Received 2 September 2013
Revised 11 December 2013
9 May 2014
8 August 2014
23 August 2014
Accepted 27 August 2014

Third party conflict management of transboundary river disputes

Elvira Bobekova
National Centre for Peace and Conflict Studies, University of Otago, Dunedin, New Zealand

Abstract

Purpose – This paper aims to fill the gaps by conducting the first large *n* study examining the role of third parties in the emergence of river agreements in Asia and Africa during the time period 1948-2007. There is a growing literature on what explains agreements in river disputes. However, beyond individual case analysis, little systematic study has been done on the role of third parties in settling river disputes through agreement, in particular on the regions that are mostly affected by the global climate change.

Design/methodology/approach – Through utilising new data on the role of third parties in river disputes, this study shows that third party involvement in the conflict management of river disputes increases the likelihood of reaching river agreements.

Findings – The findings suggest that third parties use both diplomatic and economic means to increase the likelihood of emergence of river agreements, and both strategies are equally important to induce formalised cooperation.

Research limitations/implications – Yet the present study covers only two regions, and it does not delve into a discussion of the conditions under which third party interventions are successful. Rather, these are aspects that need to be explored in the future.

Practical implications – Given the current uncertainty around security challenges resulting from climate change, and with predictions of future water wars, this research contributes to the understanding how to peacefully manage current and potential conflicts around transboundary waters.

Originality/value – This study is the first large *n* study examining the role of third parties in the emergence of river agreements in Asia and Africa.

Keywords River disputes, Conflict management, Third party, River agreements

Paper type Research paper

Introduction

In response to discussions around climate change, there is growing global concern that water scarcity coupled with population growth may cause increased conflict between countries and even increase the risk of violent encounters (Gleick, 1993; Falkenmark, 1990). Even though some scholars object to such statements (Swain, 2001; Alam, 2002; Wolf, 1998), other authors argue that unregulated and unilateral use of international rivers gives rise to interstate disputes and to low-level armed conflicts (Furlong *et al.*, 2006; Hensel *et al.*, 2006; Toset *et al.*, 2000). Particularly, the Global South is believed to be vulnerable to water conflict due to expected severe water shortages in these regions and low capacity to adapt to these changes. In addition, rapid population growth in this part of the world is increasing the pressure to utilise major river systems.

International Journal of Conflict Management
Vol. 26 No. 4, 2015
pp. 402-426

1044-4068
DOI 10.1108/IJCMA-09-2013-0072

To Dr Isak Svensson, Associate Professor, Department of Peace and Conflict Research, Uppsala University.

However, although water scarcity is increasing due to global climate crises and increasing use of water for economic needs, we have not witnessed water wars to date. Instead, there were about 400 river treaties signed over the past century (Giordano and Wolf, 2003). This is puzzling. If pressure is increasing for such an essential and shrinking resource, then why do we not see more evidence of international military confrontation between riparian states? The major reason, I posit, is the development of increasingly sophisticated conflict management approaches to riparian disputes. In particular, the emergence of negotiated agreements, where the parties agree on the distribution of water and its use, is a both a hopeful and fascinating development. Nevertheless, the absence of water wars in the past does not guarantee that the militarised conflicts will not emerge in the future, particularly when there are increased demands on fresh water. There are still many basins that do not have any formal agreements and are vulnerable to the outbreak of conflict (Giordano and Wolf, 2003, p. 168).

Therefore, it is essential to understand why countries reach agreements in the presence of riparian conflicts because the presence of formalised river agreements gives a framework within which disputing states can resolve their disputes peacefully and avoid potential conflict (Wolf *et al.*, 2003; Tir and Stinnett, 2012). The past few years have seen the growth of an important and well-developed research field in regards to what makes states manage their riparian disputes peacefully and what makes them reach an agreement. Scholars mention various factors that are believed to increase the chances of cooperation over international rivers. One body of this literature (Swatuk and Van der Zaag, 2003; Lowi, 1993; Tir and Ackerman, 2009; Song and Whittington, 2004) argues that power preponderance is one of the important factors that induces cooperation amongst riparian states. Some authors (Wolf, 1995; Giordano *et al.*, 2002; Espey and Towfique, 2004; Wolf, 1997) argue that water relations within and between countries are linked to historical, economic and political conditions.

However, this literature has not examined the role of third parties in getting the riparian parties to the stage of signing river agreements. I claim that power issues alone cannot explain why riparian states manage conflict, but that the role of third parties needs to be also taken into account. Asymmetric power relationships between riparian states can be balanced towards more symmetric relationships through the involvement of the third parties. International organisations, for instance, as a third party can create cooperative environments and break stalemate situations by shifting the power balance. Third parties can use "carrots and stick" methods such as financial incentives and aid to incentivise parties to compromise. Therefore, failure to uncover the role of third parties in the conflict management of river disputes may overemphasise the role of power dynamics and underestimate the role of international institutions in an analysis of water security and climate change.

Previous research of resolution of riparian conflicts has suffered from two major omissions. First, hitherto no one has examined the role of third parties in getting the riparian parties to the stage of signing river agreements. In recent years, we have observed a growing number of international organisations, donors and external parties becoming involved in the conflict management of transboundary rivers in response to the security implications of climate change (Salman, 2009; Kirmani and Le Moigne, 1997). Previous research has looked at institutional issues more broadly, rather than focusing on conflict management explicitly (Hensel *et al.*, 2006; Stinnett and Tir, 2009;

Tir and Stinnett, 2012). Some research has looked only at negotiation attempts rather than river agreements as a dependent variable (Hensel *et al.*, 2006) or has explored whether international institutions increase the likelihood of the emergence of agreements, but does not focus on riparian conflicts explicitly (Hensel, 2008). Hence, there is little understanding as to whether these external actors are effective in facilitating riparian cooperation, and if so, how and why they are able to promote riparian cooperation in terms of river agreements.

Second, previous research on third parties in riparian disputes has been geographically restricted, as it only explores disputes in America, Western Europe and the Middle East. Previous quantitative research that explored the role of international institutions in settling river, territorial and maritime contentious issues has omitted Asia and Africa from its analysis (Mitchell and Hensel, 2007; Hansen *et al.*, 2008). Yet Asia and Africa are particularly important to examine for three reasons. First, the majority of basins in these regions were identified as being at risk to political and water stresses and most vulnerable to potential water conflict (Wolf *et al.*, 2003; Falkenmark, 1989; De Stefano *et al.*, 2012). In this regards, for instance, Gleditsch (2012) in his overview of the literature on climate change and conflict mentions that Africa and Asia are the regions to focus on; thus previous research has ignored the regions most vulnerable to climate change. Second, most of the states in these regions are developing nations with weak socio-political institutions. It is almost a truism that developing countries will be affected the worst; however, there is little understanding on how to resolve the increasing conflicts caused by climate change in poor and fragile countries (Smith and Vivekananda, 2009). Third, there is more intensive third-party engagement in these regions due to the socio-political conditions existing in the majority of their states. For example, the activities of international development banks and other international organisations are much more focused on these regions.

This study thus aims to fill this gap in the research. This study aims to answer the following research questions:

RQ1. Under what conditions do international third parties mitigate river disputes through river agreements?

RQ2. Do third-party actors increase the likelihood of the emergence of river agreements, and if so, why and how do they facilitate cooperation among riparian states?

Drawing on rational choice theory and bargaining perspective, I argue in this study that third-party involvement in riparian disputes increases the likelihood of the emergence of river agreements. I posit that conflicting riparian states face commitment and information asymmetry problems and third parties can help disputing parties overcome these bargaining failures by facilitating communication, obtaining and sharing information, providing financial aid and providing technical expertise. Third parties in river disputes are likely to utilise both diplomatic and economic means of involvement by linking river cooperation to the developmental needs of states. Additional factors such as power preponderance are also conducive to the emergence of river agreements, while scarcity of water may decrease the likelihood of the emergence of an agreement.

The paper consists of five sections. The first section discusses the previous literature to situate the current study in a broader context. The next section outlines the theoretical framework which is utilised in explaining the role of third parties in conflict

management of river disputes. The next section describes the methodology and research design of the study. The fourth section presents the findings of the research project, followed by the final section: the conclusion and recommendations for future research.

