase the availability of information while preventing the costs of creating new rules (Axelrod, 1984; Keohane, 1984; Young, 1989; Keohane and Ostrom, 1995; Gilligan, 2003; Conca, 2006). The above leads us to the following assumption:

Hypotheses 1: "The higher the number of parties, the more likely a treaty will be associated with higher uncertainty costs, hence we expect a higher number of CRM in a more institutionalised form"

5.1.2 Bargaining Costs

Bargaining costs relate to the outlays that must be made when parties have to decide upon an institutional arrangement. One of the main components of such costs is the amount of time that is necessary to come to a consensus (Williamson, 1970; Furubotn and Richter, 2000). When parties differ substantially with regards to their preferences, resources and information, more time and effort will be required to come to a consensus (Ostrom et al., 1993). Eventually, this cost-provoking effect becomes even stronger when the number of signatories grows (Lindemann, 2005).

On the other hand, institutionalised procedures and the adoption of mature CRM's are expected to effectively reduce the costs of future transactions (Susskind, 1994; Kasper and Streit, 1998; Gilligan, 2003; Maitland et al., 2009). Also, when third parties have the authority to issue binding resolutions, bargaining costs can be kept low.

In addition, when parties have the same expectations and preferences, transaction costs are expected to drop (Shirley, 2003). Consequently, we assess the homogeneity in parties' preferences by looking at the **compatibility of political systems** and the **level of trust** between them. Politically compatible countries, and politically stable countries in particular, may be deterred from involvement with states that find themselves in a political turmoil or that are institutionally weaker. Besides the fact that democracies are believed to be more politically stable and committed to solving common transboundary problems (Kalbhenn; 2007), they also tend to interact more than autocracies (Milner, 1997). For this last reason, we expect democratic states to engage more in cooperative processes of conflict resolution (negotiation and mediation). Based on the above we can formulate the following hypotheses:

Hypothesis 2a: "When signatories are more democratic, we expect lower bargaining

costs and hence a lower number of CRM per treaty, together with more negotiation and mediation mechanisms”

Hypothesis 2b: *“When signatories have incompatible political systems, we expect a higher number of CRM per treaty”*

Concerning the level of trust, we look at the history of interstate militarised dispute and the diplomatic relations for the year in which the treaty was signed. Following the reasoning that parties with cooperative, trustful relations, generally feel less need to adopt conflict resolution and/or to specify its terms of use, we expect parties with trustful relations to adopt less mature CRM.

Hypothesis 3: *“The higher the level of trust between parties, the lower the bargaining costs, hence we expect an immature CRM”*

5.1.3 Sovereignty Costs

Concerns over sovereignty have strong effects on state preferences, particularly with regards to the sum of decision-making power they are willing to hand over to international or supranational institutions. The traditional model of dispute resolution places total control by states at one end of a continuum (Keohane et al., 2000) while on the other end highly legalistic dispute settlement mechanisms transfer the entire policy-making authority to international institutions (Buhr, 2005). We argue that particularly the level of trust affects this cost.

When parties share trustful relations, sovereignty costs are low, inducing the preference for interstate negotiation (Carroll, 1988; Keohane et al., 2000). Furthermore, Benevenisti (1996) adds that in case states' relationship is characterised by distrust, they are more likely to introduce the requirement of consensus regarding

the activation of CRM.

Hypothesis 4a: “The higher the level of trust, the lower the sovereignty cost, hence we expect the CRM to be negotiation and mediation”

Hypothesis 4b: “The lower the level of trust between parties, the more we expect parties to adopt a consensus rule for the activation of the CRM”

5.1.4 Resource availability costs

Since our study specifically examines the adoption of conflict resolution in transboundary water agreements, we need to consider the costs attached to the management of common pool resources. For example, when countries are water poor, the risk of conflict between them is assumed to increase (Homer-Dixon, 1999; Dinar et al., 2007), eventually stimulating the adoption of CRM. The continuous risk of conflict would also stimulate the choice for institutionalised and mature CRM. Yet, an opposite thesis⁷ argues that resource scarcity may induce cooperation instead of conflict, generating relations of trust and decreasing the perceived need of states to adopt CRM. Finally, Dinar (2006) found that the likelihood of cooperation increases when scarcity grows, until scarcity goes beyond a certain level, where it will be responsible for a reduced incentive to cooperate. This means that scarcity might be a necessary condition for cooperation to take place, but not a sufficient one.

Considering this U-shaped relation, our study will only take dyads that face either high scarcity or low scarcity into consideration⁸.

