Explaining the Effectiveness of Binding and Nonbinding Agreements. Tentative Lessons from Transboundary Water Pollution

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Abstract

Deciding whether agreements should involve binding or nonbinding agreements is a crucial strategic element when it comes to designing effective governance systems. Until today, legally binding agreements seem to be the preferred approach. Over 1500 bilateral and 900 multilateral treaties have been signed so far. Yet, at least some of them have proven ineffective if not counterproductive for solving the problems they were negotiated for. Therefore, it is at no surprise that states increasingly use a different approach for solving transboundary environmental problems: Nonbinding agreements. Instead of signing legally binding agreements, state officials negotiate international norms that are intentionally nonbinding but still possess legal relevance.

Key *theoretical* arguments suggest that nonbinding agreements can be (at least) equally effective as binding treaties. Yet, *empirically*, the rather simple question whether nonbinding commitments are more effective in solving international environmental problems than binding agreements remains open. The lack of systematic efforts to compare the effectiveness of binding and nonbinding agreements under comparable conditions is recognized as a significant gap in international environmental regulation research. This paper aims at identifying theoretical advantages of using hard and soft law in earth system governance. Moreover, first tentative empirical evidence on the effectiveness of legally binding agreements compared with flexible action programs will be gained by inspecting the Rhine river as one important case in the field of transboundary water pollution.

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1. Introduction

Since the early 1970s, transboundary environmental problems have gained the attention of researchers, politicians and activists alike. The range of these problems spans from such currently prominent examples as climate change and the protection of the ozone layer to less publicly known environmental challenges such as the pollution of the sea, the pollution of lakes and rivers or the reduction of species-depletion (Köppel 2009b).

States that decide to solve transboundary environmental problems through cooperation have several options at their disposal (Guzman 2005, Lipson 1991). Agreements have proven to be one important mechanism for solving such transboundary problems. In general, one can distinguish between two different forms of transboundary agreements: Legally binding treaties and nonbinding agreements.

Legally binding treaties such as the Kyoto protocol seem to be the preferred approach for solving transboundary environmental problems. Up to now, over 1500 bilateral and 900 multilateral treaties have been signed.[2] Yet, at least some of them have proven ineffective if not counterproductive for solving the problems they were negotiated for.[3] For instance, the Kyoto Protocol has received fundamental critique for being the "wrong tool for the nature of the job" (Prins and Rayner 2007: 973). It was not only criticized for being ineffective as an instrument for achieving demonstrable reductions in emissions but also for its negative consequences (Prins and Rayner 2007, Victor 2001).[4] Therefore, it is at no surprise that states increasingly use a different approach for solving transboundary environmental problems: Nonbinding agreements. Instead of signing legally binding treaties, state officials negotiate international norms that are intentionally nonbinding but still possess legal relevance (Skjærseth et al. 2006: 104, Thürer 2000: 453).

Whereas a consensus has emerged in recent years that agreements actually can make a difference (Miles 2002, Young 2004: 3). Relatively little research has been done to evaluate what makes them effective and more specifically, which type of agreement is more effective under what conditions. This is quite puzzling, since the question is not for academic merit only. We will not be able to solve transboundary problems without knowing how agreements need to be designed to be effective.

Important from an academic viewpoint, the existing literature on the effectiveness of binding versus nonbinding agreements offers contradictory theoretical as well as empirical results. Key *theoretical* arguments suggest that nonbinding agreements can be (at least) equally effective than binding treaties. However, *empirically*, the rather simple question whether nonbinding agreements are more effective in solving international environmental problems than binding treaties remains open. Studies from Helmut Breitmeier et al. (2006a) and Bernhard Zangl (2006) show that legalization of

[2] Data from Ronald B. Mitchell. 2002-2007. *International Environmental Agreements Database Project (Version 2007.1).* Available at: http://iea.uoregon.edu/. Date accessed: 28 November 2008.

[3] Such as, for instance, treaties concerning the protection of forests, of tropical timber trade or river ecosystems (Bernauer 1996, Conca et al. 1996: 154-56).

[4] In this regard, critics point for instance to the many loopholes especially in regard to the Clean Development Mechanism that allowed profiteers to make money without reducing emissions (Prins and Rayner 2007).

international institutions raises their effectiveness. Yet, case studies from Arnold Gurtner-Zimmermann (1998), Petra Holtrup (1999), Raphael Tschanz (2001), Jutta Brunnée and Stephen Toope (2002) indicate that nonbinding agreements can reach higher levels of effectiveness than binding treaties. In addition, the large-scale research project from David Victor et al. (1998) on the effectiveness of international environmental commitments argues that nonbinding agreements have proven more effective in changing the behavior of relevant actors.

The value added of such research is the following: It addresses an important „real world" problem (King et al. 1994: 15). Freshwater is one of humanity's most precious but also most vulnerable natural resources.[5] The 260 international river basins[6] existing worldwide cover 45 per cent of the Earth's land surface and contain a large part of the consumable freshwater. Freshwater pollution and the pollution of transboundary rivers in particular is therefore widely regarded as one of the most significant environmental problems worldwide (Bernauer and Kuhn forthcoming: 2).[7]

In addition, besides addressing an important real world problem, such research also contributes to solving four major deficits in the existing literature. First, it sheds light on the effect of binding and nonbinding agreements, one main element of regime design that has remained an underexplored field of investigation "despite its potential great benefit to scholars and political decision-makers alike" (Sprinz and Kaan 2006: 1). Second, this research uses the impact dimension for measuring regime effectiveness that has hitherto only rarely been used for addressing this or similar research questions.[8] Third, with evaluating the effectiveness of binding vs. nonbinding agreements, this research addresses a question that has received contradictory theoretical *and* empirical results so far. Finally, this research seeks to provide fruitful new insights to an emerging literature of transboundary rivers. Insights gained here seem to be especially fruitful since upstream-downstream problems are among the hard to solve problems in international environmental politics. Knowledge produced in the realm of this research project thus may also be relevant in other transboundary environmental settings.

In the following section, we will review the relevant literature. In Section 3 central concepts will be defined. Section 4 identifies theoretical advantages of using binding and nonbinding agreements in governance systems. Section 5 gains first tentative empirical evidence by inspecting the Rhine River as one important case in the field of transboundary water pollution. In Section 6, we then finally conclude with suggestions for future research.

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[5] As UNECE'S recent report states: (2007: iii): „Water is everyone's business. The issues involved range from those of basic human well-being (health and food security) to those of economic development (industry and energy), to the essential preservation of natural ecosystems on which we all depend."