Previous empirical studies on conflict management of riparian disputes

There is an emerging field of literature explaining why rivers are peacefully managed. Scholars mention various factors that are believed to increase the chances of cooperation over international rivers. For example, Espey and Towfique (2004) in their large *n* study revealed that economic, political and language differences do not have any effect on treaty formation, while religious differences and lack of trade relations are found to hinder treaty formation. Wolf (1997) also argues that despite many differences, such as institutions, law and enforcement and the power balance between riparian states, these differences are not so prohibitive as to preclude cooperation. Sometimes cooperation and the emergence of river agreements are explained from the realist perspective. Lowi (1993), for instance, argues that cooperation is a mere reflection of a power balance when a dominant state in the basin coerces weaker states to sign an agreement. However, Dinar *et al.* (2011) suggest that power asymmetry is not a significant factor for the formation of bilateral agreements. Thus, in the existing literature, there is no consensus on the factors that enable states to manage their riparian disputes peacefully and reach an agreement.

However, this field of literature has not examined the role of third parties in getting the riparian parties to the stage of signing river agreements. With the exception of selected case studies, there is a gap in the literature exploring the role of third-party actors in the conflict management of transboundary river disputes and their role in the emergence of river agreements. Most scholars study international river disputes and cooperation generally, rather than particularly studying the role of third parties, and they mention the role of third parties in managing riparian conflicts only briefly (Wolf, 1997; Dombrowsky, 2007; Nielsson, 1990; Lowi, 1993; Turton, 1999; Elhance, 2000; Dinar, 2008). There are several case studies dedicated to the study of the role of third parties in managing river disputes (Zawahri, 2009; Weinthal, 2002; Nakayama, 1997; Biswas, 1992, 1999; Nishat and Faisal, 2000), but the findings of these works are inconclusive and divergent. For example, some scholars argue that third parties do not have enforcement mechanisms and states are reluctant to relinquish their sovereignty to larger international organisations which, in turn, diminishes the role of these third parties (Lowi, 1993; Turton, 1999; Dombrowsky, 2007). However, another body of literature finds that third-party involvement in river disputes plays a significant role in the resolution of these disputes and that third-party involvement has facilitated cooperation over transboundary rivers (Zawahri, 2009; Weinthal, 2002; Nakayama, 1997; Biswas, 1992, 1999; Nishat and Faisal, 2000).

For example, Biswas argues that the dispute over the Indus River was highly escalated and only the personal involvement of the Head of the World Bank helped to reduce tension. In the dispute between India and Pakistan, the World Bank after several rounds of negotiation helped to separate eastern and western rivers between two states (Biswas, 1999). The World Bank's assistance in the Indus basin dispute is believed to have prevented potential war over water.

There are several quantitative works but these do not specifically look at the role of third parties. Some scholars (Hensel *et al.*, 2006; Stinnett and Tir, 2009; Tir and Stinnett, 2012) study the role of organisations which are specifically created for overseeing river

cooperation in river disputes; these organisations could sometimes be the outcome of negotiation efforts by third parties. In addition, the study by Hensel (2008) does not separate out riparian conflicts, instead it examines all types of claims including territorial, maritime and river claims rather than only river disputes. The study of river claims is important because a generalised conclusion for all types of conflicts ignores the specificity of each type of dispute.

In addition, previous research primarily focused on mediation efforts in river disputes, yet there is a need to incorporate a broader conceptualisation of third-party involvement. The rationale for a broader third-party concept is threefold. First, it is because the nature of river disputes relates to the usage of transboundary river water for irrigation purposes, dam building or infrastructure development even though the access to potable water is not an issue. This allows third parties to have an influence on riparian states through economic incentives such as aid, river related projects, workshops and feasibility studies which can affect the emergence of agreements. These activities are not often captured as third-party involvement if it is conceptually restricted to mediation efforts only.

Second, as previous research has shown (Wolf, 1998; Yoffe *et al.*, 2004), conflicts over water have never resulted in a large full-scale war, but rather, have resulted in diplomatic or low-level conflict. At such a low level of dispute, other non-interventionist techniques are expected to be used by third parties. However, the majority of existing research on third-party intervention in riparian disputes focuses on active third-party techniques such as mediation. In this context, small-scale activities such as seminars and workshops will be relevant and consideration should not be constrained to mediation techniques only. Third, a broad conceptualisation is also important because it can help us to understand whether third-party activities that are related to development needs of states are more effective than pure diplomatic efforts in facilitating cooperation in riparian contexts.

"Third party involvement" in this study is, thus, defined as the efforts and measures undertaken by external actors, who are not directly involved in a dispute, to influence and encourage disputing states to manage and resolve issues by peaceful means and reach a formal agreement.

And so, in setting out to address these shortcomings in previous literature, this research project becomes the first quantitative large sample empirical study aiming to identify through statistical analysis whether third-party intervention increases the likelihood of reaching river agreements between states that experience riparian disputes.

Theoretical framework

This study draws on rational choice theory that treats international conflicts as a part of the rational bargaining process and is based on the assumption that there are alternatives which are preferable to conflict, but yet wars do occur because of bargaining failure (Fearon, 1995; Reiter, 2003). Bargaining perspective helps not only to explain why wars do occur but also helps to situate the role of third-party mediators in the prevention of costly conflicts. In this study, the author uses two explanations from bargaining perspective: a commitment problem and an information asymmetry problem to explain how third-party actors assist disputing parties to reach a peaceful solution.

One of the mechanisms that leads to bargaining failure is that rational leaders are prone to withhold private information about their relative capabilities and misrepresent such information to gain a better deal (Fearon, 1995). Because transboundary rivers transcend political boundaries and demarcate national borders, this also gives rise to other unique features such as the upstream/downstream relationship between riparian states. An upstream state can be in a more advantageous position and may have the capacity to control the flow of river water. It is not unusual for riparian states to treat scientific data on water as a state secret, as states perceive that the full release of information may disadvantage their bargaining position.

Most of the time, river disputes arise due to the usage of transboundary river water for irrigation purposes, dam building or infrastructure development. Elhance (2000) mentions that any developmental works on the river, including projects such as dams, reservoirs and hydroelectric plants require physical and technical parameters of water projects in the respective river basin. Unless such data and information is freely exchanged between riparian states, downstream states will express their concerns when such development works are being undertaken. When upstream states do not release the negotiated amount of water, this can be blamed on a low level of precipitation or drought. The downstream state may not believe such statements because they do not have independent sources where they can obtain or verify this information.

Furthermore, many developing states do not have modern technologies, hardware and the required expertise to maintain large water projects that allow access to such data and information exchange (Elhance, 2000). Accurate information and precise data on hydrological, biological and chemical properties which are freely exchanged, together with joint databases, may help avoid inaccurate assumptions about the activities of other parties and avoid poor political decisions (Savenije and Van der Zaag, 2000). Third parties can help to increase capacity and build infrastructure allowing open access and an exchange of information.

Another problem is that of commitment. Disputants cannot make credible commitments when they have opportunities to renege on agreements. Even though cooperation is desired and beneficial at the time the agreement is reached, there is a possibility that this may change over time and one of the actors may renege on an agreement in the future. This argument is particularly relevant in the transboundary upstream/downstream relationship where there is always an opportunity for upstream states to renege on an agreement because they have the power to turn the "tap" on or off.

For example, in the Nile basin, Egypt does not want any interruption to the flow of the Nile, and despite assurances that dams for hydro-electric production do not decrease the volume of water, the idea that upstream states can control the river flow is not acceptable to Egypt. On the one hand, there is a credibility problem because downstream Egypt does not trust upstream states and does not want any state having the tools to control the river, given the utmost importance of the river to Egypt (Swain, 1997). For example, Egypt has treated the comprehensive study, supported by the World Bank, on water availability in Egypt as a state secret (Swain, 1997, p. 684).

However, there are cases when the most powerful state in the basin is also an upstream state. In this instance, weaker downstream states may not have the leverage to encourage upstream states to enter an agreement and recognise their water rights. The case of the Euphrates basin shared between Turkey, Syria and Iraq fits in this scenario. Turkey is the upstream hegemon and is unilaterally developing the Euphrates River

despite opposition from downstream states. Being one of the most powerful states in the region and also being an upstream state, Turkey has little incentive to consider the water rights of downstream states. In addition, upstream Turkey also has little incentive to comply with agreements. Riparian states thus find it difficult to cooperate unless they have some enforcement mechanisms that oblige states to abide by the terms.

