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FINDINGS FROM THE FIELD

How sludge impairs the effectiveness of policy programs: a field experiment with SMEs

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Abstract
Small and medium-sized enterprises constitute the largest share of companies in most economies. As major resource users and significant contributors to environmental pollution, they are relevant targets for public policy programs aimed at increasing sustainability. We study how 'sludge' – small frictions in the choice architecture – can impact the uptake and effectiveness of such public policy programs targeted at SMEs. To this end, we conducted a field experiment within an existing policy program designed to support SMEs in implementing cost-effective environmental management practices. We manipulated the process of receiving free green items intended to support the implementation of those environmentally friendly practices within firms. We find that sludge, in the form of minor additional effort required to order the items, substantially undermined the program's effectiveness. These results have important implications for policymakers: even minor sludge in the choice architecture can seriously impair the effectiveness of public policy programs targeted at companies.

Keywords: choice architecture; environmental management; field experiment; public policy; sludge; small and medium-sized enterprises (SMEs)

Introduction

Designing effective public policy is crucial for addressing pressing societal issues such as climate change. An important target group for policy interventions are small and medium-sized enterprises (SMEs),[1] which constitute about 99.9% of all businesses and account for approximately 70%–75% of industrial pollution in Europe and the U.S. (Calogirou *et al.*, 2014; Lamoureux *et al.*, 2019). SMEs often lag behind larger

[1]SMEs are defined as firms with fewer than 250 employees (Eurostat, 2019).

companies in adopting effective environmental management practices (e.g., Quintás *et al.*, 2018; Weinhofer and Hoffmann, 2010, see also Bloom *et al.*, 2012). Consequently, many public policy initiatives aim to support SMEs in becoming more sustainable, thereby reducing their environmental impact and resource usage (see, e.g., Blundel *et al.*, 2013; Koirala, 2019). However, such policy programs are only effective if SMEs make use of them.

To optimize the success of policy programs, it is essential that their processes be designed to make application and implementation easy and straightforward for the targeted individuals or firms. Unfortunately, this is not always the case. Thaler (2018) introduced the term 'sludge' to describe small frictions in the choice architecture that can have large consequences. Sunstein (2018, 2020, 2021) expanded the definition of sludge as 'friction, reducing access to important licenses, programs, and benefits' (Sunstein, 2018, p. 1843). Although the exact definition of sludge is still somewhat debated in the literature (see, e.g., Madsen *et al.*, 2021; Mills, 2020; Shahab and Lades, 2021; Shreedhar *et al.*, 2024, for further definitions and discussions of the concept),[2] there seems to be consensus that sludge, whether intentional or not, can often be harmful (Soman, 2020; Sunstein, 2020; Hortal, 2023).

Whereas most empirical work on sludge has focused on its effects on individuals and households, our paper examines the impact of minor sludge in a field experiment within a policy program targeting SMEs. In this experiment, we manipulated the presence or absence of sludge in the context of a well-established environmental consulting program for SMEs in Switzerland. The program is free for participating firms and aims to support SMEs in implementing effective environmental management practices. A consultant visits the firm for about an hour to identify potential improvements in environmental management with the relevant decision makers. During the experiment, we offered firms ($N = 173$) free sample items to directly implement some of the measures frequently proposed by consultants. Firms could receive items such as high-quality recycled paper, LED light tubes, or switchable power strips. We manipulated the ordering process for these green items to study the effect of sludge. In one treatment, the consultant placed the order directly. In the sludge treatment, the consultant directed the firms to a website where they had to place the order themselves. This treatment reflects the choice architecture in many governmental support programs, in which even motivated firms (or individuals) must spend time and effort to benefit. Following the typology introduced by Shahab and Lades (2021), we consider this as a minor sludge in the form of implementation costs. The effect of sludge in our setting is considerable: it cuts the order rate roughly in half.