[6] River basins or catchment areas are defined by "their common mouth, which is either the point where the river flows into the sea or an inland delta" (Lindemann 2006: 1).

[7] This is especially true for the citizens of the European Union as the 'Eurobarometer' recently revealed (European Commission 2005: 9-11).

[8] For one of the frontrunners in using the impact dimension of regime effectiveness, see (Helm and Sprinz 2000).

2. Literature Review

This research is mainly motivated by four central shortcomings in the existing literature.

First, research on the effectiveness of international regimes has not – with few exceptions[9] – analyzed the effect of regime design so far. For over a quarter of a century, scientists have dwelled on the question whether international institutions matter and if so under what conditions (Haas 1989, Hasenclever et al. 1997, Krasner 1983b, Levy et al. 1995, Miles 2002). More recent studies with increased complexity assess the institutional mechanisms with which institutions influence state behavior and which states are influenced by institutions (Goldstein et al. 2007, Kelley 2007, Mitchell and Deane 2008, Morrow 2007, Simmons and Hopkins 2005, Von Stein 2005). Yet, research on the effects of institutional design has remained "underexplored (…) despite its potential great benefit to scholars and political decision-makers alike" (Sprinz and Kaan 2006: 1). Even efforts for assessing the influence of several international institutions comparatively have remained a rare phenomenon. The majority of research focused on the evaluation of single institutions. As Mitchell and Deane (2008) have recently argued, scholars have been engaged in discussing the question of 'do regimes matter' (Haas 1989), while diplomats pursue with the business of institutional design thereby adopting certain design elements and avoiding others. This, however with little scientifically-inspired knowledge on the effectiveness of their doing.

Second, studies on the effectiveness of international institutions have focused mainly on the output and outcome but not on the impact dimension. As the public policy literature proposes, one can make a distinction between three potential indicators: Output, Outcome and Impact (Easton 1965, Mitchell 2007: 896-97, Underdal 2002: 5-6, Young 2004: 12-13). *Outputs* can be thought of as the norms, principles, and rules that states adopt when implementing a regime. *Outcome* refers to the regime-induced changes in human behavior. And *impacts* are best thought of as the changes in environmental quality (the biophysical environment itself). To the knowledge of the author, the impact dimension for measuring regime effectiveness has hitherto only rarely been used for addressing this or similar research questions.[10] This investigation shall complement existing research by evaluating the effectiveness of binding and nonbinding agreements comparatively.

Third, the existing literature on the effectiveness of binding versus nonbinding agreements offers contradictory theoretical and empirical results.[11] *Theoretically*, there are good reasons for arguing that binding treaties are more effective in causing changes in environmental quality than nonbinding agreements and vice versa (see section 4). Even more important from an academic point of view, the existing literature also offers contradictory *empirical* results. Studies from Helmut

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[9] See, for instance: (Chayes and Chayes 1995, Haas et al. 1993, Köppel 2009a, Koremenos et al. 2004, Mitchell 1994, Sprinz and Kaan 2006, Wettestad 1999).

[10] For one of the frontrunners in using the impact dimension of regime effectiveness, see (Helm and Sprinz 2000).

[11] Generally, an increasing scientific occupation went along with the trend towards the legalization of international institutions in the past years. One merit of this was, for instance, a special issue of *International Organization* from the year 2000 on „Legalization and World Politics" (Goldstein et al. 2000) in which the authors (Abbott 2000, Abbott et al. 2000, Abbott and Snidal 2000, Kahler 2000) specified the term „legalization" on which further research could build on (Böhmelt and Pilster 2009, Brütsch and Lehmkuhl 2007, List and Zangl 2003, Mayer and Rittberger 2001, Skjærseth, et al. 2006).

Breitmeier et al. (2006a) and Bernhard Zangl (2006) show that legalization of international institutions raises their effectiveness. Yet, case studies from Arnold Gurtner-Zimmermann (1998) and Petra Holtrup (1999), Raphael Tschanz (2001), Jutta Brunnée and Stephen Toope (2002) indicate that nonbinding agreements can reach higher levels of effectiveness than binding treaties. In addition, the large-scale research project from David Victor et al. (1998) on the effectiveness of international environmental commitments argued that nonbinding agreements have proven more effective in changing the behavior of relevant actors than binding treaties.

Finally, little research has been done on the effectiveness of transboundary water regimes in comparison. For a long time, transboundary rivers had only small scholarly attention.[12] During the past years this has changed to a certain extent (Beck et al. 2008, Bernauer and Kuhn forthcoming, Bernauer and Siegfried 2008, Dombrowsky 2007, Fischhendler 2008, Lindemann 2006). Yet, the field is dominated by qualitative case studies of single transboundary rivers[13], which rely almost exclusively on the output dimension of effectiveness (Bernauer and Siegfried 2008, Dombrowsky 2007, Gurtner-Zimmermann 1998). And even the recently published studies that assess the effectiveness of transboundary river regimes do so without assessing the effect regime design might inherit (Bernauer and Kuhn forthcoming, Sigman 2004). Nevertheless, research in this field is vital as the German Advisory Council on Global Change (2007: 90) stated recently: „Water crisis today is more a crisis of water management in many areas than a problem of hydrological resources “. Yet, we will not be able to solve transboundary problems without knowing how agreements need to be designed to be effective.

3. Definitions

We focus here on the effectiveness of international regimes. Following Krasner's (1983a: 2) broadly accepted regime definition: “Regimes can be defined as sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given area of international relations”. However, we exclude the norms and principles included in Krasner's definition of regimes (Mitchell 1994: 4, Wettestad 1999: 7-13). Instead, we follow Wettestad's (1999: 8) assumption that ”the main concepts of regimes are rules/procedures and regulations/programmes – which can be termed 'structural' and 'regulative' components of regimes”. Consequently, the terms “regimes” and “institutions” are used interchangeably.

Finally, the terms *binding* and *hard law* are used interchangeably throughout the analysis. Although there is no single agreed-upon definition and the discussion on the distinction between hard and soft law is highly controversial, we will follow a pragmatic approach.[14] For most scholars it is the consent to be legally bound that is the essential difference (Birnie and Boyle 2002: 13, Mitchell 2003:

[12] One of the few exceptions is Thomas Bernauer and his research group at ETH Zurich (Bernauer 1997, Bernauer 1996, Bernauer and Moser 1996, Durth 1996, Gurtner-Zimmermann 1998, Marty 2001) and the NeWater (New Approaches to Adaptive Water Management under Uncertainty) research project supported by the European Commission under the sixth framework program (Huntjens et al. 2008, Raadgever and Mostert 2005).