Mediation is one of the widely used strategies to ensure that communication between disputing parties takes place and information is exchanged. Third parties or mediators are therefore seen to be able to ameliorate these bargaining problems in recent mediation literature (Svensson, 2006; Kydd, 2003). Third parties can increase absolute gains of cooperation via financial aid making the opportunity costs of non-cooperation and reneging on agreements too costly. Third-party actors can influence the negotiation process via their position and leverage and can act as guarantors to resolve commitment problems (Greig and Regan, 2008). Third parties may also absorb the costs of negotiation if parties agree to come to the negotiation table in the first place. Likewise, if disputants refuse to cooperate, third parties may use sanctions or "pressing" actions (Carnevale, 1986).

Thus, the proposed hypothesis is that third parties increase the likelihood of reaching river agreements by addressing the credibility and information asymmetry problems between states.

Research design

The statistical study utilised Tir and Ackerman's (2009) dataset as a point of departure. Tir and Ackerman used Toset *et al.* (2000) data to identify the relevant universe of cases and their units of analysis were dyad year in the 1948-2000 time period. However, the present study covers the time period between 1948 and 2007; therefore, the figures for variables from 2000 to 2007 were further updated. The universes of cases of this study are contiguous pairs of states in Asia and Africa which have at least one river in common. Even though some studies focus on basin-level cooperation, the units of analysis as dyad years provides more fine-tuned data to explore the factors that contribute to interstate cooperation. In addition, third-party involvement gives rise to numerous interactions over time. Therefore, the dyad year level allows examination of the changes in observations taken over time.

Further, only conflict dyads have been included in the dataset. The study aims to explore the conflict management of river disputes and identify the role of third parties in managing river disputes. In addition, previous research that explores the factors that bring about river agreements clumps together cases with and without contention over river water (Tir and Ackerman, 2009). However, these agreements, which are signed by states that do not have any contentious issues over river water, do not require signatories to change their behaviour and might not carry any meaningful implication for these states. On the other hand, states experiencing disputes over river issues might find it much more difficult to reach an agreement because an agreement requires a change of behaviour. In this context, the factors that are found to be important for the emergence of agreements in both conflict and non-conflict cases may not necessarily be the same when states experiencing conflict are singled out.

To select conflict dyads, I utilised the International Water Event Database (Yoffe and Larson, 2002). The Water Event Database provides an intensity scale of cooperation or conflict for the event and bar scale (Water Event Intensity Scale) rating and detailed

summary of the event. Bar scale rating ranges from 7 (being an extremely positive relationship) to −7 (being an extremely negative relationship such as declaring war) (Yoffe and Larson, 2002). All dyads that have any negative interaction (from −1 to −7) between 1948 and 2007 are included in the data starting from the year when the first negative event occurred. For example, if the first negative event occurred in 1980, the dyad has been included only from 1980 until 2007. All dyads that have only positive interactions are excluded from the data because of the absence of negative interactions over river issues. The definition of intensity of conflicts is obtained from the Water Event Database (Yoffe and Larson, 2002).

As with statistical analysis, it is difficult to establish causality; it is possible that third parties may be involved when there is already a river agreement in place. To take this into account, all dyads where third-party involvement took place after a river agreement was signed were excluded from the analysis. There are 25 conflict dyads covering Asia and Africa over the 1948-2007 time period.

River agreements as dependent variable

The dependent variables in this study are river treaties which are identified from the International Freshwater Treaties Database (Wolf, 2007). According to the International Freshwater Treaties Database, river treaties that are included in the database relate to "international freshwater resources, where the concern is water as a scarce or consumable resource, a quantity to be managed or an ecosystem to be improved or maintained", and they concern "water rights, water allocations, water pollution, principles for equitably addressing water needs, hydropower/reservoir/flood control development, and environmental issues and the rights of riverine ecological systems" (Wolf, 2007). Multilateral treaties were separated into bilateral treaties before inclusion into the dataset (Tir and Ackerman, 2009). In my dataset, there are a total of 34 river treaties. River agreement is a dichotomous variable that equals one when river agreement is present and zero when river agreement is absent.

Data collection and operationalisation of third-party involvement

For this study, new data were collected on the involvement of third parties dealing with river issues in Asia and Africa. Databases such as Factiva, Water Event Database, New York Times (Historical) and Times Digital Archive as well as case studies and books have been used to identify the events when third parties were involved in river cooperation or dispute. Events which have occurred are included in the dataset and are assigned the year these events are reported to have occurred.

Third-party activities. In the context of this research, the following activities are considered as conflict management practices by third parties: activities facilitating communication (good offices, seminars, conferences) mediation, conciliation, feasibility study, adjudication, arbitration, projects facilitating riparian cooperation over river usage and financial aid or funding. Definitions of some of these third-party techniques were taken from the ICOW general codebook (Hensel, 2008).

To identify if a pure diplomatic type of third-party involvement is more effective than a development type of involvement, third party activities were divided into two categories: peace diplomacy and development third-party involvement. The following variables were included in the variable "peace diplomacy": conferences and seminars, diplomatic meetings and talks, mediation, good offices and conciliation. The following

variables were included in the variable "development third party involvement": river related projects, funding and aid and feasibility studies. The variable "meetings and talks" is coded further into diplomatic meetings and developmental meetings. The meetings which are purely political/diplomatic, the aim of which is to discuss possible cooperation, are coded as diplomatic meetings.

Peace diplomacy

Good offices. "Good offices" refers to the least intrusive form of third-party participation, involving an attempt by the third party to facilitate communication between the claimants (Hensel, 2008, p. 9). The party actors often provide a neutral place for meeting or meet with each party separately, exchanging the proposals and communicating between them.

Mediation. In mediation, a third party plays a more active role, discussing the issue with disputants and proposing a plan for conflict resolution. The mediator is also involved in the negotiation process (Hensel, 2008). For example, the case of the World Bank involvement in the Indus basin between India and Pakistan is considered as mediation.

Conciliation. Conciliation is a fact-finding exercise by a third-party actor who investigates the claim or issue in an impartial way and helps to establish the actual situation. Such investigation may or may not result in a recommendation. The conciliator then issues a final report containing conclusions and offering a (nonbinding) recommendation for settlement (Hensel, 2008, p. 9).

Seminars/symposiums/conferences. Often, third parties facilitate communication between disputing riparian states through seminars and symposiums. Seminars/symposiums/conferences which are financed and coordinated by a third party were included in the dataset. Seminars/symposiums/conferences organised by disputing states themselves are not included in the data. However, if another riparian state (not involved in the dispute) organises a seminar on this particular dispute, it is coded as a third-party involvement.

Seminars organised by local actors such as local NGOs are not coded as third-party involvement. Their role in pushing the governments to more cooperative relationships with other riparian states is recognised. But not all events organised by local NGOs are captured in the news. Due to inconsistency in the news coverage, these actors are not included. However, if seminars or conferences are organised through local NGOs, but the event is financed by external actors, these events are coded as a third-party involvement.

Development third-party involvement

Projects assisted by third parties. Often third parties set up projects with the aim of facilitating cooperation and increasing the dialogue for sustainable water management. Only projects which focus on facilitating a cooperative environment in the basin are included. The projects which focus on one particular issue (such as improved water sanitation or irrigation facility), which do not affect the relationship of riparian states, are not included. Integrated Water Management Projects (such as ZACPLAN, Nile Basin Initiative, etc.) for the basins are also coded as a project.

Feasibility study. Feasibility study is another type of fact-finding exercise which aims to study the possibility of joint river management or carry out a study of the physical

features of a river or basin. This sort of exercise helps to establish the facts, collect the data and study the social and economic infrastructure of basin countries. This gives an opportunity to draw a plan for joint management of a river or gives the objective facts and data from where the parties can start negotiation over the disputed issues.

Financial aid and funding. States can be induced to sign a treaty or agreement by financial or political leverage. Because financial and political leverage plays an important role in the emergence of an agreement, financial aid to enhance cooperation between riparian states has been included as a third-party technique. For example, in the case of the Mekong basin, donors provided grants and financial support to set up the Mekong Committee. The aim of the Committee was to promote regional cooperation in the development of the river. However, the aid to only one riparian state to develop the river is not considered as a third-party involvement or when aid or funding is not used as a leverage for riparian cooperation. Even though the aid to an individual state could be the donor's leverage to convince the state to enter into agreement, it will not necessarily be true in all cases.