⁷ Since water is crucial for the economic well-being of a state and places parties in interdependent positions, ultimately enhancing the will to negotiate an agreement which will allow for an efficient exploitation of the resource.

⁸ Data on water scarcity is obtained through the Water Poverty Index of the Earthtrends database (data from 1980 until 2002)

Hypothesis 5: “The higher the water poverty, the higher the resource availability cost, hence the more we expect a high number of CRM per treaty and the mechanisms to be more mature and institutionalised”

Also adaptive capacity can affect this cost. We measure this proxy by using the Human Development Index (UNDP), which looks at the average of life expectancy, education and GDP and provides data from 1980 up to 2007. The reasoning is that states with high adaptive capacity can more easily provide alternative solutions to water scarcity problems and as such avoid the risk of conflict over resource use. In short, they are believed to be able to adapt easier to changing circumstances than states with low adaptive capacity. As such, they perceive less need of conflict resolution.

Hypothesis 6: “The higher the adaptive capacity of parties, the less CRM per treaty we expect”

In the same line, external resource dependency can influence at the operation costs of conflict resolution. Aquastat (FAO) provides data on water resources from +-1960 to 2007. A country with a dependency rate equal to 0% does not receive any water from neighbouring countries and is therefore less likely to adopt well - developed conflict resolution mechanisms. Our hypothesis is therefore as follows:

Hypothesis 7: “ When both countries are highly dependent on external resources, we expect a higher number of CRM per treaty and we expect them to be institutionalised and mature”

5.2 Monitoring and Enforcement Costs

If it were possible for parties to envision all future contingencies, reach prior agreement about how they should be handled and develop enforceable mechanisms, all transaction costs involved would be expended prior to the agreement (Ostrom et al., 1993). But since these conditions are rarely met, ex post transaction costs or continuing costs nearly always occur (Furubotn and Richter, 2000). Because both costs usually occur together⁹, we will further discuss them as such.

The main reason these costs arise is because of the need to monitor the agreed upon mechanisms (Furubotn and Richter, 2000) and to ensure the parties fulfil their exchange obligations (Maitland et al., 2009). Four proxies (the level of trust, the compatibility of political systems, adaptive capacity and external resource dependency) allow us to assess the monitoring and enforcement costs.

Furubotn and Richter (2000) argue that the biggest saving of this cost type can be achieved through decentralisation. Since democratic governance systems are characterised by an enhanced level of decentralisation¹⁰, we expect them to adopt less monitoring and enforcement mechanisms. In the same line, it is generally agreed upon that parties with trustful relations face lower enforcement costs over time, as uniform ideas exist about implementation procedures and the nature of fair solutions to dispute (Furubotn and Richter, 2000; Ostrom, 2005). Ultimately, we expect the possibility to encounter monitoring and enforcement mechanisms higher when structures for conflict resolution are institutionalised, as is the case with commissions, permanent tribunals and domestic or international courts. Table 3 summarises the theoretical framework of our study.

⁹ Appropriate enforcement, for example, also requires monitoring activities, which will at its turn induce a cost (Furubotn and Richter, 2000).

¹⁰ The opposite applies for autocracies, which are usually characterised by a high level of centralisation

Hypothesis 9: “The more parties are democratic, the more the monitoring and enforcement costs decrease, the less we expect a monitoring and enforcement mechanisms”

Hypothesis 10: “The higher the level of trust between parties, the more the enforcement costs decrease, hence the less we expect an enforcement mechanism”

Hypothesis 11: “The more CRM is institutionalised, the more we expect a monitoring and enforcement mechanism”

Table 3: Theoretical Framework

TRANSACTION COST TYPE	INDICATORS	UNIT OF MEASUREMENT	HYPOTHESES
1. POLITICAL COSTS			
1.1 Uncertainty	Number of signatories	Bilateral, Multilateral	1. The higher the number of parties, the more likely a treaty will be associated with higher uncertainty costs, hence with a high number of CRM and more institutionalised forms of CRM
1.2 Bargaining	Compatibility of political systems	Political system (democracy, autocracy)	2a. When signatories are more democratic, we expect lower bargaining costs and hence a lower number of CRM per treaty together with more negotiation and meditation 2b. When signatories are politically incompatible, we expect a higher number of CRM per treaty
	Level of trust	History of conflict and diplomatic representation	3. The higher the level of trust between parties, the lower the bargaining costs, hence we expect an immature CRM
1.3 Sovereignty	Level of trust	History of conflict and diplomatic representation	4a. The higher the level of trust, the more we expect the CRM to be negotiation and mediation. 4b. The lower the level of trust between the parties, the more we expect them to adopt a consensus rule for the activation of CRM
1.4 Resource availability costs	Water availability	Water poverty index	5. The higher the water poverty, the higher the resource availability costs, hence the more we expect a high number of CRM and mechanisms to be institutionalised and mature
	Adaptive capacity	Human development index	6. The higher the adaptive capacity, the less CRM per treaty we expect
	External resource dependency	Aquastat index	7. When both countries are highly dependent on external resources, we expect a higher number pf CRM per treaty, and we expect them to be institutionalised and mature
2. MONITORING AND ENFORCEMENT COSTS			
2.1 Monitoring and Enforcement	Compatibility of political systems	Political system (democracy – autocracy)	8. The more parties are democratic, the more the monitoring and enforcement costs decrease, hence the less we expect a monitoring or enforcement mechanism
	Level of trust	History of conflict and diplomatic representation	9. The higher the level of trust between parties, the more the enforcement costs decrease, hence