[2]Mills (2020) challenges the normative interpretation of nudge as good and sludge as bad. Defining sludge in relation to nudges, Mills elaborates the concept of nudge/sludge symmetry: '… a nudge decreases the frictions associated with a specific option, sludge is simultaneously imposed on all other options available to a decision-maker' (p. 1). Madsen *et al.* (2021) classify different kinds of frictions such as sludge, red tape and administrative burdens and discuss differences and overlaps. Relevant to our empirical set-up, Shahab and Lades (2021) compare sludge with transaction costs and provide a categorization of different types of sludge, and Shreedhar *et al.* (2024) discuss how sludge can act as a barrier to green behavior.

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Our paper has implications for policymakers and the scientific literature. Our findings contribute to the literature on sludge by providing a quantitative estimate of its potential negative impact on the success of policy programs targeted at firms. Sludge reduces the order rate in our experiment by almost half. Given that firms are often assumed to act more rationally than individuals (e.g., Friedman, 1970, see also Charness and Sutter, 2012 or Fochmann *et al.*, 2021), the extent of this negative impact is noteworthy. Our results demonstrate that even minor frictions in the choice architecture can have a substantial negative impact, affecting not only individuals (as documented, e.g., by Allcott and Greenstone, 2012; Bettinger *et al.*, 2012; Fowlie *et al.*, 2015, 2018; Nathan *et al.*, 2020) but also firms. This contribution extends the emerging empirical literature on the effects of sludge, which has predominantly focused on individuals.

The substantial negative effect of sludge on firm reactions to an environmental policy program has important implications for policy design. When designing and implementing programs targeted at SMEs, policymakers should consider seemingly minor nonmonetary factors in the choice architecture. Moreover, our field experiment results underscore the importance of testing program implementation on a smaller scale. While not all policies are scalable to begin with (List, 2022), scalable programs may still fail because of small, seemingly unimportant aspects in the choice architecture. Identifying and eliminating frictions before scaling up policy interventions is crucial. This aligns with Sunstein's (2020) call for regular 'sludge audits' to detect and reduce sludge in relevant policy programs. Since audits are costly, it is essential to avoid sludge in the first place and carefully screen and pre-test new processes and programs before their roll-out to ensure take up and impact (see also Bearson and Sunstein, 2023).

Setup and experimental design

Environmental consulting program

We conducted our field experiment within an established governmental program in three Swiss cities: Lucerne, Zug, and Zurich. The program offers free environmental consulting to SMEs. During a one-hour visit, an environmental consultant discusses with the owner, CEO, or an employee in charge of sustainability measures that the firm could implement to improve resource and energy efficiency. In all three cities, the consultants follow the same structured guideline to detect potential improvements in four areas: mobility, materials, information and quality, and energy and buildings. Most proposed measures are low-cost and easy to implement, such as changing printer defaults (see, e.g., Egebark and Ekström, 2016) or replacing burnt out conventional light bulbs with LED bulbs. However, some measures might require larger adaptation processes like replacing windows or switching the heating system.

To promote the program, the cities run phone acquisition campaigns (see Appendix B.1 or Grieder *et al.*, 2024 for a more detailed description of the acquisition process). If a firm agrees to participate, it is assigned to an environmental consultant within its region. In the experiment, the research team then randomly assigned the firm to the experimental treatment. Assignment to treatment was independent of the acquisition process.

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Procedure and treatments

We gave participating firms the possibility to order a number of green items that support the implementation of frequently suggested energy and resource efficiency measures. Although, the direct impact of individual items is limited, collectively they reduce energy and resource consumption over time. At the end of the consulting process, the consultants offered the firms to order one of each of these items for free (see Appendix Figure A1 for pictures and descriptions). In total, the items each firm could order had a value of 122.50 Swiss Francs. The consultants briefly explained each item and indicated that they were free of charge. Firms were free to choose which items they wanted, but could order only one unit of each. There were no further obligations for the firms arising from ordering any of the items.

We implemented two treatments: In the DIRECT treatment, firms ordered the desired items directly with the consultant, and the items were sent to the firm based on the order placed with the consultant. In the SLUDGE treatment, the consultant referred the firms to a website where they could order the items. That website could be accessed by scanning a QR code or typing a URL into a web browser (see right-hand side of Figure A1). On the website, firms selected the items, entered the six-digit voucher code printed on the factsheet, and provided the shipping address. Placing the order online was designed to be easy, taking no more than five minutes. Apart from the voucher code, all required information for placing the order should have been readily known by anyone placing the order for the firm (see Appendix B.2 for a more detailed description of the ordering process).