Additional factors explaining river agreements. Other variables that are included in the dataset were also present in the dataset used by the Tir and Ackerman (2009) study. Power is considered by many to be a central concept in explaining conflict, and the information was obtained from the Correlates of the War Material Capabilities (Bennett and Stam, 2000). The power distribution is indicated by the natural logarithm of the ratio of the stronger state as opposed to the weaker state.

Economically, more developed states are expected to be pushed by the industrial sector and middle class to secure the future usage of water, thus forcing states to conclude a river agreement (Tir and Ackerman, 2009). The level of economic development is indicated by the less developed state's gross domestic product per capita (Banks, 1979). The state's gross domestic product per capita from 2000 to 2007 was obtained from the World Bank database.

In the riparian conflict and cooperation literature, some authors find that water scarcity leads to an increased number of low-level militarized conflicts (Furlong *et al.*, 2006; Hensel *et al.*, 2006). Therefore, the inclusion of the water availability variable takes into account whether water scarcity increases the likelihood of the emergence of agreements. Water availability per capita data is obtained from Engelman (2002), and the log number of water-poorer countries was included. River flow patterns (upstream/downstream relationship) and the number of rivers was found in the Toset *et al.* (2000) dataset.

Interdependence. It is expected that the more the states are economically interdependent, the more likely they will come to an agreement over the use of river water. This variable is created utilising the data on trade and GDP, when the volume of dyadic trade was divided by the size of the dyadic economies (Gleditsch, 2002).

Regime difference. The variable "regime difference" helps to measure how similar or different institutional arrangements are between dyads. It is expected that dyads which have similar institutional arrangements (e.g. joint democracy or joint autocracy) are more likely to reach agreements. I obtained the data for this variable from Polity IV database. The "Polity Score" captures this regime authority spectrum on a 21-point scale ranging from −10 (hereditary monarchy) to +10 (consolidated democracy) (Marshall and Jaggers, 2006). This variable was created by subtracting the lowest score from the highest. The higher the number, the further apart these dyads are in terms of their

institutional arrangements. The lower the number, the more similar the dyads are in their institutional arrangements.

Additional variables such as recent militarised disputes and alliance membership were considered to be included in the study. However, due to data limitation (for example data on alliance membership are available only up to 2001), these variables were excluded from the study. However, these variables were included and tested in the dataset between 1948 and 2001, and third-party involvement was a significant contributor to the emergence of river agreements.

Method of analysis

Two models were used to undertake the statistical analysis. First, the Heckman Selection Model was used to exclude the possibility of selection bias because I selected only the dyads that experienced a conflict. The results show that the selection effect is not present. Once the selection effect has been excluded through statistical procedure, the Cox regression model was utilised. Nevertheless, the key findings are robust in both models.

To test the hypotheses in this study, I used the Cox regression model. This event history model is also suitable when the dependent variable is dichotomous and it can also accommodate the presence of right and left censored observations (Box-Steffensmeier and Jones, 2004), which other models like logit cannot. There is no theoretical expectation that after a certain specified of period of time a third party gets involved in the dispute and that the probability that the agreement should be reached increases at a particular rate. So for, this reason duration dependency is not of much interest, and the Cox model is well-suited to accommodate this type of analysis because it leaves the particular form of duration dependency unspecified (Cox, 1975). The model used robust standard errors with repeat failures which relaxes the assumption that the observations are independent (Box-Steffensmeier and Jones, 2004, p. 114).

Results

The analysis begins with an examination of the types of third-party involvement in riparian disputes. According to the data, 91 events of third-party involvement occurred in Asia and Africa from 1948 to 2007. The type of actors involved and the techniques they utilised reflect the nature of the various river disputes. The study reveals that third-party actors are involved in riparian disputes, not necessarily just as mediators. For example, mediation makes up only 12 per cent of cases, whereas conciliation is 5 per cent and good offices is 4 per cent. Unlike conventional thinking, which associates third-party involvement with mediation and individual mediation efforts, third parties in river disputes can induce river cooperation by conducting feasibility studies, providing funding and aid, setting up river-related projects and by organising various seminars and meetings. According to Figure 1, an examination of the type of third-party involvement shows that aid or funding is the most frequently used technique, comprising 23 per cent of all third-party techniques. This finding is not surprising given the nature of river disputes that are usually related to competing development needs.

The facilitation of communication between disputing riparian states also appears to be a frequently used effective strategy. They do so by arranging numerous meetings and talks, seminars and conferences, good offices, and conciliation to ensure continued discussion and dialogue. Therefore, it is not surprising that the next most frequently

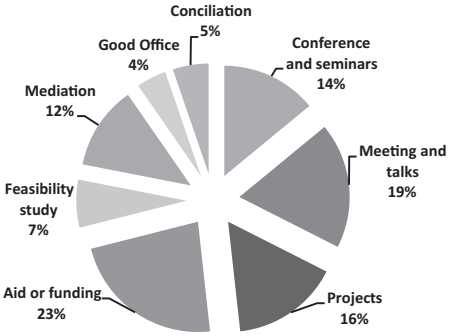

Figure 1.
Pie chart of third party techniques

used third-party technique is meetings and talks contributing 19 per cent, followed by projects comprising 16 per cent, with conferences and seminars taking up 14 per cent. Third parties dealing with transboundary river issues also appear to frequently use feasibility studies as a tool to obtain necessary information and explore the potential of a river for development purposes. Feasibility studies, for instance, comprises 7 per cent of all involvement. Third parties can assist in collecting the necessary information to determine the technical and economic feasibility of joint projects on international rivers, and third parties using this new information can, in turn, create and communicate clear benefits of riparian cooperation. Therefore, investments and assistance with obtaining and sharing information provided by third parties encourages disputing parties to reach an agreement.

Third-party actors

The types of actors also vary and include states, intergovernmental organisations (IGOs), international development banks, United Nations (UN), Organization for Security and Co-operation in Europe (OSCE), European Union (EU) and other organisations. As indicated in Figure 2, an analysis of the distribution of the type of third-party actors that are most frequently involved in settling river disputes are IGOs comprising 42 per cent of all actors. The United Nations comprises 8 per cent, OSCE comprises 1 per cent, EU comprises 1 per cent and other actors comprise 1 per cent. For example, there are two occasions of the EU's involvement between Ethiopia and Sudan and Cameroon and Nigeria, and two occasions of the OSCE's involvement in Central Asia (CA). Some of the most frequently involved IGOs are the United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP). Even though these organisations are part of the UN system, the UN and its branches have been separated in the pie chart to provide a more nuanced picture.

International development banks are the next most frequently involved third-party actors making up 25 per cent of all actors. The growth of population presents challenges to nations to keep up with developmental needs. More resources and funding are required to build infrastructure and utilise the river resources which require substantial amounts of funding which states, particularly developing nations, seek from development banks. Consequently, banks and financial institutions are drawn into disputes and have to take up the role of arbiter and mediator in river disputes. The most frequently used international development banks are the World Bank, the ADB and the African Development Bank.

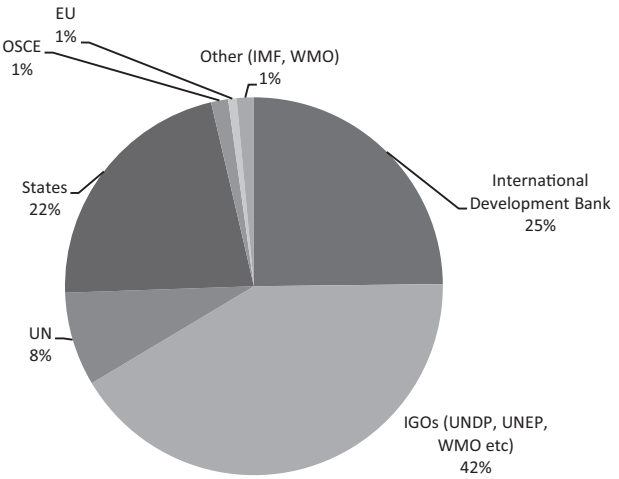

Figure 2.
Pie chart of third party actors

States make up 22 per cent of all actors. States also often get involved through their aid agencies like United States Agency for International Development, Canadian International Development Agency, Swedish International Development Cooperation Agency and Japan's Council for Environmental Cooperation Promotion. Some of the less frequently involved actors are the International Monetary Fund and World Meteorological Organization.