[13] See exemplarily, (Bernauer 1996, Bernauer and Moser 1997, Dieperink 1998, Gurtner-Zimmermann 1998).

[14] For an overview of some approaches to define hard and soft law, see (Guzman 2005: 583-84).

429,32, Skjærseth, et al. 2006: 104). This follows the technical definition of treaties codified in the Vienna Convention on the Law of Treaties (Lipson 1991: 502). Article 26 of the Vienna Convention (UN 1969) states that treaties are "binding upon the parties" and "must be performed by them in good faith". In addition, Mitchell (2003: 432) points out that agreements "are the documentation of legally binding arrangements among two or more states, regardless of whether they are designed as treaties, conventions, accords, or modifications of such arrangements." Thus, *hard law* is an intergovernmental agreement that has legally binding obligations.[15] Other dimensions that are sometimes being considered when evaluating the "hardness" of transboundary commitments are not included.[16] Conversely, the terms *nonbinding* and *soft law* are used interchangeably throughout the analysis. As Skjærseth et al. (2006: 104) point out, soft law "refers to international norms that are deliberately nonbinding in character but still have legal relevance, located 'in the twilight between law and politics.'" Thus, *soft law* is here understood as an intergovernmental agreement that does not have legally binding obligations.[17] Soft law instruments include action plans, codes of conduct, agreed measures, resolutions, and similar policies (Mitchell 2003: 431-34, Thürer 2000).

4. Theoretical Advantages of Binding and Nonbinding Agreements

Generally, the relevant literature offers convincing theoretical arguments stipulating positive effects of both nonbinding as well as binding agreements on regime effectiveness. In regard to the former, several authors have argued that *nonbinding commitments* may be more effective (Abbott and Snidal 2000, Birnie and Boyle 2002, Guzman 2005: 592, Lipson 1991: 514, Raustiala and Victor 1998: 684-89, Thürer 2000: 453-54, Tschanz 2001: 13-18):

First, a nonbinding agreement is easier and faster to achieve. It enters into force immediately, without the sometimes time-consuming ratification process of binding treaties.[18] Legally binding treaties generally do not enter into force unless instruments of ratification have been deposited or any

[15] Notice the operationalization of hard law Mitchell (2003: 431-34) suggests. Following this, hard law includes:
"1. instruments designated as convention, treaty, agreement, accord, or their non-English equivalents, and protocols and amendments to such instruments;
2. instruments, regardless of designation, establishing intergovernmental commissions;
3. instruments, regardless of designation, identified as binding by reliable sources (e.g., by a secretariat, UNEP, or published legal analysis); or
4. instruments, regardless of designation, whose texts fit accepted terminologies of legally binding agreements".

[16] Such dimensions include precision (rules are definite, unambiguously defining the conduct they require, authorize or proscribe) and delegation of authority to third parties (Abbott, et al. 2000: 401, Abbott and Snidal 2000: 423).

[17] Notice that there is also the understanding of soft law on the intra-state level. Here, firms commit themselves voluntarily to improve their environmental performance beyond what they would have been legally required to ((CERNA) 1998: 4, OECD 2003).

[18] See, for instance, the Convention on the Protection of the Rhine Against Pollution by Chlorides, signed on December 3, 1976, but did not enter into force until July 5, 1985 (Bernauer 1995: 369).

other requirement for entry into force has been fulfilled.[19] Moreover, some legally binding treaties either do not enter into force or enter into force only for a limited number of parties, which might not necessarily include the states whose involvement is most vital to the achievement of the treaties' purposes.

Second, nonbinding agreements allow states to tackle a problem collectively at a time they otherwise might not have approached due to economic or political reasons. In some instances, states do not want to restrict their freedom of action by signing a binding treaty but still want to tackle a problem through international cooperation.[20] In regard to environmental problems, this might be the case because either scientific evidence is incomplete or expected to change or because economic costs are uncertain or expected to be over-burdensome.

Third, nonbinding agreements may enable governments to formulate their commitments in a more precise and ambitious form than would be possible in a binding treaty. Especially in cases when uncertainty is high, most governments seem to approach binding commitments with caution. As Raustiala and Victor (1998: 686) state: "Governments . . . have signed only what they could implement, and thus binding commitments have typically required only modest, if any, change in behavior ex ante and have been accompanied by high compliance rates ex post." In contrast, when commitments are nonbinding, governments seem to be eager to formulate them precisely and ambitiously—even when uncertainty is high.

Some of the aforementioned advantages also seem to contribute to further benefits. For instance, enabling states to formulate their commitments in a more precise and ambitious form then they would have done in a binding treaty may contribute to two other benefits. On the one hand, nonbinding agreements allow states to move forward with deeper cooperation. States that seek deeper cooperation can use nonbinding instruments to create a smaller club of "like-minded enthusiasts" at times when it is difficult either politically or symbolically not to include laggards in binding agreements (Raustiala and Victor 1998: 687).

On the other hand, learning processes or learning by doing is facilitated due to the flexibility of nonbinding instruments. Nonbinding agreements offer states the opportunity to see the impact of rules in practice and to learn about the consequences of their agreements while keeping the flexibility to avoid any "unpleasant surprises" those commitments might hold (Abbott and Snidal 2000: 442). This allows for more effective cooperation, especially when it is unclear how best to cooperate, and it

[19] For instance, a specified number of ratifications, as is the case for the Kyoto Protocol. But note that this "advantage" can easily turn into a disadvantage when looking at it from a normative perspective. From this point of view it is little wonder when governments prefer soft law because they prefer "instruments that they can control unambiguously, without legislative advice or consent" (Lipson 1991: 516). This is especially pronounced in situations when legislative support is lacking or uncertain. Then the disadvantage may become democratic. Arguing even one step further, Prosper Weil (1983: 413, 23) argues that increasing use of soft law "might well destabilize the whole international normative system and turn it into an instrument that can no longer serve its purpose".

[20] A treaty may be hard to renegotiate and therefore too inflexible to respond to changing conditions (Birnie and Boyle 2002: 12, Guzman 2005: 591, Lipson 1991: 518).

may lower the perceived costs of moving to harder legalization (Abbott and Snidal 2000: 436, Raustiala and Victor 1998: 687).[21]

In general, compliance with nonbinding commitments seems to be low, but the influence of these commitments on the behavior of relevant actors appears to be high. States do not comply completely with nonbinding agreements, but do change their behavior significantly. Compliance and effectiveness seem to be "inversely related" (Raustiala and Victor 1998: 686).