Except for the ordering process, the consulting procedure was identical in both treatments. In both treatments the consultants discussed the items with the firms and noted which items the firms intended to order before the actual order took place. Only the implementation of the ordering process differed.[3] Figure 1 provides a schematic overview of the experimental design and procedure.

Firms were randomly assigned to treatments. When a consultant scheduled a meeting, we sent an email specifying the treatment and containing a fact sheet describing the items (see Figure A1).[4] The consultant printed the fact sheet and brought it to the consultation.

At the end of the consultation, the consultant briefly discussed each item, noted the firm's order on the fact sheet, took a picture, and sent it to us. This allowed us to measure the intention to order in both treatments. Between the treatments, the intention to order should not differ, as firms were randomly assigned to treatments and the manipulation occurred after the consultant elicited a firm's intention to order. Our main hypothesis was thus that the additional frictions in the ordering process present in the SLUDGE treatment would lead to fewer firms actually ordering items compared to the DIRECT treatment.

[3]Consultants were instructed not to discuss the exact nature of the ordering process until the very end of the consultation, especially not before the presentation of the available green items. Thus, there were no systematic differences in the consultation process up to the point when consultants elicited the intention to order.

[4]There was no case of consultant noncompliance with the randomization: consultants adhered to the procedure and implemented the treatments as specified by us in all cases.

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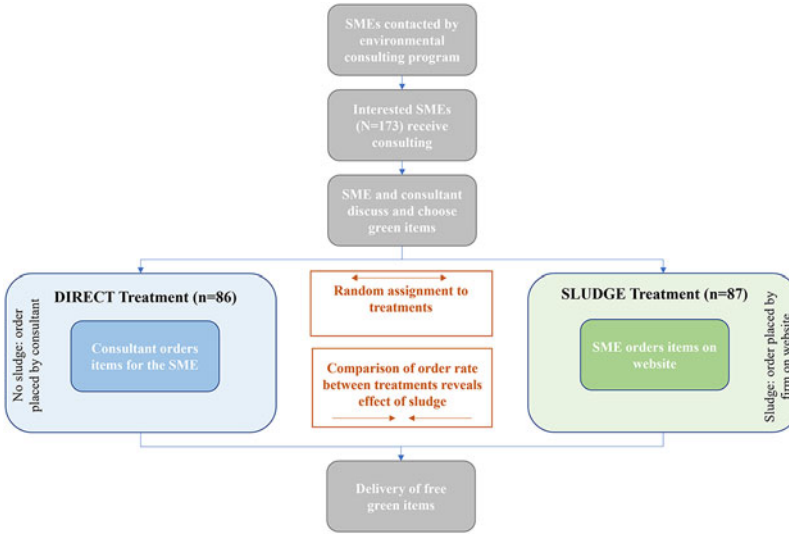

Figure 1. Schematic representation of experimental design and process.

Results

Between April 2019 and April 2020, 173 consultations took place (53 in Lucerne, 37 in Zug and 83 in Zurich), with 87 firms in the SLUDGE and 86 in the DIRECT treatment. There are no statistically significant differences in terms of industry composition, firm size and location between the two treatments (see Appendix Table A1).

We first evaluate the intention to order at least one item. Panel A of Figure 2 shows the results. In SLUDGE, 89.7% of the consulted firms intended to place an order, whereas in DIRECT, 91.9% of the firms wanted to order at least one item. The difference is not statistically significant ($z = 0.50$, $p = 0.62$).[5] Additionally, in both treatments the firms intended to order on average around two items (SLUDGE: Mean: 1.99, SD: 1.65 and DIRECT: Mean: 2.04, SD: 1.55). Again, this difference is not statistically significant ($t(171) = 0.24$, $p = 0.81$). Thus, randomization worked and, as expected, our treatment manipulation did not affect the intention to order.