			the less we expect an enforcement mechanism
	Institutionalisation of CRM	Institutionalised form of CRM	10. The more the CRM is institutionalised, the more we expect a monitoring and enforcement mechanism

6. Results

What follows are a few results, drawn from a first sample of 100 treaties. Of all agreements 55% contained mechanisms for conflict resolution, while 45% did not. The following table (4) shows the distribution among bilateral and multilateral agreements.

Table 4. CRM presence in Bilateral and Multilateral agreements

CRM presence	Yes	No
Bilateral	51%	49%
Multilateral	60%	40%

Figure 5 displays the distribution of the different CRM-categories. In our sample, the majority of the mechanisms applied were negotiation (32%) and arbitration (31%).

Figure 5. Distribution of CRM-types

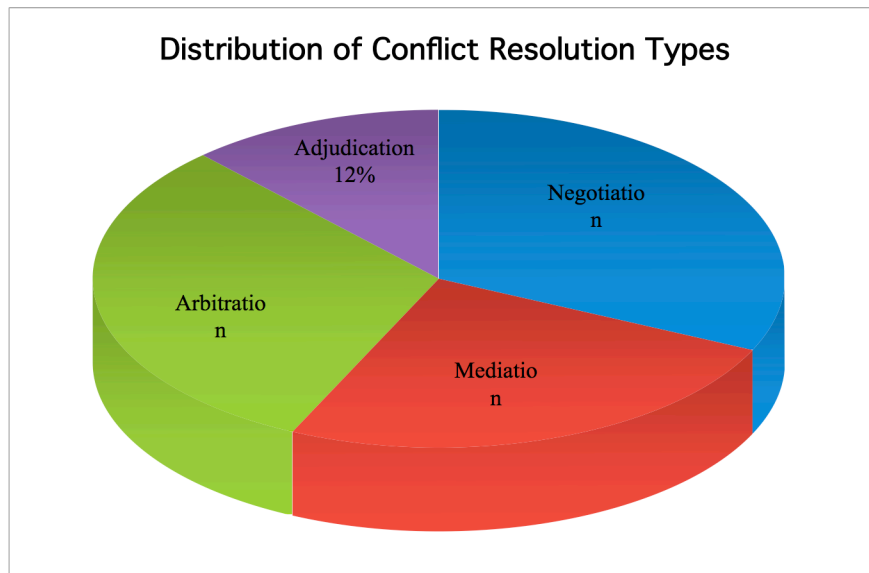
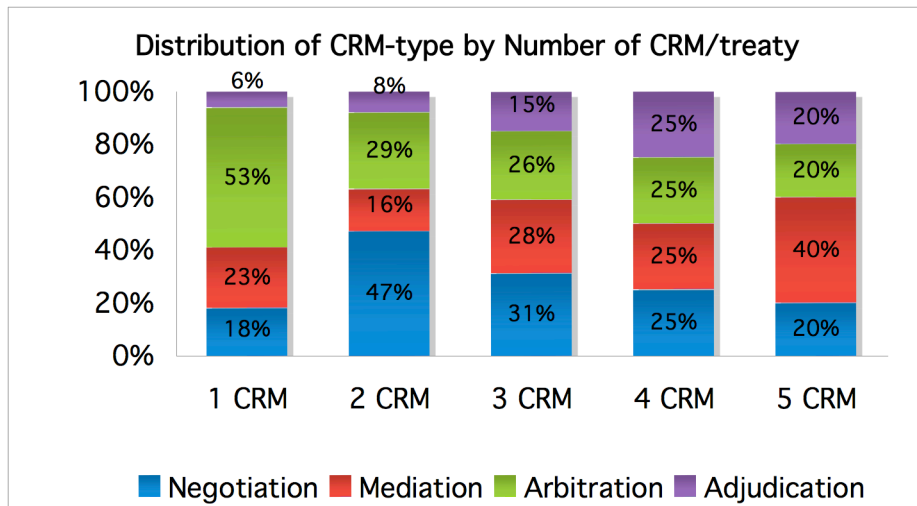


Table 6 shows us that the majority of our sample counts 2 mechanisms per agreement, while figure 7 shows the internal distribution of the mechanisms used.