The effect of third-party involvement on the emergence of river agreements

As indicated in Table I, third-party involvement along with other variables such as power distribution, interdependency and water availability have a significant effect on the emergence of river agreements. The reported numbers are coefficients and hazard ratios with standard errors. The positive sign of the coefficient of third-party involvement indicates that third-party involvement increases the likelihood of the emergence of agreements. The significance level of the p-value of 0.000 and the hazard ratio of 6.16 indicates that third-party involvement is also the strongest predictor of the emergence of river agreements. The "power distribution" is also a significant predictor with a p-value of 0.006 and a hazard ratio of 1.73. However, it is not as strong as third-party involvement and water availability. This result indicates that power imbalance is conducive to the emergence of river agreements. The "availability of water" variable is also a significant predictor with a hazard ratio of 1.84 and a p-value of 0.000. The positive sign of the "water availability" variable is contrary to my expectation but not surprising. The implication of this result is that dyads with more water find it easier to reach an agreement, or conversely, dyads with water scarcity are less likely to reach an agreement. The "interdependence" as expected is a significant factor in explaining the emergence of agreements with a p-value of 0.000. The pairs of states which have higher volumes of trade and are interdependent are more likely to reach agreements. All other variables such as the "upstream/downstream relationship", "number of rivers", "regime difference" and "level of economic development" have no significant effect on the emergence of river agreements in conflict settings. The findings

	River agreements		
Variable	Model I Third-party involvement	Variable	Model II Peace diplomacy and development involvement
Third-party involvement	1.892*** (0.374) [6.35]	Peace diplomacy	1.925*** (0.346) [6.37]
Water availability	0.632*** (0.242) [2.26]	Development involvement	1.697*** (0.361) [5.42]
Upstream/downstream relationship	−0.019 (0.198) [1.02]	Water availability	0.656*** (0.144) [1.99]
Number of rivers	−0.021 (0.117) [1.00]	Upstream/downstream relationship	−0.025 (0.205) [1.31]
Level of economic development	0.0001607 (0.000299) [0.99]	Number of rivers	−0.019 (0.110) [0.1.00]
Power distribution	0.693*** (0.145) [2.12]	Level of economic development	0.0001405 (0.0002556) [0.99]
		Power distribution	0.670*** (0.149) [2.10]
Interdependency	255.067*** (55.19432) [2.4e + 131]	Interdependency	249.043***(53.18722) [2.3e + 122]
Regime difference	0.051 (0.050) [1.06]	Regime difference	0.042 (0.057) [1.01]
Time at risk	864	Time at risk	864
Number of observations	524	Number of observations	524

Notes: Main entries are coefficients, standard errors are in parentheses; hazard ratios in square brackets; p-value (or significance levels) ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$, one-tailed test; number of observation is 524; unit of analysis is dyad-year

Table I.
Cox regression estimates of the effects of third-party involvement and other variables on the emergence of river agreements

show that third-party involvement in river disputes increases the likelihood of reaching river agreements.

The results show that both diplomatic and development types of involvement play significant roles in the emergence of river agreement. Model II shows that both development and diplomatic involvement, with a p-value of 0.000 and a hazard ratio of 6.14 for peace diplomacy and 5.32 for development involvement, are strongly correlated with the emergence of river agreements. The slightly higher hazard rate for the diplomatic type of involvement may imply that before proceeding to assist with managing transboundary rivers, political issues need to be resolved. This may require a frequent number of meetings and negotiations, which is reflected in the statistical findings. Water availability and power imbalances are also significant predictors in Model II.

Cox regression survival plots for third-party involvement

Figure 3 demonstrates the survival plots for third-party involvement. In other words, this plot presents graphically the probability of the emergence of agreements according to each point in time for cases with third-party involvement and cases without third-party involvement. The survival rate for cases with third-party involvement is much shorter, implying that dyads experiencing third-party involvement are more likely to reach agreement sooner.

Figures 4 and 5 present the survival plots for different types of third-party involvement. As shown in the figures, both types of involvement have almost the same rate of survival implying that their involvement has a similar effect.

Discussion

The findings of this study largely confirm the proposed hypothesis. The importance of mediators in dealing with credibility problems in the general mediation literature is not

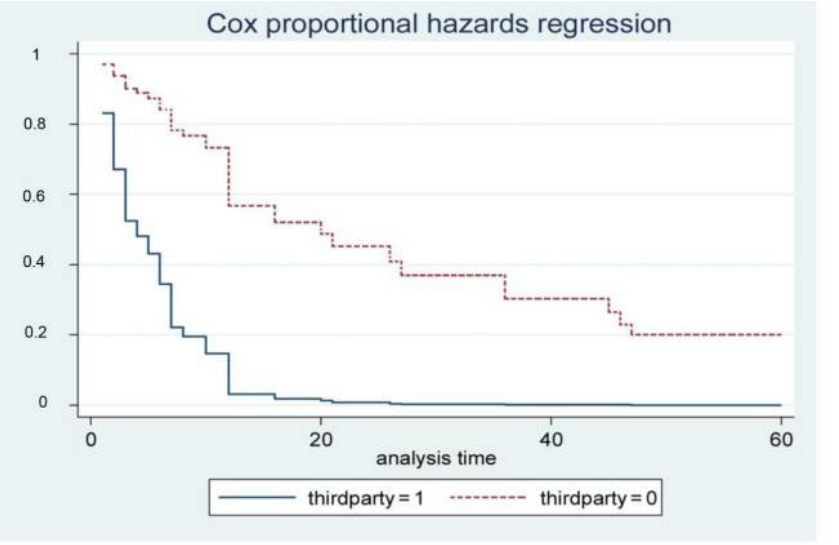

Figure 3.
Cox regression survival plot for third party involvement

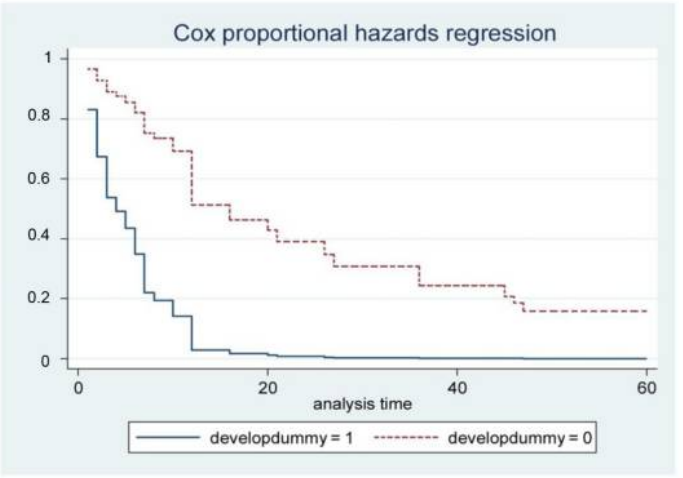

Figure 4.
Survival plot for third party involvement through development means

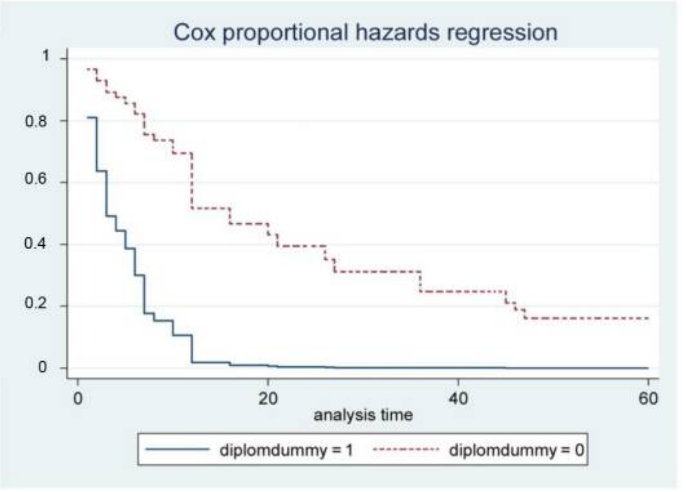

Figure 5.
Survival plot for third party involvement through peace diplomacy

new. However, third-party actors dealing with the conflict management of river disputes do not necessarily deal with credibility problems through mediation. Third parties in river disputes can use other non-diplomatic tools, along with mediation, to overcome information asymmetry and commitment problems. Third-party actors appear to assist with capacity building, help with gathering reliable data and its exchange, facilitate constant dialogue and communication and provide financial incentives to address the problems of information asymmetry and credibility problems. In the general mediation literature, such measures undertaken by IGOs, development banks and other organisations in conflict-ridden communities have generally been overlooked. As shown in this study, the activities of third-party actors can have an effect on cooperation through development assistance and other mechanisms.