Testing the effect of sludge, we find that despite very similar intentions to order, the actual order rate is considerably and significantly lower in the SLUDGE treatment: 51.7% of firms placed an order in the SLUDGE treatment compared to 91.7% in the DIRECT treatment ($z = 5.86$, $p < 0.001$).[6] Panel B of Figure 2 illustrates this result.[7]

[5]All p-values are for two-sided tests. For binary variables, we report tests for equality of proportions in the text and OLS results in Table 1. Probit estimations conducted as robustness checks yield the same results in terms of statistical significance (see Appendix Table A2).

[6]By design, in the DIRECT treatment the intention to order directly led to an actual order, making the intention to order identical to the actual order rate.

[7]With $N = 173$ observations we have sufficient statistical power. Given the difference in actual order rates between DIRECT and SLUDGE (91.7% vs 51.7%), an ex-post power calculation indicates a power of $\beta = 1.00$ for a (conventional) significance level of $\alpha = 0.05$ and of $\beta = 0.998$ for a significance level of $\alpha = 0.001$.

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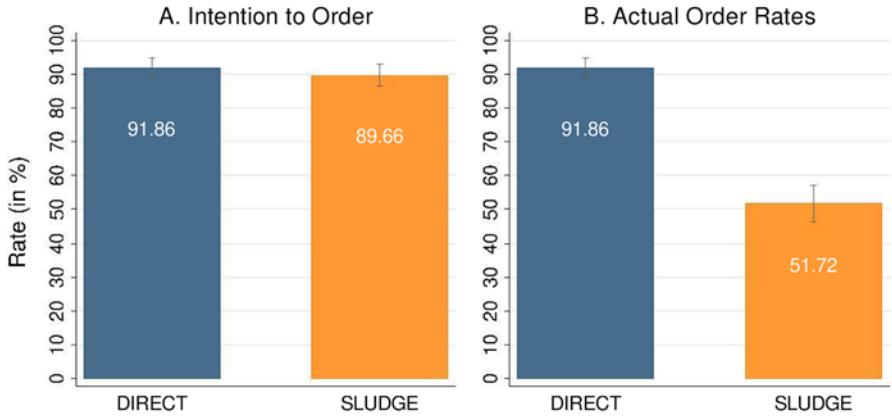

Figure 2. Intention to order and actual order rates by treatment.
Notes: Error bars represent plus/minus one binomial standard error of the mean. DIRECT: $n = 87$, SLUDGE: $n = 86$.

Table 1. Regression results for treatment effects on intention to order and order rate

	(1) Intention to order	(2) Order rate	(3) Intention to order	(4) Order rate
SLUDGE	−0.034	−0.393***	−0.031	−0.396
	(0.057)	(0.049)	(0.059)	(0.046)
Constant	0.601**	0.918***	0.724***	1.031***
	(0.209)	(0.059)	(0.184)	(0.140)
Consultant Fixed Effects	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes
Firm size control	No	No	Yes	Yes
R^2	0.150	0.270	0.174	0.284
Observation	173	173	173	173

Notes: *p < .10, **p < .05, ***p < .01. OLS estimates (linear probability model). Standard errors (in parentheses) are clustered at the consultant level. The DIRECT treatment is the baseline captured by the constant. In models (1) and (3), the dependent variable is a binary indicator for the intention to order at least one of the offered items (0 if no, 1 if yes). In models (2) and (4) the dependent variable is a binary indicator of actual orders, capturing if the firm ordered at least one of the offered items (0 if no, 1 if yes). All models include consultant and time (month) fixed effects. Models (3) and (4) additionally control for the number of employees in a firm.

In Table 1 we present the results of Ordinary Least Squares (OLS) regressions, where we regress dummy variables capturing the intention to order (columns 1 and 3) or actual orders (columns 2 and 4) on a treatment dummy, clustering standard errors at the consultant level and controlling for consultant and time (months) fixed effects.[8] In columns (3) and (4) we additionally control for firm size. The regression analyses confirm our earlier results.

[8]Each consultant was only active in one city: two in Lucerne, three in Zug, and four in Zurich. The regression results in Table 1 are robust to controlling for city fixed effects instead of consultant fixed effects (see Appendix Table A3).