Table 6: Number of CRM per treaty

Number of CRM per treaty	%
1 CRM	30%
2 CRM	38%
3 CRM	24%
4 CRM	6%
5 CRM	2%

Figure 7: Distribution of CRM-type by number of mechanisms per treaty



The above illustrates that when there are 2 mechanisms in an agreement, it is more likely that it concerns a combination of a soft law mechanism (negotiation) with a hard law mechanism (arbitration).

Figure 8 shows the distribution of conflict resolution by period, indicating an increase in mechanisms over time, while figure 9 shows the distribution by region, indicating the use of more hard law mechanisms in Africa, North America and Europe. The fact that the pattern of CRM-use in Africa is similar to the one in Europe, including the use of hard law mechanisms such as adjudication, could be due to interference of western colonial powers that drew up the bulk of the water agreements on the African continent.

Figure 8: Presence of CRM by Period

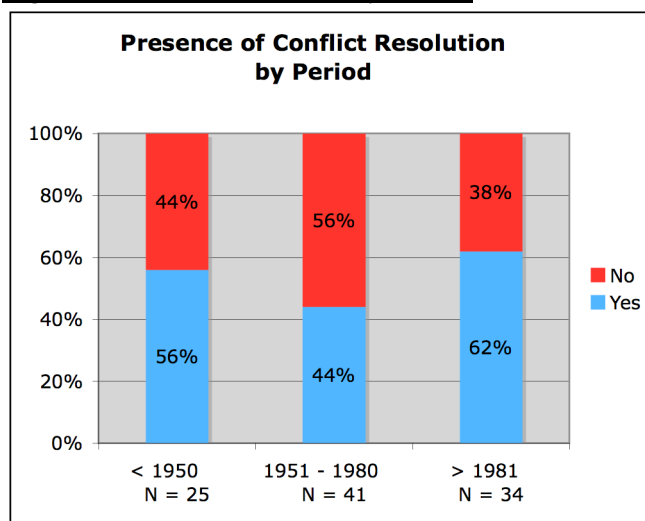
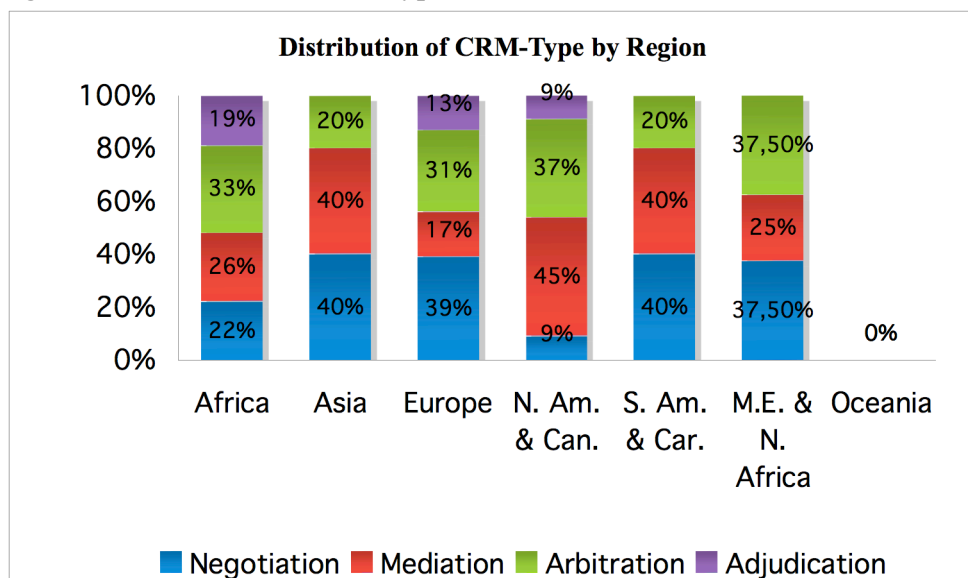


Figure 9: Distribution of CRM-type



A last figure (10) illustrates that, while considered an important aspect of transboundary water agreements, most of the treaties do not specify who will carry the cost of the CRM in place.

Figure 10: Cost-Sharing