According to the descriptive statistics, it is IGOs such as UNDP, the UN, and international development banks that are the most frequently involved actors. The diversity of third-party actors reflects the multidimensional aspects of river disputes allowing various actors to promote regional cooperation over the transboundary rivers. These findings present interesting empirical patterns in terms of what type of third-party actors get involved in different geographic regions. International development banks such as the World Bank and the ADB are some of the most frequent third-party interveners in Asia and Africa compared with other parts of the globe. For example, the review of the ICOW dataset (Hensel, 2005) on river claims has revealed that no international development bank has been recorded as a third-party intervener in the Western Hemisphere, Europe and Middle East, while in Asia and Africa, there was no single case when disputes were submitted to arbitration or adjudication as was the case in Europe. Although this could be a reflection of how the data were collected, such explicit mediation efforts by the World Bank in India (Zawahri, 2009) could have been recorded in other regions too.

Boyce (2002) in this regards argues that other actors such as multilateral agencies, international financing institutions, large international NGOs and the World Bank are gradually moving to address the issues of post-conflict reconstruction and peacebuilding (Boyce, 2002). The World Bank is increasingly taking up the role of a mediator in river disputes by assisting with the establishment of river basin organisations and providing financial support and technical expertise (Kirmani and Le Moigne, 1997).

The analysis of the World Bank's involvement in CA shows that the World Bank provided extensive financial assistance for various river-related projects. These resources might have not been available internally, and without these projects and financial injections, the situation in CA over transboundary rivers could have been more conflictual. Although Weinthal (2002) argues that the financial assistance from third parties in CA was used by riparian states to solidify their position after independence and satisfy internal needs, financial assistance was clearly a strong incentive for CA states to conclude river agreements. The analysis of the CA case shows a clear link between financial assistance and the emergence of river agreements. These findings are also in line with other empirical cases. Financial incentives, for example, were one of the tools used by the World Bank and Global Environment Facility (GEFs) to facilitate riparian cooperation between Tanzania, Kenya and Uganda in the Lake Victoria project (Okaru-Bisant, 1998). Financial incentives were also used in negotiations between India and Pakistan over the Indus river (Biswas, 1992).

Any formal cooperation in the form of an agreement raises the questions of commitment to the terms of the agreement. In river disputes, third-party actors are found to set up joint river commissions and projects which can ensure that the terms of agreements are followed through and the relevant information and data are shared among the members. Third parties appear to utilise both diplomatic and economic means of involvement to enhance river cooperation and link river cooperation to developmental needs of states. Unlike the disputes over territory, ethnic or religious issues, which are probably less susceptible to such measures as data gathering, feasibility studies or assistance with technical expertise, river disputes can accommodate utilisation of wider conflict management tools. These findings may reflect the fact that most countries in Asia and Africa are developing nations, which often lack

the capacity, financial resources and expertise to undertake conflict management activities compared to the Western developed nations. While developed Western states may be able to undertake measures such as setting up joint river institutions, where they can undertake and cover the costs involved with negotiations through having advanced technologies and having social capacity, infrastructure and trained specialists, these attributes and opportunities may be absent in many low income nations which are particularly vulnerable to water stress.

Third-party actors appear to assist not only with finances and technical expertise but can address the issue of state incapacity, deal with emerging new issues or changed circumstances and help to clarify ambiguities in agreements. Third parties appear to address these deficiencies which can be present in bilateral attempts to settle the issues.

However, third-party involvement is not the only strong predictor in river cooperation. Power imbalance appears to be also conducive to the emergence of river agreements. According to Dinar (2008), side payments by an economically stronger riparian state to another party is not uncommon in river cooperation. It is not contrary to the logic that water scarcity makes it more difficult to reach an agreement, and findings of this study are consistent with many other works which argue that the less water states have, the less likely they are to cooperate (Cooley, 1984; Gleick, 1993; Klare and Myers, 2001). The interdependency between riparian states also encourages them to seek cooperative outcomes.

Conclusion

This research project has set out to study the role of third-party actors in the conflict management of river disputes. The main purpose has been to explore whether third-party involvement in conflict management of river disputes increased the likelihood of reaching river agreements. Also, this study sought to identify how and why third-party actors were able to increase the likelihood of reaching river agreements.

While there is extensive literature which explores the role and effect of mediation in conflict management, less discussion exists in the case of river disputes where, in a more subtle way and on a long-term basis, mediating roles can be played by development agencies and banks, international organisations and international NGOs. While small-scale activities such as seminars, conferences, workshops, projects and feasibility studies may not bring immediate results, the systematic observation of a number of such activities over a long period of time can reveal the pattern and effect of such activities on interstate relations and cooperation. Such an observation was possible with the quantitative approach used here, and it also differentiates the current study from previous literature.

The results of the analyses are largely in line with the hypotheses and the study suggests that third parties in riparian disputes increase the likelihood of the emergence of river agreements. Both types of involvement, whether purely diplomatic or development involvement, seem to increase the likelihood of reaching river agreements. This is largely due to the fact that third-party actors appear to address the information asymmetry problem and commitment problems that can stall bilateral negotiation. Third parties in river disputes achieve formal river cooperation by facilitating communication, obtaining and sharing information and offering financial incentives and leverages.

Without denying that institutions are embedded in power politics and are interlinked to many other factors as discussed above, the findings reveal that third parties are able to exert influence on states and foster river cooperation in conflict settings. Even though this research project finds that third-party involvement increases the likelihood of reaching river agreements, this study do not claim that third-party involvement always brings about successful outcomes. Therefore, it is also important to understand the conditions under which third-party involvement is successful. It is recommended that this question be the subject of further exploration.

Another avenue for future research is to understand whether cooperation facilitated by third-party assistance is more sustainable compared to river agreements reached bilaterally. Understanding this puzzle is important because before advocating for more third-party assistance in river disputes, it is crucial to know if cooperation achieved by third-party assistance is effective in the long term. Even though third parties facilitate cooperation, sometimes the question of sustainable cooperation remains, and aspects such as quality and compliance to agreements may still be of importance and need to be explored further. In addition, the present study covers only Asia and Africa and further research on the role of third parties in other regions on a global scale is suggested.

Note

1. There was an additional test which included "duration of conflict" in the model. The results hold and duration of conflict was found to be insignificant.

References

Alam, U.Z. (2002), "Questioning the water wars rationale: a case study of the Indus waters treaty", *The Geographical Journal*, Vol. 168 No. 4, pp. 341-353.

Banks, A.S. (1979), *Cross-National Time Series Data Archive: User's Manual*, Center for Social Analysis, Binghamton, NY.

Bennett, D.S. and Stam, A.C. (2000), "EUGene: a conceptual manual", *International Interactions*, Vol. 26 No. 2, pp. 179-204.

Biswas, A.K. (1992), "Indus water treaty: the negotiating process", *Water International*, Vol. 17 No. 4, pp. 201-209.

Biswas, A.K. (1999), "Management of international waters: opportunities and constraints", *International Journal of Water Resources Development*, Vol. 15 No. 4, pp. 429-441.

Box-Steffensmeier, J.M. and Jones, B.S. (2004), *Event History Modeling*, Cambridge University Press, Cambridge, MA.

Boyce, J.K. (2002), "Aid conditionality as a tool for peacebuilding: opportunities and constraints", *Development and Change*, Vol. 33 No. 5, pp. 1025-1048.

Brooks, S.M. (2007), "When does diffusion matter? Explaining the spread of structural pension reforms across nations", *The Journal of Politics*, Vol. 69 No. 3, pp. 701-715.

Cameron, C.A. and Trivedi, P.K. (2009), *Microeconometrics Using Stata*, Stata Press, Texas, TX.

