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Analysis

Nudging Farmers to Comply With Water Protection Rules – Experimental Evidence From Germany

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ABSTRACT

Nitrogen runoff from agricultural fertilisation causes serious environmental damage to surface waters. Environmental and consumer advocates demand government intervention to mitigate these externalities. The present study examines the effects of nudge-based regulatory strategies. Using an incentivised single-player, multi-period business management game as an experimental device, we study how nudges affect compliance with the minimum-distance-to-water rule in a sample of German farmers. We investigate two different nudge treatments: a nudge with information and pictures showing environmental and health damages that are presumably caused by breaching the minimum-distance-to-water rule, and a nudge with an additional social comparison suggesting that the majority of farmers in the same region comply with the rule. Three core experimental outcomes are observed: first, nudging has a preventive effect and reduces not only the share of non-compliant participants, but also the total area that is illicitly fertilised. Second, against all expectations, the preventive effect of the nudge with an additional social comparison is not stronger than that of the nudge with information and pictures alone. Third, despite the overall positive effects of nudging, the nudge with social comparison even increased the severity of non-complying behaviour in the deviant subpopulation.

1. Introduction

Nitrogen fertilisation (synthetic and manure-based) is the main source of nitrogen emissions in Germany, accounting for 63% of total emissions (Geupel and Frommer, 2016). High nitrogen loads endanger aquatic ecosystems and can pose a risk to human well-being (Pretty et al., 2001). Pregnant women and infants are particularly susceptible to risks associated with nitrates in drinking water, such as increased risk of cancer, adverse reproductive outcomes, and other health issues (Knobeloch et al., 2000; Ward et al., 2005). Nitrogen surface runoff constitutes a severe threat to surface water quality. In Germany, agriculture is responsible for 80% of nitrogen inputs into surface waters (BMUB and UBA, 2016). High nutrient inputs lead to eutrophication, spread of algae, oxygen depletion, and a decrease in biodiversity (Rabalais, 2002). Brink et al. (2011) estimate the economic costs of the externalities related to water pollution through nitrate fertilising at 5 to 24 Euros per kilo of fertiliser. In order to reduce these externalities, regulatory measures are required that aim to change farmers' behaviours, and subsequently reduce the presence of fertilisers in surface waters.

The objective of the EU's Water Framework Directive (Directive 2000/60/EC) and the Nitrate Directive (Council Directive 91/676/EEC) is to protect and improve water quality. By 2027, all European surface waters should have a good ecological and chemical status (BMUB and UBA, 2016). To meet the requirements of these Directives, a range of environmental regulations has been put into practice. In Germany, the Water Framework Directive and the Nitrate Directive have been implemented by the recently amended German Fertiliser Application Ordinance (DüV, 2017) and the Fertiliser Act (DüngG, 2017). One important measure to prevent nitrogen runoff is the minimum-distance-to-water rule. According to the DüV, a distance of four meters (before 02 June 2017: 3 m) from the edge of any water body must be maintained when fertilising. Environmental organisations and drinking water suppliers call for a minimum distance of five meters (BUND et al., 2014; German Association of Energy and Water Industries, 2014; German Technical and Scientific Association for Gas and Water, 2014). Despite recent regulatory tightening, nitrogen loads in surface waters are still high. In 2015, the government's target value of 2.5 mg nitrate per litre was exceeded at 81% of measuring sites (BMUB and BMEL, 2017; UBA, 2017).

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Conventional policy options aimed at reducing nitrogen leaching are command-and-control measures, entailing governmental regulations and legislation, as well as that economic instruments can be used to steer farmers' behaviour by setting financial incentives (Dowd et al., 2008). Command-and-control measures may fail if farmers, for example, perceive the sanctions imposed as not high enough (Dosi and Zeitouni, 2001). Nevertheless, higher sanctions may not forestall non-compliant behaviour as the key problem is to monitor diffuse nitrogen emissions from fertiliser use and identify the person responsible (Gunningham and Sinclair, 2005; Shortle and Horan, 2017).

Instead of regulating emissions directly, it is recommendable to regulate the inputs that are responsible for the pollution (Söderholm and Christiernsson, 2008). Increasingly popular among policy makers are economic instruments (Vries and Hanley, 2016). However, e.g. fertiliser taxes have been particularly evaluated critically in the recent literature (for a review, we refer to Böcker and Finger, 2016; Söderholm and Christiernsson, 2008). Furthermore, payments for environmental services (PES) or subsidies for replacing fertiliser-dispensing machinery with new technologies are offered to farmers. Tradable permits, as observed in the context of CO_2 emissions, are not considered as a potential instrument to control diffuse nitrogen emissions due to inefficient design (Vries and Hanley, 2016). In general, the main problem of input-based financial incentives is geographical heterogeneity of farms implying diverse and complex farm management decisions related to fertiliser use as well as adverse selection (Jayet and Petsakos, 2013; Shortle and Horan, 2013). Additionally, the implementation of substitute or complementary economic incentive measures to existent command-and-control measures, such as EU Directives, can be problematic in terms of enforceability (Söderholm and Christiernsson, 2008).