In regard to legally *binding agreements*, three merits can be identified as well (Abbott 2000, Abbott and Snidal 2000: 430-31, Thürer 2000: 453-54, Victor, et al. 1998):

First, binding treaties strengthen the credibility of a commitment. Binding commitments enhance credibility by constraining "self-serving autointerpretation" (Abbott and Snidal 2000: 427). Another way is by increasing the costs of reneging. In a nutshell, one essential element of binding treaties is that they "visibly stake the parties' reputations to their pledges" (Lipson 1991: 508-09). When looking at nonbinding agreements, in contrast, it becomes evident that their flexibility also means that they can be more easily abandoned. In addition, public debates that may provide national support for an agreement can more easily be avoided. Here, the stakes are diminished.

Second, binding treaties increase compliance because of the commitment required. Harder legalization raises the political costs of noncompliance.[22] *Pacta sunt servanda* and when a state violates an international commitment, it may face several consequences. These possible consequences range from the loss of reputation as a reliable partner to specific and costly retaliation to more dramatic changes in the national reputation, such as being perceived as a nation that is untrustworthy or even as one that makes promises in order to deceive. In some cases, the consequences may also be combined with some form of direct sanction (Guzman 2005: 582, Lipson 1991: 508-12).[23]

Finally, binding treaties reduce intergovernmental transaction costs.[24] Once a treaty is signed, ratified, and put into effect, transaction costs of subsequent interactions are reduced (Abbott and Snidal 2000: 430-31). This holds true for the enforcement of commitments as well as the process of applying and elaborating the rules the parties agreed upon. In regard to the former, enforcement costs are reduced when comparing hard law to alternatives like persuasion, frequent renegotiation or coercion. In regard to the latter, binding treaties facilitate the application, interpretation, and elaboration of provisions by setting clear limits on negotiation and dispute resolution.[25]

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[21] In addition, nonbinding agreements can also function as a "way station to harder legalization" (Abbott and Snidal 2000: 423).

[22] Charles Lipson (1991: 508) hypothesizes in regard to the latter that "[t]he more formal and public the agreement, the higher the reputational costs of noncompliance".

[23] In this regard, Guzman (2005: 604-05) emphasized the non-zero-sum nature of sanctions in the international arena. Sanctions in the case of international agreements are a net loss to the parties. One party faces a cost for there is no offsetting gain to the other parties involved.

[24] The disadvantage of this is higher negotiation costs than with nonbinding agreements because of the higher violation costs. States put more care in negotiating and drafting binding treaties because they seek to comply with the rules they are legally bound to (Abbott and Snidal 2000: 434).

[25] As Abbott and Snidal (2000: 430) argue, in the case of virtually all agreements, provisions need to be applied to specific factual situations, interpreted, as well as elaborated to resolve ambiguities.

5. First Empirical Evidence: The Rhine River

To gain first tentative empirical evidence from research on the effectiveness of legally binding treaties compared with nonbinding agreements in cases of transboundary river pollution; this paper examines closely one case: The Rhine River.

The Rhine is the basin of the third-largest river of Europe and extends on its 1300 kilometer long journey from the Swiss Alps to the North Sea. It runs through parts of nine countries that are riparian states of the Rhine: Austria, Belgium, Italy, Liechtenstein, Luxembourg, France, Germany, the Netherlands, and Switzerland. Here, the main stem of the Rhine drains some of the most populated and industrialized areas of these countries. Other rivers of similar size to the Rhine are the Northern Dvina in Russia, the Fraser in Canada or the Colorado in the United States (Bernauer 1996: 201-02, Lindemann 2006: 16-17, Van der Veen 1981: 41-42).

Around 55 million people reside and work in the catchment area, which has an average population density of approximately 270 persons per square kilometer. Approximately twenty percent of all chemical companies in the Western world are located in the Rhine catchment area, which makes it one of the most important industrial areas of the world with large chemical industries, potash, and coal mines as well as other resources. Moreover, the Rhine provides the source for drinking-water production for more than 20 million people (Bernauer and Moser 1996: 401, Dieperink 1997: 1-3, ICPR 1994: 9, International Water Assessment Centre 2001: 35, Lindemann 2006: 16-17, Van der Veen 1981: 41-42). This it is no surprise that by the mid-1970s, levels of water pollution in the Rhine River had come to a point where the "artery of Western Europe" (Dieperink 2002: 67) had been turned into the "world's biggest sewer" (Teclaff and Teclaff 1985: 589).

The first attempts to manage the Rhine date back to 1449. The first treaties that were signed concerning the Rhine go back to the Nineteenth Century and mainly concern the regulation of free shipping in the river.[26] The Central Commission for Rhine Navigation, established to regulate all matters concerning navigation, first met on August 5, 1816. The first international exchange over water quality was made in this time as well despite the fact that most serious pollution of the river did not begin until around 1850 (International Water Assessment Centre 2001: 35, Lindemann 2006: 16-17, Van der Veen 1981: 41-50, 81). More specific discussions at an international level did not start until the early 1950s. These discussions were formalized in 1963 in a regulatory framework for the protection of the river: *The Convention on the Protection of the River Rhine* (Rhine Convention).[27] More treaties concerning water pollution followed in 1976: *The Convention for the Protection of the Rhine Against Chemical Pollution* and the *Convention for the Protection of the Rhine Against Chlorides*. More recent attempts were made with the Rhine Action Program (RAP) in 1987 and the new *Convention on the Rhine* in 1999. Table 1summarizes the history of the ICPR.

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[26] For a more detailed overview, see (Durth 1996: 170-74).

[27] The Rhine Convention provides the legal basis for the ICPR. Nevertheless, the ICPR started meeting as early as 1950 after it was established through an exchange of letters between the Governments of Switzerland, the Federal Republic of Germany, France, Luxembourg and the Netherlands. The European Economic Community (that is today the European Union) becomes a member of the ICPR in 1976 with the signing of an additional treaty. For more background information regarding the RC, see: (Dieperink 1995: 124, Dieperink 1998: 479).

Table 1: History of the International Commission for the Protection of the Rhine (ICPR)

1950	Common forum where discussions at an international level was created
1963	Convention on the Protection of the River Rhine (Rhine Convention/RC)
1976	Convention for the Protection of the Rhine against Chemical Pollution (RCC)
1976	Convention for the Protection of the Rhine against Chloride Pollution
1987	Rhine Action Program (RAP)
1999	New Convention on the Rhine

For gaining first insights concerning the effectiveness of binding and nonbinding agreements this paper analyzes two initiatives: the 1976 Rhine Chemical Convention as a legally binding approach and the 1987 Rhine Action Program as a nonbinding approach. The first question that must be addressed is how to measure whether the agreements were effective or not.