Carnevale, P. (1986), "Strategic choice in mediation", *Negotiation Journal*, Vol. 2 No. 1, pp. 41-56.

Cooley, J.K. (1984), "The war over water", *Foreign Policy*, Vol. 54, pp. 3-26.

Cox, D.R. (1975), "Partial likelihood", *Biometrika*, Vol. 62 No. 2, pp. 269-276.

De Stefano, L., Duncan, J., Dinar, S., Stahl, K., Strzepek, K.M. and Wolf, A.T. (2012), "Climate change and the institutional resilience of international river basins", *Journal of Peace Research*, Vol. 49 No. 1, pp. 193-209.

Dinar, S. (2008), *International Water Treaties: Negotiation and Cooperation Along Transboundary Rivers*, Routledge, New York, NY.

Dinar, S., Dinar, A. and Kurukulasuriya, P. (2011), "Scarcity and cooperation along international rivers: an empirical assessment of bilateral treaties", *International Studies Quarterly*, Vol. 55 No. 3, pp. 809-833.

Dombrowsky, I. (2007), "Conflict, cooperation and institutions in international water management: an economic analysis", in Van Den Bergh, J. (Ed.), *Advances in Ecological Economics*, Edward Elgar, Cheltenham.

Elhance, A.P. (2000), "Hydropolitics: grounds for despair, reasons for hope", *International Negotiation*, Vol. 5 No. 2, pp. 201-222.

Engelman, R. (2002), "People in the balance: population and natural resources at the turn of the Millenium", *Population Action International*, available at: www.populationaction.org

Espey, M. and Towfique, B. (2004), "International bilateral water treaty formation", *Water Resources Research*, Vol. 40 No. 5, pp. 1-8.

Falkenmark, M. (1989), "The massive water scarcity now threatening Africa: why isn't it being addressed?", *Ambio*, Vol. 18 No. 2, pp. 112-118.

Falkenmark, M. (1990), "Global water issues confronting humanity", *Journal of Peace Research*, Vol. 43 No. 3, pp. 359-360.

Fearon, J.D. (1995), "Rationalist explanations for war", *International Organization*, Vol. 49 No. 3, pp. 379-414.

Furlong, K., Gleditsch, P.N. and Hegre, H. (2006), "Geographic opportunity and neomalthusian willingness: boundaries, shared rivers, and conflict", *International Interactions*, Vol. 32 No. 1, pp. 79-108.

Giordano, M., Giordano, M. and Wolf, A. (2002), "The geography of water conflict and cooperation: internal pressures and international manifestations", *The Geographical Journal*, Vol. 168 No. 4, pp. 293-312.

Giordano, M. and Wolf, A. (2003), "Sharing waters: post-Rio international water management", *Natural Resources Forum*, Vol. 27 No. 2, pp. 163-171.

Gleditsch, K.S. (2002), "Expanded trade and GDP data", *Journal of Conflict Resolution*, Vol. 46 No. 5, pp. 712-724.

Gleditsch, N.P. (2012), "Whither the weather? Climate change and conflict", *Journal of Peace Research*, Vol. 49 No. 1, pp. 3-9.

Gleick, P.H. (1993), "Water and conflict: fresh water resources and international security", *International Security*, Vol. 18 No. 1, pp. 79-112.

Greene, W.H. (2003), *Econometric Analysis*, Prentice Hall Publishers, Upper Saddle River, NJ.

Greig, J.M. and Regan, P.M. (2008), "When do they say yes? An analysis of the willingness to offer and accept mediation in civil wars", *International Studies Quarterly*, Vol. 52 No. 4, pp. 759-781.

Hansen, H.E., Mitchell, S.M. and Nemeth, S.C. (2008), "IO mediation of interstate conflicts", *Journal of Conflict Resolution*, Vol. 52 No. 2, pp. 295-325.

Hensel, P.R. (2005), *Codebook for River Claims Data: Issue Correlates of War (ICOW) Project*, Florida State University, Florida, FL.

Hensel, P.R. (2008), *General Codebook Issue Correlates of War (ICOW) Project*, University of North Texas, Texas, TX.

Hensel, P.R., Mitchell, S.M. and Sowers, T.E. (2006), "Conflict management of riparian disputes", *Political Geography*, Vol. 25 No. 4, pp. 383-411.

Kimball, A.L. (2006), "Alliance formation and conflict initiation: the missing link", *Journal of Peace Research*, Vol. 43 No. 4, pp. 471-389.

Kirmani, S.S. and Le Moigne, G. (1997), *Fostering Riparian Cooperation in International River Basins: The World Bank at its Best in Development Diplomacy*, World Bank Publications, Washington, DC.

Klare, M. and Myers, J.J. (2001), *Resource Wars: The New Landscape of Global Conflict*, Metropolitan, New York, NY.

Kydd, A. (2003), "Which side are you on? Bias, credibility, and mediation", *American Journal of Political Science*, Vol. 47 No. 4, pp. 597-611.

Lowi, M.R. (1993), *Water and Power: The Politics of a Scarce Resource in the Jordan River Basin*, Cambridge University Press, Cambridge, MA.

Marshall, M.G. and Jaggers, K. (2006), "Polity IV data sets", available at: www.cidcm.umd.edu/polity/data/

Mitchell, S.M.L. and Hensel, P. (2007), "International institutions and compliance with agreements", *American Journal of Political Science*, Vol. 51 No. 4, pp. 721-737.

Nakayama, M. (1997), "Successes and failures of international organisations in dealing with international waters", *Water Resources Development*, Vol. 13 No. 3, pp. 367-382.

Nielsson, G.P. (1990), "The parallel national action process", in Groom, A.J.R. and Taylor, P. (Eds), *Frameworks for International Cooperation*, Pinter Publishers, London.

Nishat, A. and Faisal, I.M. (2000), "An assessment of the institutional mechanisms for water negotiations in the Ganges-Brahmaputra-Meghna system", *International Negotiation*, Vol. 5 No. 2, pp. 289-310.

Okaru-Bisant, V. (1998), "Institutional and legal frameworks for preventing and resolving disputes concerning the development and management of Africa's shared river basins", *Colorado Journal of International Environmental Law and Policy*, Vol. 9 No. 2, pp. 331-369.

Reiter, D. (2003), "Exploring the bargaining model of war", *Perspective on Politics*, Vol. 1 No. 1, pp. 27-43.

Salman, S.M.A. (2009), *The World Bank Policy for Projects on International Waterways: An Historical and Legal Analysis*, Martinus Nijhoff, Washington, DC.

Sartori, A.E. (2003), "An estimator for some binary-outcome selection models without exclusion restrictions", *Political Analysis*, Vol. 11 No. 2, pp. 111-138.

Savenije, H.H.G. and Van der Zaag, P. (2000), "Conceptual framework for the management of shared river basins: with special reference to the SADC and EU", *Water Policy*, Vol. 2 No. 1, p. 23.

Smith, D. and Vivekananda, J. (2009), *Climate Change, Conflict and Fragility: Understanding the Linkages, Shaping Effective Responses*, International Alert, London.

Song, J. and Whittington, D. (2004), "Why have some countries on international rivers been successful negotiating treaties? A global perspective", *Water Resources Research*, Vol. 40 No. 5, p. W05S06.

Starr, H. (2002), "Opportunity, willingness, and Geographic Information Systems (GIS): reconceptualizing borders in international relations", *Political Geography*, Vol. 21 No. 2, pp. 243-261.

Stinnett, D.M. and Tir, J. (2009), "The institutionalization of river treaties", *International Negotiation*, Vol. 14 No. 2, pp. 229-251.

Svensson, I. (2006), *Elusive Peacemakers: A Bargaining Perspective on Mediation in Internal Armed Conflicts*, Institutionen för freds-och konfliktforskning, Uppsala.

Swain, A. (1997), "Ethiopia, Sudan, and Egypt: the Nile river dispute", *Journal of Modern African Studies*, Vol. 35 No. 4, pp. 675-694.

Swain, A. (2001), "Water wars: fact or fiction?", *Futures*, Vol. 33 Nos 8/9, pp. 769-781.

Swatuk, L. and Van der Zaag, P. (2003), "River basin security: theory and practice in the Save and Pungwe river basins of Zimbabwe and Mozambique", 44th Annual Meeting of International Studies Association, Portland.