Conventional regulations aimed at mitigating externalities such as environmental pollution are either based on the monitoring and enforcement of mandatory rules or the use of incentive-based instruments. Unfortunately, such rules are at times ineffective and controls and sanctions, as well as incentive-based schemes, are frequently associated with high costs (Dowd et al., 2008). Therefore, behaviourally-informed soft policies such as boosting and nudging are increasingly of interest (Sousa Lourenço et al., 2016). Boost policies are aimed at fostering people's mid- to long-term decision-making processes through the promotion of professional standards and competences (cf. Reijula et al., 2018). An example would be the provision of information regarding best management practices through agricultural advisory services (Dowd et al., 2008; Ju et al., 2004). Nudge policies, in contrast, use framing to make seemingly minor but decisive aspects of the decision environment immediately more salient to people.

Nudging exploits various psychological mechanisms and “alters people's behaviour in a predictable way without forbidding any options or significantly changing their economic incentives” (Thaler and Sunstein, 2008, p. 6). A simple example is when bold printing or pictures are used to highlight aspects of people's decision environment that are expected to promote the desired behaviour (Kahneman, 2011). Other relevant mechanisms are reciprocity (e.g. Falk and Fischbacher, 2006) and, in particular, social norms (e.g. Kallgren et al., 2000) that can be reinforced through social comparisons (e.g. Bartke et al., 2017). According to social learning theory, other people and especially peers serve as role models that influence individual behaviour (Bandura and Walters, 1963; BIT - Behavioural Insights Team, 2013a; Carman, 2004; Falk et al., 2013). Norm-based nudges exploit the fact that, besides the pursuit of material benefits, people strive for consistency with internalised values (“moral norms”) and conformity with external social expectations (“social norms”). Internal norms can be invigorated through external appeals such as “empathy nudges”. In contrast with that, external norms can be made more salient and effective even if they are not internalised (Steg and Vlek, 2009). External social norms come in two forms: Injunctive norms reflect behaviours that are perceived as being approved of by relevant others (group norms). Descriptive norms are people's perceptions of how others behave regardless of the social acceptance of this behaviour. Cialdini et al. (1991) claim that injunctive norms introduce the prospect of social rewards and sanctions, whereas descriptive norms constitute decisional shortcuts.

Besides fields such as consumption behaviour (Demarque et al., 2015) or tax compliance (Bobek et al., 2007), nudges are particularly popular in health economics when it comes to encouraging people to make healthy eating choices (Arno and Thomas, 2016). In the area of environmental policy, so-called “green nudges” are also increasingly researched (Croson and Treich, 2014; Schubert, 2017). Pro-environmental interventions based on activating descriptive norms were found to be effective in the field of littering (Cialdini et al., 1990), recycling (Schultz, 1999; Schultz et al., 2007), and energy conservation (Kantola et al., 1984; Schultz et al., 2007). Moreover, descriptive social norms and injunctive group norms can predict both intentions to recycle and recycling behaviour (Nigbur et al., 2010). Leeuw et al. (2015) report that descriptive norms are relevant predictors of pro-environmental intentions of high-school students whereas injunctive norms produce no substantial intentional effect. This is an indication that among adolescents it may be more important what others do than what they say. In a framed laboratory experiment, Czap et al. (2015) investigate how “empathy nudges” can be used to promote environmentally friendly behaviour in farmers. Their results show that the appeal to put oneself in the shoes of a person who is affected by environmentally damaging behaviour can prevent such behaviours.

The increasing consideration of nudging as a policy tool to steer people's behaviour has provoked a debate on its legitimacy. Its opponents criticise nudging as a paternalistic and manipulative limitation to people's autonomy (Hansen and Jespersen, 2013; Hausman and Welch, 2010). As a soft alternative to often ill-fitted command-and-control approaches, these critics often suggest boost policies, which are based on transparently building up professional standards and competences (Gigerenzer, 2015; Hertwig and Grüne-Yanoff, 2017). Concerns are also raised regarding the question of how to institutionalise nudging from a legal point of view, both on the national level and in transnational contexts such as in the EU (Alemanno, 2016). Nudge advocates, in contrast, positively emphasise its choice-preserving character (Jolls and Sunstein, 2006) compared to harsh mandatory prescriptions, and they stress that nudging has often been found to be a cost-effective tool to steer people's behaviour (Michalek et al., 2016). Benartzi et al. (2017) compare nudge interventions with alternative policy tools with regard to the impact per US dollar spent and conclude that nudging is usually preferable.

The fact that nudging has become such a popular policy instrument in some countries, and that it seems to work in many cases, raises the question of how various forms of nudging work in various contexts (policy impact analysis). Policy impact analyses regarding specific instruments can be carried out ex post or ex ante (Henning and Michalek, 2008). In conventional ex-post analysis, regulatory measures are implemented and evaluated retrospectively. One big drawback of this approach is its low internal validity since ceteris-paribus comparisons are hardly possible (Patel and Fiet, 2010). Controlled field trials can mitigate this problem, but often entail high implementation costs and ethical concerns (Burtless, 1995). The aim of an ex-ante analysis is to assess the impact of a policy prior to its implementation. Thus, costs can be kept low. Ex-ante policy evaluations can be implemented as experiments in the form of business management games (Mußhoff and Hirschauer, 2014). Compared to classical laboratory experiments, business management games have the advantage that a realistic decision-making environment can be simulated. This is particularly important since contexts can have a decisive influence on people's behaviour (Levitt and List, 2009).

Whereas nudging has been primarily regarded as an alternate tool to induce desired behaviours without resorting to mandatory rules (Thaler and Sunstein, 2008), nudging can also be applied as a preventive measure to promote compliance with existing regulations. In this case, it is a complement to mandatory law and a partial substitute for costly