Several efforts have been made to measure and understand the performance of international environmental regimes. Central to all of them is the detection of an indicator of influence: What exactly should be evaluated? What should be used as an indicator for success? Certainly, this is a crucial step since it determines whether an institution has been effective in influencing certain phenomena or not. Three potential indicators have been proposed by the public policy literature in this regard: Output, Outcome and Impact (Easton 1965, Mitchell 2007: 896-97, Underdal 2002: 5-6, Young 2004: 12-13). *Outputs* can be thought of as the norms, principles, and rules that states adopt when implementing a regime. *Outcome* refers to the regime-induced changes in human behavior. And *impacts* are best thought of as the changes in environmental quality (the biophysical environment itself).

Although most of the research uses the output or outcome dimension as an indicator for evaluating regime effectiveness, we will use the impact dimension for evaluating the influence of binding and nonbinding agreements for the following reason.[28] Using impacts allows to focus on the ultimate interest of (environmental) agreements – to solve the problems that motivated their establishment. Focusing on *outputs* certainly has the advantage of being easier to identify (most of them, for instance, are almost always official documents for public usage) and easier to pin down the causal effect of a regime on changes in principles and rules (for instance, a national law refers to or uses the language of the regime) (Mitchell 2007: 896-97). Almost the same holds true for *outcomes*. Outcomes are easier to identify (environmental regimes almost always identify behavioral changes that are needed to achieve their goals) and the causal chain between a given regime and behavioral changes is almost always shorter (Mitchell 2007: 896-97). Yet, even if we detected that a regime caused changes in outputs and outcomes, we would still not know whether it really has been effective – if it also caused changes in respect to environmental quality. Changing outputs and outcomes certainly is a necessary but not a sufficient condition for causing changes in environmental quality.

[28] For a more thorough discussion on the advantages and disadvantages of using these indicators, see: (Mitchell 2007: 896-97).

5.1 Effectiveness of Binding Agreements: The 1976 Rhine Chemical Convention

The Rhine Chemical Convention (RCC) is the follow-up of the Rhine Convention and thus builds on the institutional foundation of this treaty. The RCC was signed in 1976 and entered into force in 1979. Signatory states are Germany, France, Luxembourg, the Netherlands, Switzerland, and the European Union. The RCC was developed only after dealing with considerable difficulties. The Netherlands as the downstream country and the initiator of the agreement could draw on the support of France. Germany and Switzerland opposed the Convention because of the uncertainty regarding the economic as well as political consequences of the treaty.[29] After these difficulties were surmounted, the RCC was shaped as a framework agreement. It distinguishes between black and gray lists of substances (in Annex I and Annex II). One of its main goals is to eliminate the pollution of Annex I substances, such as mercury and cadmium, and to reduce the pollution of Annex II substances, such as lead and nickel. Additionally, three protocols—one for cadmium (1983), one for mercury (1985), and one for carbon tetrachloride (1986)—were added. Some evidence supports the assumption that the RCC has been an effective regime. For instance, the International Water Assessment Center called it the "most important convention for the present day management of the river" (International Water Assessment Centre 2001: 35).

The Rhine Chemical Convention was strongly inspired by several treaties or drafts of politically binding agreements: The EEC Directive on Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment of the Community, the draft European Convention for the Protection of International Watercourses Against Pollution (which has never been adopted by the member states of the Council of Europe), and the 1974 Paris Convention for the Prevention of Marine Pollution from Land-Based Sources (Dieperink 1995: 127, Kiss 1985: 613, 25).

Central goals of the Rhine Chemical Convention:

- Improve the quality of the waters of the Rhine (Article 1)
- Eliminate pollution of the surface waters of the Rhine basin by dangerous substances in the families and groups of substances appearing in Annex I (Article 1)
- Reduce the pollution of the Rhine by the dangerous substances in the families and groups of substances appearing in Annex II (Article 1)

5.2 Effectiveness of Nonbinding Agreements: The 1987 Rhine Action Program

The Rhine Action Program (RAP) was adopted in October 1987. Difficulties with implementing the 1963 Rhine Convention were one reason for adopting this new approach. Another was a widely publicized accident at the Swiss chemical firm Sandoz in November 1986 where several tons of toxic substances were spilled into the Rhine (Bernauer and Moser 1996: 395-96).

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[29] Germany especially feared that the competitive position of its Rhine industry would have to bear considerable competitive discrimination compared to their competitors in Europe and the world and that the costs resulting from the treaty would be too high. Only after the EEC Directive on Pollution Caused by Certain Dangerous Substances Discharged into the Aquatic Environment of the Community had been signed in 1976 (76/464/EWG) was Germany willing to sign the RCC as well. See, (SRU 1976: 35).

The principal goal of the RAP is to keep the Rhine ecosystem alive and healthy as well as to reintroduce vanished species. The reintroduction of the salmon in the river and its tributaries by the year 2000 was established as a visual sign and symbol of the health of the ecosystem as a whole (Bernauer and Moser 1996: 395, Frijters and Leentvaar 2003: 28-29, ICPR 2003b).

Central goals of the Rhine Action Program:

- Improve the Rhine ecosystem to such an extent that vanished species, such as the salmon, would again become indigenous
- Guarantee the use of Rhine water as a source for drinking water supply
- Reduce the pollution of river sediments to such an extent that its' deposition on land or its' dumping into the sea is possible without negative consequences for the aquatic environment
- Improve the protection of the North Sea

For achieving these goals, the RAP was split into three phases. In the *first phase* (1987-1989), the ICPR drafted a list of "priority substances" (substances that are most harmful to the ecosystem of the Rhine River), took stock of the sources and the amount of inputs, and made proposals for their reduction. Moreover, it demanded the implementation of the state of the art in industrial production and municipal waste-water treatment plants. In the *second phase* (1990-1995), the discharges of priority substances were to be reduced by fifty percent and even by seventy percent by 1995 for some heavy metals (such as dioxin, lead, cadmium, and mercury). The amount discharged in 1985 was taken as a baseline. In the *third phase* (1996-2000), additional measures were to be implemented after an interim result (Bernauer and Moser 1996: 393, ICPR 2003b: 9).

Some first evidence supports the assumption that the RAP has been effective. For instance, Frijters and Leentvaar (2003: 29) conclude in their Rhine Case Study that:

> "The implementation of the Rhine Action Program has proved to be very successful. Measures have been taken all along the river to prevent pollution, and as early as 1994, the ICPR could report that most of the reduction goals had been reached . . . . The actual state of the river shows that an enormous improvement in the water quality of the Rhine has taken place in a very short time. From being the sewer of Europe in the 1970s the Rhine is now a clean transboundary river".

