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The revealed preferences of Baltic Sea governments: Goals, policy instruments, and implementation of nutrient abatement measures

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ABSTRACT

Nitrogen and phosphorus loads are considered a major reason for the eutrophication of the Baltic Sea. Until now, most of the abatement has been made at point sources while the implementation of policies for nonpoint sources has not led to equally large reductions in emissions. The purpose of this study is to investigate the determinants of how nutrient abatement measures are implemented by countries in the agricultural sector of the Baltic Sea region. We investigate how goal setting, policy instrument choice, and the level of implementation is determined by characteristics of the abatement measure as well as socio-economic characteristics of the country where it is implemented. Econometric analysis of a cross-sectional data set suggests that income, institutional capacity, and economies of scope in abatement and enforcement are important determinants of policies developed and their implementation.

1. Introduction

Eutrophication of the Baltic Sea has been recognized as a major problem since the 1960s (Boesch et al., 2006; Gustafsson et al., 2012). Excessive nutrient loads are considered a major explanation. Internationally agreed upon nutrient reduction targets for the Baltic Sea were first defined in the Ministerial Declarations of 1988 and 1990. These declarations stipulated that by 1995, emissions of nitrogen and phosphorus to the Baltic Sea should be reduced by 50% of the emissions level 1985. These targets were not met, however (Lääne et al., 2002). The Baltic Sea Action Program (BSAP), launched in 2007, defined new load reduction targets (Backer et al., 2010; HELCOM, 2015) and required a decrease in nitrogen and phosphorus loads by 16 and 70%, respectively, compared to the reference period of 1997–2003. A subsequent follow-up suggests that substantial progress has been made towards the nitrogen target, where almost ¾ of the intended reduction was achieved, whereas for phosphorus, only ¼ of the targeted reduction was achieved (HELCOM, 2015). Most of the reductions made since the 1980s are due to abatement at municipal and industrial point sources, but it has proven to be much more difficult to curb emissions from agriculture, forestry and scattered settlements. Consequently, agriculture remains the main source of nutrient inputs into the Baltic Sea (HELCOM, 2015). It is argued that the failure to reach overall load reduction targets can be explained by inefficient policy instruments and insufficient enforcement (Eckerberg, 1997; European Commission, 2005) as well as rapidly increasing costs of abatement and political difficulties to distribute these costs among countries, sectors, and stakeholders (cf. Gren et al., 1997; Markowska and Zylicz, 1999; Gren, 2001; Elofsson, 2010, 2012; Hyytiäinen and Ahlvik, 2015; Iho et al., 2015). Together, this suggests that the reasons for not meeting targets can be found throughout the whole chain of policy choice, design, and enforcement.

The purpose of this study is to investigate the determinants of how nutrient abatement measures are implemented by countries in the agricultural sector in the Baltic Sea region. We investigate how goal setting, policy instrument choice, and the level of implementation of a measure are determined by characteristics of the abatement measure as well as the socio-economic characteristics of the country where it is implemented. To this end, we use cross-sectional data on 25 different measures in ten countries in the Baltic Sea catchment, compiled by Salomon and Sundberg (2012), in combination with data on institutional and economic conditions in the countries in question. The results suggest that income, institutional capacity, and economies of scope in abatement and enforcement are important determinants of policies developed and their implementation.

There are two strands of economic literature that are relevant for our study: environmental performance and revealed preferences of regulators. The literature on environmental performance is mainly focused on health-related air pollutants and CO_2 emissions while water pollution has received less attention. Most studies use cross-sectional data sets with country-level data. Typically, the dependent variable is either an

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index of sustainability or environmental performance, which captures multiple aspects of attitudes, policy design, and enforcement (Dasgupta et al., 2001; Grafton and Knowles, 2004); a measure of the state of environmental media, such as air, water, and biodiversity (Grafton and Knowles, 2004); or, the quantity of emissions (Esty and Porter, 2005). Determinants considered include economic factors such as income, competitiveness, and spatial concentration of economic activity (Kaufman et al. 1998; Barrett and Graddy, 2000; Eriksson and Persson, 2003; Esty and Porter, 2005; Farzin and Bond, 2006; Tsurumi and Managi, 2010), as well as institutional factors, such as the level of democracy, multilevel governance, representation in the parliament, consensus culture, social capital, and environmental interest groups (Jahn, 1996; Barrett and Graddy, 2000; Bowles and Gintis, 2002; Neumayer, 2002; Scruggs, 2003; York et al., 2003; Grafton and Knowles, 2004; Wälti, 2004; Farzin and Bond, 2006; Fiorino, 2011). Notably, the role of different factors can vary across pollutants, e.g., the impact of democracy on environmental performance is smaller for water pollutants with a small health impact than it is for air pollutants with a large health impact, which could be due to less activity from health concerned citizens (Barrett and Graddy, 2000; Li and Reuveny, 2006).