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The results are unlikely driven by firms procrastinating orders in the SLUDGE treatment. We accepted orders until the end of 2020, eight months after the last consultation and 20 months after the first consultation in our sample. Although some firms might have ordered items after December 2020, it seems unlikely that this would significantly change the effect. We also have no indication that the usage rate of the items differed by treatment. From November 2019 to January 2020, we conducted a survey as part of a broader program evaluation in Zurich, contacting all SMEs who participated in the consulting program in Zurich between 2009 and 2019. We received responses from a small number of firms that had been part of the experiment ($n = 9$ firms from the SLUDGE treatment and $n = 13$ firms from DIRECT). These firms indicated they used the items they received in 88.6% of the cases in SLUDGE ($n = 35$ items) vs 87.2% in DIRECT ($n = 47$ items).[9]

This survey evidence also indicates that our results are unlikely to be entirely driven by consultant demand effects, i.e., that firms, at the end of the consulting procedure, felt pressured by the consultant to order items, or that they felt an obligation to do so because of a sense of reciprocity (or similar). Such an effect would have led firms to overstate their intentions to order in both conditions and the actual order (or lack thereof) via the website in the SLUDGE condition would reveal the true preference. If such demand effects were important in our set-up, we would expect firms who had received items in the SLUDGE treatment to report more often that they actually made use of these items than firms in the DIRECT treatment, as – according to the demand effect explanation – in the SLUDGE treatment only firms who truly wanted the items received them, whereas in DIRECT we would expect a higher fraction of firms that did not actually want the items to receive them nonetheless. As stated above, this is not the case and the usage rates reported in the survey are very similar across the two treatments (88.6% in SLUDGE vs 87.2% in DIRECT). While we cannot rule out consultant demand effects with certainty, the fact that the consulting program is voluntary, and firms actively opt into the program, also speaks against such consultant demand effects as the main explanation for our findings. It seems implausible that firms interested in becoming more energy efficient or environmentally friendly are actually not interested in receiving (free) items that help them reach this goal.[10]

Conclusions

The results of our field experiment provide clear evidence that minor sludge in the form of implementation costs (Shahab and Lades, 2021) can strongly affect SME behavior. The small nonmonetary friction in the order process roughly cut the order rate in half, significantly reducing the number of SMEs taking advantage of the free items offered by the consulting program to help implement simple improvements in environmental management practices. To receive support, enroll in programs, or implement sustainability measures, firms typically need to bear certain nonmonetary costs, often in the

[9]Due to the small sample size, we refrain from describing this survey evidence in more detail.

[10]Consider also that we selected the green items for the experiment in collaboration with the consultants, focusing on items that were frequently recommended to firms by consultants prior to the experiment. Moreover, we ensured that only items of interest and applicable to a large portion of firms were included.

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form of time and effort. Our results show that even a small and seemingly innocuous nonmonetary implementation cost can have significant consequences for take-up and implementation rates (see also Bearson and Sunstein, 2023).

Given that the participating firms in our field experiment are self-selected, presumably having some interest in sustainability, it is remarkable that we find such a strong effect of minor sludge. Even if the relevant decision makers in firms are intrinsically motivated to change their management practices and make their firms more environmentally friendly, they fail to order the free environmental items in almost half of the cases when they face a minor nonmonetary cost. In our experiment, sludge thus effectively acts as a barrier to implementing green actions (see also Shreedhar *et al.*, 2024). The effects of such seemingly minor sludge could be even larger for firms or decision makers who do not have the same basic readiness to change their management practices and behavior as those in our sample.

Our study shows that sludge can have a substantial negative effect on policy programs that provide tools to implement environmental management measures in SMEs. In our experiment, a seemingly minor design detail of the policy program had a large effect and reduced program effectiveness, as measured by the order rate of the items, by almost half. Our results contribute to the emerging empirical literature on sludge by demonstrating that sludge affects not only individual decisions but also firm behavior. Correspondingly, our findings are relevant for policymakers interested in optimizing the impact of policy programs targeted at SMEs.

Supplementary material. To view supplementary material for this article, please visit https://doi.org/10.1017/bpp.2024.44.

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