5.3 Comparing the Effectiveness of Binding and Nonbinding Agreements

The evolution of Rhine water pollution reveals first empirical evidence for the effectiveness of binding treaties as well as nonbinding agreements. For gaining this first empirical evidence, we analyze Rhine pollution with heavy metals such as cadmium, lead, mercury, and nickel. Additionally, we observe BOD_5, which is a typical variable used for describing water quality.[30] Using heavy metals and BOD_5 as

[30] Differences in water quality can either have natural reasons or can be caused by human activities. Changes in the water quality caused by natural reasons can occur through natural processes such as chemical reactions between rocks and water or erosion and sedimentation caused by flowing water. The process when human activities change the natural water quality is referred to here as pollution, particularly when it has detrimental effects. See (Meybeck et al. 1990: 41-45).

indicators has three major virtues. First, all indicators are produced by human activity.[31] Second, all forms of pollution can be influenced by governments if they decide to do so.[32] Third, all indicators are subject to the agreements. Cadmium, for instance, is among the most important substances regulated in the Rhine Chemical Convention as well as among the "priority substances," the discharges of which were to be reduced by seventy percent. Moreover, it was the first chemical that the ICPR suggested for the introduction of limiting values.

After the *Rhine Chemical Convention* was signed in 1976, Rhine pollution declined significantly. This pattern is basically similar for all observed pollutants. When comparing the five-year period between 1976 and 1981, it becomes evident that Rhine levels of cadmium pollution decreased by more than seventy percent, BOD_5 by more than sixty percent, mercury and lead by more than fifty percent, and nickel by almost forty-five percent (see Table 3). Only five years after the treaty was signed, Rhine pollution is lower than ever before.[33] These results find support from other studies (Bernauer and Moser 1996: 395-96, Tschanz 2001). Even more importantly, the amount of pollution remains close to these low levels. During the five-year period between 1981 and 1986 Rhine pollution with cadmium and mercury declined by more than seventy-five percent (see Table 3) and with nickel and mercury by twenty percent to thirty percent.

Table 2: Rhine pollution at measuring station Bimmen/Lobith[34]

	1976	***1981***	***1986***	***1987***	***1992***	***1997***	***2002***
Cadmium	3.40	1.00	0.20	0.21	0.09	0.20	0.20
Nickel	16.00	9.00	6.20	5.00	4.90	3.80	3.30
Mercury	0.75	0.32	0.08	0.12	0.06	0.03	0.20
Lead	26.00	12.00	9.20	7.80	5.00	3.70	3.10
BOD_5	9.90	3.70	3.70	3.70	-	-	-

Table 3: Reductions in percent at measuring station Bimmen/Lobith

	1976-1981	***1981-1986***	***1987-1992***	***1992-1997***	***1997-2002***
Cadmium	70.59	80.00	57.14	-122.22	0
Nickel	43.75	31.11	2	22.45	13.16
Mercury	57.33	75.00	50.00	50.00	-566.67
Lead	53.85	23.33	35.90	26.00	16.22
BOD_5	62.63	0	-	-	-

[31] For a more detailed insight regarding heavy metals or BOD_5, see, e.g., (Köppel 2009a: 17-21, United Nations Environment Programme (UNEP) 2002). See generally *(Behrendt and Fisheries 1993)*.

[32] The discharge of untreated or poorly treated sewage is the major source of organic pollution that leads to low BOD_5 levels. Organic pollution can thus be curbed by the installation of waste-water treatment plans or by reducing the amount of sewage discharged into the river. Nevertheless, as Kuhn and Bernauer (2006: 13-14) put it, "doing so is costly."

[33] Of course, this is true only as far as data on pollution levels can be traced back.

[34] Data taken from the publications of the ICPR (ICPR 1967, ICPR 1976, ICPR 1982, ICPR 1990, ICPR 1996, ICPR 2004).

After the first phase of the *Rhine Action Program* went into effect in 1987, Rhine pollution declined significantly as well but to a lesser degree than with the RCC. Table 3 indicates that Rhine cadmium and mercury pollution declined by more than fifty percent, lead by thirty-five percent, and only the amount of nickel hardly changed at all between 1987 and 1992. After 1992, pollution levels decreased more slowly.[35]

Table 4 reveals an even more impressive picture. Here, emissions into the Rhine from point sources are measured during the years 1985 to 2000. In short, the emissions from point sources declined sharply. During the time period between 1985 and 1992, cadmium emissions decreased by eighty percent, lead and nickel by more than seventy percent and mercury by forty-five percent. The decline in emissions also continues between 1992 and 1996. These results find support from other studies[36] that hail the RAP as a "success story of international river cooperation" (Dombrowsky 2007: 223, 24).

Table 4: Emissions into the Rhine from point sources in kg/a[37]

	Emissions in kg/a				*Reductions in percent*		
	1985	***1992***	***1996***	***2000***	***1985-1992***	***1992-1996***	***1996-2000***
Mercury	2.795	1.531	941	659	45.22	38.54	29.97
Cadmium	21.763	4.079	1.801	1.672	81.26	55.85	7.16
Nickel	393.870	101.961	62.288	62.972	74.11	38.91	-1.10
Lead	303.140	89.997	65.182	43.092	70.31	27.57	33.89

When looking at important rival variables, the picture becomes more nuanced. As Table 5 shows, the *level of economic integration among the member countries*[38] remains on a constantly high level from 1958 to 1996 with the average trade of the riparian states ranging between 27 and 36 percent of their total trade. Thus, the riparian states are well integrated what finds additional support in the literature (for example: Lindemann 2006: 25).

[35] With two exceptions: Cadmium increased by 122% between 1992 and 1997, mercury by an incredible 560% between 1997 and 2002. Both can be explained by the low numbers of pollution where small changes in absolute terms lead to huge changes in relative terms (see Table 2).

[36] *See, e.g.*, (Bernauer and Moser 1996, Durth 1996, Gurtner-Zimmermann 1998: 241, Holtrup 1999, Mostert 2003: 34).

[37] Data taken from (ICPR 2003a).

[38] The *level of economic integration among the member countries* could be an important rival factor since a high degree of economic integration seems to reduce incentives to substantially cheat on agreements. The involved countries stand in iterated interactions – they meet again and again in many other contexts. In addition to this, economic integration enhances the chances for issue linkages as well as for other types of intertemporal and cross-issue trade exchange (Bernauer 1997: 172-74, Mitchell 2002: 20). Accordingly, we expect a negative effect of economic integration on pollution. The variable is operationalized as "average trade (imports + exports) of each riparian country with all others/total trade of each". Data is taken from the Gledditsch (2002) "Expanded trade and GDP" data set.