The literature on revealed preferences examines the choices of a regulatory agency and, thereby, infers the criteria that determined these choices (McFadden, 1976; Helland, 1998). Most of these studies investigate decisions by a single regulatory agency. For example, Fernandez (2004) examines how project attributes affect the approval of environmental improvement projects by a North American Free Trade Agreement (NAFTA) institution, showing a preference for projects solving trans-boundary wastewater pollution and the "polluter pays" principle. Cropper et al. (1992) demonstrate that EPA decisions on pesticide cancellation are determined by risks, benefits, and interest group activity. Gupta et al. (1996) analyze EPA decisions on the cleanup of contaminated sites, showing the trade-offs between cleanup costs, permanence of remediation, and socioeconomic concerns. Metrick and Weitzman (1996) demonstrate that attributes of endangered species affect listing, spending, and priority decisions in conservation programs. Shepherd et al. (2009) investigate determinants of National Fire Plan (NFP) expenditures on forest restoration and wildfire risk reduction in northern New Mexico (USA), showing that preferences for social equity differ between the programs. Walsh et al. (2015) extend this type of analysis to decisions by multiple local governments, investigating whether geological, political, and socioeconomic factors determine the occurrence of local bans on fracking.

Compared to earlier studies on environmental performance, our study adds to the literature by comparing across both measures and countries and by including several pollutants, which are interdependent in production and in the generation of environmental damage. We also add to the scarce literature on environmental performance and water pollutants and to the literature on revealed preferences by examination of agri-environmental policies aimed at reducing nutrient emissions.

The paper is organized as follows: Section 1 briefly describes how eutrophication goals, the associated policy instruments, and enforcement of those policies are determined in the Baltic Sea region. Section 2 presents our hypotheses on the determinants of the resulting goals, policy instruments, and implementation, followed by a description of the econometric approach and the data. Section 3 outlines the results, and Section 4 includes the discussion and conclusions.

2. Policy processes in the Baltic Sea countries

The Baltic Sea catchment includes 14 different countries. Nine of those have a coastline on the Sea: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia and Sweden.

With the exception of Russia, all are members of the European Union (EU). There are five upstream countries without a coastline: Belarus, Norway, Slovakia, the Czech Republic, and Ukraine. Out of those five, Belarus contributes the most to Baltic Sea nutrient loads (HELCOM, 2015).

2.1. Goal setting

International cooperation on the marine environment are set forth under the Helsinki Convention, which was established in 1974 along with its main body, the Helsinki Commission (HELCOM). The contracting parties include the littoral countries and the EU. HELCOM compiles pollution source data and provides non-binding recommendations for pollution abatement. Decisions within the framework of HELCOM are taken unanimously. Goals for abatement become binding when adopted by national legislative bodies. These national goals can be set in terms of total nutrient loads to the Baltic Sea, such as implied by the BSAP agreement, as well as in terms of the adoption of specific nutrient abatement technologies or management practices.

2.2. Decisions on regulation

There are both national and international institutions with jurisdiction over environmental protection in the Baltic region. The EU regulates nutrient loads through different directives that are implemented in national legislation, such as the Water Framework Directive, the Marine Strategy Directive, the Urban Waste Water Directive, and the Nitrates Directive. Typically, these directives define minimum emission or recipient standards with which countries need to comply. Countries are free to use more stringent regulation than required in the directives. Specific agri-environmental instruments are included in the EU's Rural Development Program. Countries can choose from a variety of instruments, most of which apply subsidies to environmental measures. National co-funding is required. In addition to the above, countries can choose to regulate emissions on a national or regional basis for sources other than those covered by EU directives and Rural Development Programs.

2.3. Decisions on implementation

The enforcement of policy instruments is usually a shared responsibility of different governments at different levels. There are requirements from the EU with respect to the monitoring and control of measures, which are eligible for support through the Rural Development Programs and with which countries are obliged to comply. Regional or local governments typically carry out the actual control and enforcement of measures in the agricultural sector.

3. Methods

In an ideal world, we would have a well-defined, objective function for society as a whole, and the observed government's behavior could be evaluated on the basis of how well it satisfies society's objectives. However, in practice, policies for eutrophication could serve several purposes. For example, those policies could aim to improve both inland and Baltic Sea water quality and to provide financial support to farmers. This is difficult to account for in the objective function, as we do not know how these different purposes should be traded off against each other. Moreover, the costs and benefits are not well known for many measures. In this section, we therefore instead attempt to identify variables that could influence eutrophication policy given the institutional setting as well as the types of benefits and costs that may arise.

3.1. Determinants of goal setting

The BSAP agreement provides country-wise load reduction targets. For these targets to be met, national policies are necessary that typically include goals, policy instruments, and implementation efforts. National environmental goals are usually determined by politicians, and can be of a visionary nature or in terms of quantified performance targets (Edvardsson, 2004).

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