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Beggar-thy-Neighbor or Free-riding? Transboundary Behaviors in Decentralized Water Pollution Policies

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Abstract

Public policies with different degrees of centralization face optimization problems at different administrative levels, which motivates beggar-thy-neighbor and free-riding behaviors that lead to insufficient regulations at jurisdictional boundaries. This paper investigates whether states exhibit these behaviors when implementing nonpoint-source (NPS) water pollution policies. I compile a unique and comprehensive dataset of three NPS policies and hydrological information using ArcGIS. Depending on the policies' characteristics, I use a Probit model, a duration model with selection, and a Heckman selection model, respectively. I find that rivers within 30 km of state borders are less likely to be treated by the two more decentralized policies, i.e. Water Quality Assessment Program, especially the Total Maximum Daily Load (TMDL) Program, but receive larger amounts of grants under the relatively centralized NPS Pollution Management Program. States exhibit beggar-thy-neighbor behavior within 5 km upstream of state borders, with a 10.28% to 18.9% lower probability of TMDL development than intrastate rivers, and exhibit free-riding behavior within 10 km downstream of state borders, with a 25.71% to 55.81% lower probability of TMDL development. The free-riding behavior is affected by the upstream state's environmental and political-economic characteristics. Each behavior leads to a large deadweight loss.

policies. S303(d) can only be conducted based on S305(b) assessment outcomes. S319(h) funding is not a follow-up to the other two policies, because many watersheds were approved for S319(h) grants without a TMDL. I differentiate the degree of decentralization of the three NPS policies by their levels of state authority and state-borne costs. S303(d) is the most decentralized policy because states have higher authority and costs in implementing S303(d) than in S305(b) and S319(h). States bear low costs and have low authority in S319(h) since grants are subject to final approval by the federal government. Therefore, S319(h) is the least decentralized among the three policies.

I adopt different empirical strategies to study states' behaviors based on the decision-making process of each NPS policy. S305(b) water quality assessment has binary outcomes, a catchment is either assessed or not depending on various factors that affect decision-making. Therefore, I use a discrete choice model (Probit) to study the effect of these factors on the probability of assessment. The development of TMDLs under S303(d) is based on the water quality assessment results. Only impaired water bodies need treatment. Based on the priority ranking, different water bodies receive TMDLs at different times. Thus, I use a duration model with selection: the first step is a discrete choice model (Probit) that selects the impaired water bodies, and the second step is a proportional hazard model that estimates the probability a catchment receives a TMDL. The amount of S319(h) NPS pollution management grants is based on the watershed restoration plan submitted by states and the Environmental Protection Agency (EPA)'s approval. Different watersheds receive different grant amounts. I conduct a Heckman two-step analysis to select the watersheds treated by S319(h)

environmental policies on environmental quality may be insignificant (List and Gerking (2000)), or positive (Millimet (2003), Sigman (2003)), or both, depending on jurisdiction homogeneity (Oates and Schwab (1988)) or decision-making process (Silva and Caplan (1997)). The debate over environmental federalism for water pollution control has intensified in recent years. This is because the Clean Water Act has been unclear in the jurisdiction definition of \waters of the United States" (WOTUS). The 2020 Navigable Waters Protection Rule (NWPR) adopts a narrow federal jurisdiction that excludes the \interstate waters". However, some studies point out that unclear jurisdictional responsibility and treating waters as locally public goods would increase interstate water pollution (Greenstone and Hanna (2014), Keiser et al. (2021), Keiser et al. (2022)). Keiser et al. (2022) proposes future research to connect studies of economic behavior with the nation's hydrological network to improve ex-ante projections of the impacts of future water rules and regulations. This paper fills an important gap in this literature.

The remainder of the paper proceeds as follows. Section 2 explains the mechanisms of each NPS pollution policy; Section 3 constructs the theoretical model for the transboundary policy behaviors; Section 4 presents the empirical approaches for each policy; Section 5 describes data; Section 6 presents the main estimation results; Section 7 discusses some extensions of the results; Section 8 concludes.

2 Policy Background

The series of nonpoint-source (NPS) pollution policies in the CWA are Section 305(b) Water Quality Assessment, Section 303(d) the Total Maximum Daily Load (TMDL) Program, and Section 319(h) Nonpoint-source Management Program Grants. These NPS pollution policies are water-quality based instead of effluent-based as are most point-source pollution policies. This is because nonpoint-source (NPS) water pollution cannot be regulated at the end of the pipe like point sources. Table 1 briefly summarizes the degrees of decentralization of the three NPS policies evaluated by their levels of state authority and state-borne costs.

2.1 Section Nrne costs.