Thiem, J. (2007), "Dealing effectively with selection bias in large-n research", in Gschwend, T. and Schimmelfennig, F. (Eds), *Research Design in Political Science: How to Practice What They Preach*, Palgrave Macmillan, New York, NY.

Tir, J. and Ackerman, J.T. (2009), "Politics of formalized river cooperation", *Journal of Peace Research*, Vol. 46 No. 5, pp. 623-640.

Tir, J. and Stinnett, D.M. (2012), "Weathering climate change: can institutions mitigate international water conflict?", *Journal of Peace Research*, Vol. 49 No. 1, pp. 211-225.

Toset, H., Gleditsch, N.P. and Hegre, H. (2000), "Shared rivers and interstate conflict", *Political Geography*, Vol. 19 No. 8, pp. 971-996.

Turton, A.R. (1999), "Water and state sovereignty: the hydropolitical challenges for states in arid regions", in MEWREW Occasional Paper, Water Issues Study Group, School of Oriental and African Studies, University of London, London.

Weinthal, E. (2002), *State Making and Environmental Cooperation: Linking Domestic and International Politics in Central Asia*, MIT Press, Cambridge, MA.

Winship, C. and Mare, R.D. (1992), "Models for sample selection bias", *Annual Review of Sociology*, Vol. 18, pp. 327-350.

Wolf, A. (1995), *Hydropolitics Along the Jordan River: The Impact of Scarce Water Resources on the Arab-Israeli Conflict*, United Nations University Press, Tokyo.

Wolf, A. (1997), "International water conflict resolution: lessons from comparative analysis", *International Journal of Water Resources Development*, Vol. 13 No. 3, pp. 333-366.

Wolf, A. (1998), "Conflict and cooperation along international waterways", *Water Policy*, Vol. 1 No. 2, pp. 251-165.

Wolf, A. (2007), *International Freshwater Treaties Database*, Oregon State University, Oregon.

Wolf, A., Yoffe, S. and Giordano, M. (2003), "International waters: identifying basins at risk", *Water Policy*, Vol. 5 No. 1, pp. 31-62.

Yoffe, S., Fiske, G., Giordano, M., Giordano, M., Larson, K., Stahl, K. and Wolf, A.T. (2004), "Geography of international water conflict and cooperation: data sets and applications", *Water Resources Research*, Vol. 40 No. 5, pp. 1-12.

Yoffe, S. and Larson, K. (2002), "Basins at risk: water event database methodology", *Basins at Risk: Conflict and Cooperation Over International Freshwater Resources*, Department of Geosciences, Oregon State University, Oregon.

Zawahri, N.A. (2009), "Third party mediation of international river disputes: lessons from the Indus river", *International Negotiation*, Vol. 14 No. 2, pp. 281-310.

Further reading

Breen, R. (1996), *Regression Models-Censored, Sample Selected, or Truncated Data*, Sage, Thousand Oaks, CA.

King, G., Keohane, R.O. and Verba, S. (1994), *Designing Social Inquiry: Scientific Inference in Qualitative Research*, Princeton University Press, Princeton, NJ.

Appendix 1

The heckman selection model

I am selecting only pairs of states that have experienced a dispute over transboundary rivers, which raises the possibility of selection effect. Therefore, one may ask that systematic selection of only conflict dyads may raise the concern of whether river agreement is a function of conflict occurrence. It is important to address this to ensure that the estimates are not biased.

In this case, estimating the selection effects in large n studies could be done via the Heckman model (Thiem, 2007). It is advised to include a variable in the selection stage that is not included in the outcome stage to identify the model, a variable that affects selection, but not the outcome (Sartori, 2003). I included boundary length as an additional variable in the selection stage. Starr (2002) finds that boundary length is associated with the greater probability of conflict. However, it is unlikely that boundary length can have much effect on the emergence of river agreements. Boundary length has also been used as an independent variable to test if this variable has any effect on the emergence of agreements. The results show that there is no effect of boundary length on concluding agreements between riparian states.

Yet, there is also the possibility that the dependent variable "river agreement" is also associated with the occurrence of conflict. While the Heckman probit model cannot incorporate dependent variables into the selection stage, a seemingly unrelated recursive bivariate probit analysis (Brooks, 2007; Greene, 2003) can allow the factors that cause equation (1) to be removed from the analysis of equation (2) (Kimball, 2006) (Table AI).

$p = -0.35$ with a 95 per cent confidence interval (−0.99, 0.98). The likelihood-ratio test has a p-value of 0.80. Thus, the estimated correlation between the errors is not significantly different from zero, and the hypothesis that the two parts are independent is accepted[1]. This means that the Cox regression model can be used instead.

Variable	
Outcome: river agreements	
Water availability	0.322444 (0.3287967)
Upstream/downstream relationship	−0.5115149 (1.119034)
Number of rivers	−0.1165435 (0.2422039)
Level of economic development	−0.0000449 (0.0003283)
Power imbalance	0.2793238** (0.1310757)
Third party involvement	0.6536702* (0.3500841)
Constant	−3.764302*** (0.8202975)
Selection: conflict dyad	
Water availability	−0.3884236*** (0.125531)
Upstream/downstream relationship	1.113471**(0.5396584)
Number of rivers	0.2560836*** (0.0870824)
Level of economic development	0.0002797 (0.0002566)
Power imbalance	−0.1981005* (0.1090162)
Boundary length	0.0001269 (0.0002522)
Constant	1.647227 (1.129976)
Rho (S.E)	−0.3689998 (1.50462)
Wald chi-squared (6)	47.32
N	2,966

Table AI. Results for the Heckman probit selection model

Notes: Cell entries report coefficients, standard errors (in parentheses); p-value (or significance levels) ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Diagnostics for the heckman probit selection model

I have undertaken some diagnostics tests to test the validity of the key tobit assumptions of normality and homoscedasticity. Using generalised residuals for censored regression, I have used the conditional moment tests for testing homoscedasticity and normality discussed by Cameron and Trivedi (Cameron and Trivedi, 2009, p. 535). All results show that homoscedasticity and normality assumptions are met, which means that the data are normal (Table AII).

The $p = 0.12$ with the 95 per cent confidence interval (−0.19, 0.42). The likelihood-ratio test has a p-value of 0.43. Thus, the estimated correlation between the errors is not significantly different from zero, and the null hypothesis that the two parts are independent is accepted. This means that we can use the Cox regression model instead.

Variable	
Outcome: conflict dyad	
Boundary length	0.0001174 (0.0002532)
Upstream/downstream relationship	1.163573** (0.5368446)
Water availability	−0.4063989*** (0.1267193)
Number of rivers	0.2685958*** (0.0877655)
Power imbalance	−0.2106124* (0.109182)
Level of economic development	0.0002573 (0.0002479)
River agreements	1.226069** (0.4915749)
Constant	1.75399 (1.143513)
Selection: river agreements	
Upstream/downstream relationship	−0.0423757(0.2769552)
Water availability	−0.4063989 (0.1267193)
Number of rivers	−0.0259033 (0.0572013)
Power imbalance	0.0646866 (0.0491003)
Level of economic development	0.0002204* (0.0001225)
Constant	−1.931683*** (0.5292425)
Rho (S.E)	0.1290768 (0.1660458)
Wald chi-squared (12)	63.70
n	2966

Notes: Cell entries report coefficients, standard errors (in parentheses); p-value (or significance levels) ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$

Table AII. Results for seemingly unrelated recursive bivariate probit analysis

Appendix 2

Variable	Observation	Mean	SD	Minimum	Maximum
Water availability	546	8.00	0.82	6.618	10.870
Upstream/downstream	546	0.170	0.376	0	1
Number of rivers	546	3.62	2.73	1	14
GDP	546	411.11	518.91	36	5,626
Power imbalance	546	1.57	0.92	0.05	4.24
Third party	546	0.16	0.36	0	1

Table AIII. Summary statistics

Table AIV.
Tabulation for third-party involvement

Third party	Frequency	(%)	Cum
0	455	83.70	83.70
1	91	16.30	100.00
Total	546	100.00	

Table AV.
Tabulation for third-party involvement and river agreements

	River agreements		
Third party	0	1	Total
0	433	22	455
1	75	16	91
Total	508	38	546