In regard to the *Environmental Kuznets Curve (EKC),* a continuous increase in economic growth from 1958 to 1996 can be observed.[39] Whereas per capita GDP of the riparian states amounted to $2,103 in 1958, a continuously increase occurred to more than $21,800 in 1996 (see Table 5). Additionally, experts argue that a clear decoupling of economic growth and environmental pressures has been apparent for Switzerland and Germany (OECD 1993a: 103-04, OECD 1998: 125). Therefore, the EKC seems to be an interesting rival explanation on the first sight. Yet, on the second sight the EKC seems to be less convincing for explaining Rhine water pollution reductions. This becomes obvious when looking at the evolution of other transboundary European river pollution cases. In Table 6 Mosel pollution is illustrated. Table 7 shows the pollution of the Meuse. In both rivers, an overall increase in pollution can be observed during the years 1985 to 1992. Yet, when following the EKC argument, pollution levels should in fact decline especially when considering that in both rivers, the majority of the riparian states are the same as in the Rhine River.[40]

In regard to *power relations*, there is no powerful (downstream) hegemon who could have forced the other riparian states to reduce polluting the Rhine (see Table 5).[41] In general, it is difficult to identify a hegemon. But the Netherlands, as the downstream country, are certainly not the most powerful country in the basin. This observation finds additional support in the literature (for example: Breitmeier et al. 2006b: Database, Durth 1996: 168, Holtrup 1999: 85, LeMarquand 1977: 100-01). Moreover, our findings support the claim that the constellation between the riparian states in regard to the distribution of power remained on a constant level from 1958 on until (at least) 1991.

Macro changes such as changes in the industry structure[42] could explain at least some portion of pollution reductions. Yet, the results remain mixed. On the one hand, the industrial production of the involved countries increased significantly from 1970 to 1990 (See Table 5). Moreover, the number of total sales of the chemical industry in Germany as the major polluter almost tripled (Allen 1989:

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[39] In short, the *Environmental Kuznets Curve (EKC)* claims that there is an inverted-U relationship between pollution of a certain environmental good and economic development. At lower income levels, pollution grows rapidly because people are mostly concerned about food, shelter, jobs and other material needs. They are less concerned about environmental quality, about clean air and water, and are less likely to have strong environmental regulation or to have the capacity to afford costly pollution control measures. This alters as income levels increase. Now, people usually value the environment more highly and can afford the costs of higher environmental clean-ups. Consequently, the level of pollution declines (Dasgupta 2002: 147, Kuhn and Bernauer 2006: 18-19, Paudel et al. 2005). Economic activity for assessing the relevance of the *Environmental Kuznets Curve* is operationalized following recent scholarship who used income as measure for economic growth (for instance: Dasgupta 2002: 147, Paudel, et al. 2005: 3, 7-8). Here, we will use per capita Gross Domestic Product (GDP) as a measure. Data is taken from the Gledditsch (2002) "Expanded trade and GDP" data set.

[40] France and Germany in the case of the Mosel; France and the Netherlands (and Germany as well) in the case of the Meuse.

[41] This logic is derived from the Realist school of thought. The dominant state enforces others to comply with the rules and/or complies itself because it is capable of doing so and is interested in the issue (Hasenclever, et al. 1997: 83-104, Mitchell 1996: 11, Simmons 1998: 79-80). Since the issue-area in question is characterized by an upstream-downstream problem, collective action theory assumes that the only riparian country that could possibly have an interest in changing the behavior of the involved actors is the downstream country (Mitchell and Keilbach 2001: 902). For the purpose of this paper, power is perceived as economic power. The economic power of the upstream countries (polluter countries) is compared to the economic power of the downstream country (victim country). Power is measured as: Power = Average GDP polluter country(ies) / average GDP victim country. Data is taken from the Gledditsch (2002) "Expanded trade and GDP" data set.

[42] Changes in the industry structure could be an important factor since we are making assessments over multiple decades. Even without an agreement, changes in the industry structure and thus a decline in pollution might be occurring. For instance, the end of the Cold War may have lead to such changes in the industry structure. In a very short time period, a whole industrial sector can collapse causing pollution levels decline. As an indicator for industrial production OECD (1993b: 239) Production Indices (with 1985=100) are used.

159-64, comparing the year 1972 with 1986). If this was the only information available, macro changes could have been ruled out as an important rival variable. A continuous increase in industrial production would be an improbable driver in declining river pollution. Yet, on the other hand, the available literature suggests that modest structural change with respect to the industry seems to have happened. For instance, there is evidence that structural changes in the major polluting industries occurred. Through these, older technologies were replaced by cleaner industrial processes.[43] Moreover, experts ascertain that the metal refining industries as well as the iron, steel/coke factories that were responsible for some of the majority of point sources in their peak years had reduced their emissions dramatically by 1988. As reasons for this, the implementation of good housekeeping practices, the introduction of cleaner processes, and the installation of waste-water treatment as well as a change of what is considered as a valued resource (for example cadmium in zink refineries) are named (Bernauer and Moser 1996: 396, Stigliani 1993: 789).[44]

Table 5: Development of Important Rival Variables

	1958	***1963***	***1968***	***1973***	***1975***	***1976***	***1981***	***1986***	***1991***	***1996***
Level of Economic Integration	0.27	0.32	0.34	0.36	0.33	0.33	0.31	0.34	0.34	0.32
Environmental Kuznets Curve	2,103	2,798	3,809	5,460	6,420	6,905	10,700	14,322	19,272	21,809
Power of the Riparian State	1.09	1.15	1.07	1.08	1.04	-	1.08	1.10	1.08	-
Industrial Production	***1970***		***1975***		***1980***		***1985***		***1990***	
France	77		84		102		100		114	
Germany	80		82		96		100		118	
Netherlands	71		84		95		100		110	
Switzerland	87		85		97		100		115	

Finally, a comparison with other transboundary European rivers underscores our observations. Table 6 shows the pollution of the Mosel.[45] In Table 7, the pollution of the Meuse is demonstrated.[46] Two issues seem important.

[43] As one example for this, Stigliani et al. (1993: 789) cite the switch from thermal smelters to electrolytic refineries for zinc and cadmium production.

