Global Environmental Change xxx (2013) xxx–xxx

Contents lists available at ScienceDirect

Global Environmental Change

journal homepage: www.elsevier.com/locate/gloenvcha

Demand, supply, and restraint: Determinants of domestic water conflict and cooperation

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ARTICLE INFO

Article history:
Received 3 February 2013
Received in revised form 18 November 2013
Accepted 26 November 2013

Keywords:
Climate variability
Demand
Restraint
Supply
Water conflict
Water cooperation

ABSTRACT

This article focuses on one of the most likely empirical manifestations of the "environment-conflict" claim by examining how demand for and supply of water may lead to domestic water conflict. It also studies what factors may reduce the risk of conflict and, hence, induce cooperation. To this end, the article advances several theory-based arguments about the determinants of water conflict and cooperation, and then analyzes time-series cross-section data for 35 Mediterranean, Middle Eastern, and Sahel countries between 1997 and 2009. The empirical results show that demand-side drivers, such as population pressure, agricultural productivity, and economic development are likely to have a stronger impact on water conflict risk than supply-side factors, represented by climate variability. The analysis also reveals that violent water conflicts are extremely rare, and that factors conducive to restraint, such as stable political conditions, may stimulate cooperation. Overall, these results suggest that the joint analysis of demand, supply, and restraint improves our ability to account for domestic water-related conflict and cooperation.

1. Introduction

A number of recent studies have argued that there is a long-term trend toward a reduction of violence in human affairs, both at the international and the domestic level (Goldstein, 2011; Pinker, 2011). However, while there seems to be widespread agreement on this trend, we are far from reaching consensus about its causes (Blattman and Miguel, 2010) or on the prospects that it will continue (Gleditsch et al., 2013). In fact, a rather pessimistic view is found in the environmental-security literature, warning that the unsustainable use of natural resources and the ensuing environmental degradation may generate violent conflict over scarce natural resources (Bächler, 1999; Homer-Dixon, 1999; Kahl, 2006).

Inspired by the debate around the notion of "limits to growth" (Meadows et al., 1972), social scientists have picked up on a long-standing argument initiated by Malthus (1798/1993), who focused on how increasing scarcities may lead to violent conflict (Buttel et al., 1990). As outlined in his *An essay on the principle of population*, Malthus primarily considered the impending gap between food production and population pressure. More recently, concerns have been voiced over social consequences of a broader range of scarcities and (human-induced) environmental degradation (Hauge and Ellingsen, 1998; Gleditsch, 2003). Increasing water scarcity has been a key element in this literature, provoking scholars and policymakers alike to foresee future "water wars" (see Ward, 2002; Katz, 2011; Theisen et al., 2011). Projections of severe, human-induced climate change with its effects on the water supply in many parts of the world have boosted such neo-Malthusian fears.

A contrasting view is offered by cornucopians, who argue that scarcities can be overcome by human ingenuity, technological progress, the wise use of market mechanisms, or social and political institutions that promote cooperation (Simon, 1989, 1996; Lomborg, 2001; Kenny, 2011). For example, Wolf (1998) analyzes the patterns of state interactions over international freshwater resources and contends that resource competition is more likely to be accompanied by cooperation rather than conflict.

Similar disagreements run through the recent literature on the security implications of climate change. Pessimists predict an increased frequency and severity of armed conflicts as global

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doi:10.1016/j.gloenvcha.2013.11.018

warming progresses (Burke et al., 2009), while others view the conflict potential of climate change as small or overshadowed by more traditional determinants of violent conflict (see Buhaug, 2010; Bernauer et al., 2012b; Gleditsch, 2012).

In this article, we re-examine this controversy within a broader theoretical framework. Specifically, we focus on the demand for and supply of water resources, while also considering factors that may be conducive to restraint between the actors involved. To empirically test our arguments, we rely on time-series cross-section data on domestic water conflict and cooperation in 35 Mediterranean, Middle Eastern, and Sahel countries for 1997–2009: the water-related intrastate conflict and cooperation (WARICC) data by Bernauer et al. (2012a). We show that demand-side drivers, such as population pressure, agricultural productivity, and economic development, are likely to have a stronger impact on water conflict risk than supply-side factors, represented by climate variability. We also find that violent water conflicts in the study region are extremely rare, and that factors conducive to restraint, such as stable political conditions, may lead to cooperation. Overall, our analysis suggests that the joint analysis of demand, supply, and restraint improves the ability to account for domestic water-related conflict and cooperation.

The next section briefly reviews the existing (mainly empirical) literature on environmental degradation and conflict/cooperation. We then present the theoretical framework, where we classify our explanatory factors as representing demand, supply, and restraint. Next, we outline the research design and describe the empirical tests of our hypotheses. After discussing the findings, we conclude with an assessment of remaining gaps and ideas for further research.