[44] As Bernauer and Moser (1996: 402) state: "These developments were interpreted by actors potentially affected as a sign of further tightening of environmental regulation in the future. Hence these actors reacted by reducing their pollution in advance of anticipated legally binding laws by installing waste treatment plants or transferring especially polluting activities out of the Rhine catchment area". There seems to be some evidence that the RCC might have been important in this regard. For instance, Germany's industry that has "jealously guarded its ability to self-regulate (…) for one hundred years" has begun to face "increasing regulatory scrutiny" (Allen 1989: 173). Gurtner-Zimmermann (1998: 243) underscores this when arguing that during the 1970s and 1980s recommendations from the ICPR were often used as points of reference in the setting of national water quality standards and objectives.

[45] The Mosel is a European river flowing through France, Luxembourg and Germany.

First, the correlations between the Rhine Chemical Convention and pollution reductions after this binding treaty was signed in 1976 seem less impressive on the second sight. While Rhine pollution with cadmium declined by 80 percent and with lead by 23 percent during the years 1981 to 1986, the pollution of the Mosel and Meuse declined by almost similar levels. In regard to the former, cadmium pollution declined by 30 percent. In regard to the Meuse, cadmium declined by 67 percent and lead by 66 percent. This could indicate that other factors than the binding treaty were responsible for a decline in European river pollution.

Second, the correlations between the Rhine Action Program and pollution reductions receive further support. Whereas during the years 1985 to 1992 all observed pollution levels of the Meuse increased impressively (with cadmium by 350 percent and with lead by 176 percent) and some pollution levels of the Mosel increased as well (with lead by 50 percent); Rhine pollution declined significantly (cadmium pollution declined by more than fifty percent, lead by thirty-five percent; See Table 3). This could indicate that the relationship between the existence of the RAP and the decline in Rhine water pollution is more than just correlational but some of causation.

Table 6: Mosel Pollution[47]

Mosel	*Emissions in kg/a*					*Reductions in percent*			
	1980	***1985***	***1992***	***1997***	***2002***	***1980-1985***	***1985-1992***	***1992-1997***	***1997-2002***
Cadmium	4,1	2,8	0,2	0,1	0,1	31,71	92,86	50	0
Lead	-	2	3	2	2	-	-50	33,33	0
BOD_5	4,2	3,6	4,7	2,6	3,9	14,29	-30,56	44,68	-50

Table 7: Meuse Pollution[48]

Meuse	*Emissions in kg/a*					*Reductions in percent*			
	1980	***1985***	***1992***	***1997***	***2002***	***1980-1985***	***1985-1992***	***1992-1997***	***1997-2002***
Cadmium	1,2	0,39	1,76	0,37	0,58	67,5	-351,28	78,98	-56,76
Lead	20	6,71	18,53	6,1	13,6	66,45	-176,15	67,08	-122,95
BOD_5	3,9	4,3	2,6	2,3	3,9	-10,26	39,53	11,54	-65,22

6. Conclusions: Challenges for Future Research

Three major conclusions can be drawn from this study.

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[46] The river Meuse is located in North-Western Europe. It rises in France and flows through Belgium and the Netherlands before draining into the North Sea. It has a catchment area of 33,000 km² covering parts of France, Luxembourg, Belgium (mostly the Walloon Region), the Netherlands and Germany and has a length of 870 km. Although the Meuse shares the part of the same delta as the Rhine and thus belongs (from a scientifically point of view) to the Rhine basin, the European countries have considered the Meuse to be a separate basin (Bouman 1996, Huisman et al. 2000).

[47] Data taken from OECD Environmental Data Compendium: Inland Waters; http://www.oecd.org/document/49/0,3343,en_2649_34283_39011377_1_1_1_37465,00.html, accessed 26 October 2009. Unfortunately, data before 1980 and for nickel and mercury is not available.

[48] Data taken from OECD Environmental Data Compendium: Inland Waters; http://www.oecd.org/document/49/0,3343,en_2649_34283_39011377_1_1_1_37465,00.html, accessed 26 October 2009. Unfortunately, data before 1980 and for nickel and mercury is not available.

First, there are theoretically convincing advantages for using both binding and nonbinding agreements. A *nonbinding agreement* is easier and faster to achieve, allows states to tackle a problem collectively at a time they otherwise would not for economic or political reasons, and enables governments to formulate the commitments in a more precise and ambitious form than they would have done in a binding treaty. In addition, some of these advantages contribute to further benefits such as allowing states to move forward with deeper cooperation and facilitating learning processes or learning by doing. Yet, *binding treaties* come not without their merits as well. They strengthen the credibility of a commitment it otherwise would not have, they increase compliance with the commitment, and they reduce intergovernmental transaction costs.

Second, empirical evidence seems to support theory in practice. The case of the Rhine River indicates that there is a correlation between the existence of a binding and a nonbinding agreement and the evolution of transboundary water pollution. Rhine pollution declined significantly after the Rhine Chemical Convention was signed in 1976. Only five years after the RCC was signed, the amount of cadmium decreased by more than seventy percent and the amount of BOD_5 by more than sixty percent. After the Rhine Action Program went into effect in 1987, the pollution of the Rhine declined significantly as well. Five years after the first phase of the RAP went into effect, Rhine pollution with cadmium and mercury decreased by more than fifty percent and lead by thirty-five percent.

Finally, there is a lot of work to be done for further research. In particular, further research should focus on at least three issues. First, alternative explanations need to be included. The evidence presented here is merely an indication for the effectiveness of binding and nonbinding agreements. Other factors could have influenced the pollution levels as well.[49] In addition, the relationship between binding and nonbinding agreements needs to be assessed. Past research indicates that the benefits of nonbinding agreements have been most evident when combined with legally binding measures. Then, binding treaties may serve either as a backstop if nonbinding agreements are abandoned or as a "necessary rite of passage, helping to raise the profile and effectiveness of all efforts—binding and nonbinding, formal and informal" (Raustiala and Victor 1998: 688). Second, more cases of transboundary water pollution need to be included in the analysis. This is a necessary step for generating predictions beyond the case observed. Including more cases and alternative explanations also allows assessing the question of which form of agreement is effective under which conditions. Finally, further research will have to clarify to what extent further findings are applicable beyond cases of transboundary water pollution. Upstream-downstream problems such as the pollution of transboundary rivers certainly are hard cases for international cooperation (Mitchell and Keilbach 2001). Solutions for effective cooperation in these cases could help mitigate other environmental problems such as climate change or the reduction of species-depletion, to name only a few.

[49] The Rhine Action Program in particular was effective in a very specific context: After the 1986 Sandoz accident environmental awareness and the political pressure for reducing water pollution was extremely high (Mostert 2003: 33-34).

7. References

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