2. Existing research on environmental factors and domestic conflict or cooperation – a short overview

There is a long tradition of empirical work on the security implications of environmental change in general and water scarcity in particular. The evidence offered by this literature is mixed, however. Whereas some single or comparative case studies contend that environmental stress is likely to lead to violent conflict (e.g., Libiszewski, 1996; Suliman, 1996; Homer-Dixon, 1999; Kahl, 2006), others argue that resource scarcity plays only a minor role in generating conflict (e.g., Benjaminsen, 2008; Kevane and Gray, 2008; Witsenburg and Adano, 2009). The discrepancy in conclusions between these works may be understood in part as a result of which cases have been analyzed. A limitation of the case-study tradition is its near-exclusive selection of cases involving conflict: a research design that fails to shed light on the absence of violence in other countries with similar scarcities or environmental problems (Gleditsch, 1998). In turn, this makes it difficult to draw firm conclusions across a wider range of countries and to generalize results.

The recent emergence of climate change as a major issue on policy agendas has led to a revival of the neo-Malthusian argument and a wave of quantitative studies examining possible links between climate variability and domestic violence. The bulk of this research provides little evidence for a powerful direct link between climate change or variability and armed conflict (Bernauer et al., 2012b; Deligiannis, 2012; Gleditsch, 2012; Scheffran et al., 2012; Meierding, 2013; Theisen et al., 2011; however, see also Hsiang et al., 2013), however, and research that finds significant effects does not agree on the direction of the relationship (for contrasting examples, see Theisen, 2008; Burke et al., 2009; Buhaug, 2010; Ciccone, 2011; Fjelde and von Uexkull, 2012; Hendrix and Salehyan, 2012; Koubi et al., 2012; Raleigh and Kniveton, 2012; Wischnath and Buhaug, 2014).

There is less statistical work addressing the effects of environmental change on a broader spectrum of interaction types and most of the relevant research concerns international river basins in interstate relations (e.g., Wolf et al., 2003; Furlong et al., 2006; Mitchell and Hensel, 2007; Brochmann and Hensel, 2009; Bernauer and Kalbhenn, 2010; De Stefano et al., 2010; Kalbhenn, 2011; Brochmann, 2012; Brochmann and Gleditsch, 2012). The predominant finding from this literature is that cooperative interactions are more prevalent than conflictive interactions and that water-related international interactions involving violence are rare. Yet, it remains unclear whether this pattern is detectable also at a domestic level of interaction. In contrast to mainstream comparative climate-conflict studies, which rely on binary indicators of conflict/no conflict or event counts, our work is based on data (Bernauer et al., 2012a) that consider cooperation and conflict as relative phenomena along a common continuum (see also Zeitoun and Mirumachi, 2008; Zeitoun et al., 2010) and use issue coding to identify the issue at stake in each case (e.g., the quality of water supply in a city). This approach allows conflict and cooperation over domestic water issues to co-exist.

3. A theory of domestic water conflict and cooperation: demand, supply, and restraint

Water is an essential resource for human beings and it always features high on lists of scarce resources that may be worth fighting for, particularly in dry areas such as the Mediterranean region, the Sahel, or the Middle East (Libiszewski, 1996; Bernauer and Kalbhenn, 2010). Most writings in the neo-Malthusian tradition assume that the balance between the supply of and demand for scarce resources is important in generating social conflict (e.g., Percival and Homer-Dixon, 2001, p. 14). Unfortunately, the literature remains vague on which of the two is more relevant in generating conflict, and few studies have assessed this dynamic empirically (see Beck and Bernauer, 2011). The third causal component that we will consider here, i.e., restraint, is mostly absent from this previous research or it is implicitly assumed to be working through the other two mechanisms.

Against this background, we define domestic-level water conflict as *unilateral actions* by individuals, firms, NGOs, or state authorities, or *interactions* between them over water-related issues that are likely to or actually worsen the water quality/quantity at the domestic level. Conversely, we define domestic-level water cooperation as *unilateral actions* by individuals, firms, NGOs, or state authorities, or *interactions* between them over water-related issues that are likely to or actually improve the water quality/quantity at the domestic level. While cooperation and conflict can co-exist, we expect that water conflict is more likely when the demand for water is high, its supply low, and restraint against conflict ineffective. In turn, we generally expect more cooperation over water issues to arise when there is lower demand, higher supply, and more effective restraint. This argument is partially based on the idea that actors increase cooperative actions in anticipation of conflict in the future and mirrors Zeitoun and Mirumachi (2008, p. 300): "tensions rising from the distributional nature of water conflicts – that is, scrambles for a larger share of the pie – would be reduced, as the pie itself is enlarged."

3.1. Demand

A major driver of freshwater demand is population pressure, which is at the core of the original Malthusian model and remains central to today's scenarios of future water stress. The logic is simple: higher population density, all else held constant, increases the demand for water and may also amplify inequality in access to this resource (e.g., Matthew and Gaulin, 2001; Gizelis and Wooden, 2010). According to a recent UNEP (2008) report, one-third of the African population now lives in drought-prone areas, and almost all

Please cite this article in press as: Böhmelt, T., et al., Demand, supply, and restraint: Determinants of domestic water conflict and cooperation. Global Environ. Change (2013), doi:10.1016/j.gloenvcha.2013.11.018