



The long-term impact of matching and rebate subsidies when public goods are impure: Field experimental evidence from the carbon offsetting market



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ABSTRACT

In this paper, we investigate both short- and long-term impacts of financial stimuli on public goods provision when contributions are tied to individual harm-related behavior. We conduct a large-scale field experiment to examine voluntary contributions to a carbon offsetting program during the online purchase of a bus ticket. We systematically vary the individual payoff structure by introducing different price rebates (25%, 50%, 75%) and corresponding matching grants (1/3:1, 1:1, 3:1). Using data on returning customers, we investigate the long-term effects of the different stimuli, both while treatments were in place as well as their persistence for the time after treatment removal. In the first bookings, our results show that all price rebate schemes increase the participation rate in the offsetting program, while we find weaker effects for matching grants. When bookers are treated repeatedly, only the equal (1:1) matching scheme continues to lead to higher participation rates. Even after removing the subsidies, we report higher participation rates for customers previously facing a 1:1 matching scheme. This treatment is also the only one increasing net contributions of customers compared to the control group.

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1. Introduction

How can we stimulate voluntary contributions to public goods? So far, most experimental and empirical investigations have focused on the provision of pure public goods such as donations to charities. Voluntary contributions to public goods are, however, increasingly attached to conventional private goods. Thus, individuals often make a joint decision on both the consumption of the private and the contribution to the public good. Typical examples include donations to providers of open-source software or green goods which explicitly link public goods contributions to individual harm-related behavior.

As one of the most prominent green goods, carbon offsetting programs provide the opportunity to reduce pollution externalities and therefore diminish one's own contributions to a public bad (Kotchen, 2009). Recent empirical and experimental investigations confirm a positive relationship between the personal perception of individual impacts on climate change, e.g. for detrimental carbon emissions, and the willingness to contribute to climate protection (Löschel et al., 2013;

Diederich and Goeschl, 2014). Harding and Rapson (2014) argue that, in contrast to charitable giving, carbon offsets and private consumption are inherently linked and may therefore be subject to potential feedback effects from one to the other. This is why contributions to a public good in the presence of own disamenities may deviate from pure donations being unrelated to private consumption. In particular, it is unclear how financial stimuli such as price rebates or matching grants, which successfully enhance the provision of pure public goods (e.g., Karlan and List, 2007; Meier, 2007; Eckel and Grossman, 2008; Rondeau and List, 2008; Anik et al., 2014), affect contributions in joint decisions on both types of goods. Empirical evidence in the field of green electricity programs indicates that customers typically prefer to register at the minimum participation level (Jacobsen et al., 2012). This raises the question of whether the positive effects of price rebates and matching grants can be transferred to carbon offsetting. Customers might be sensitive to treatments with varying minimum costs of participation in the carbon offsetting program. Recent field experimental investigations on carbon offsetting focus on the effect on different pre-default settings (opt-in vs. opt-out) and offsetting prices (Araña and León, 2012; Löfgren et al., 2012) on the program's effect or study the implications of awareness campaigns (Jacobsen, 2011). However, they do not analyze the effect of financial incentives like price rebates and matching grants.

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In this paper, we examine repeated contributions to a public good that are explicitly linked to the harm-related consumption of a private good. We study carbon offsetting behavior in a large-scale field experiment within the German long-distance bus market. Thereby, we systematically vary the individual payoff structure by introducing different financial stimuli in a randomized controlled trial. In particular, we offer different discounts by introducing a price rebate on carbon offsets of either 25%, 50% or 75%. In addition, we consider different matching schemes that multiply the participants' contributions at a specific rate. We differentiate between matching rates of 1/3:1 (1/3 kg of CO₂ added for every kg offset by the customer), 1:1 and 3:1. Hence, our design enables us both to compare the impact of these stimuli in contrast to the control group and to study how treatment intensity affects decision behavior. Moreover, by using data on returning customers, we investigate the long-term effects of the different stimuli, both while treatments are in place as well as their persistence after treatment removal.

Previous field studies based on pure public goods like charitable giving decisions found both matching grants (Karlan and List, 2007; Meier, 2007) and price rebates (Eckel and Grossman, 2008) to increase donations.¹ Moreover, in Eckel and Grossman (2008), matching grants were more effective than rebates. Our analysis, based on a contribution decision being related to individual harm-related behavior and not based on a pure donation decision, delivers a more diverse picture. All price rebate schemes immediately increase participation rates in contrast to the baseline scenario, whereas we find weaker effects for matching grants. In terms of treatment intensity, we report a modest price sensitivity with diminishing marginal effects for large interventions. In line with experimental findings from charitable donations by Karlan and List (2007), large match ratios (3:1) do not have any additional impact on participation rates, relative to smaller match ratios (1:1). We find similar results also for rebates, as a reduction of the price by 75% does not attract more customers than a discount of 50%. From the second booking onwards, most treatment effects vanish. Only the equal (1:1) matching scheme continues to lead to higher participation rates when bookers are treated repeatedly. Even after removing the subsidies, we report higher participation rates for customers previously facing a 1:1 matching scheme, confirming its superiority in the long-term. The 1:1 matching scheme is also the only mechanism being able to significantly increase the net contributions of customers in contrast to the control group. Our analysis of repeated booking decisions suggests that price rebates rather serve as an instrument to temporarily increase participation, in particular among non-frequent customers, while a 1:1 matching scheme appears to be more likely to stimulate the long-term involvement of returning customers.

The remainder of the paper is organized as follows. Section 2 describes the offsetting program and the experimental protocol. We present and discuss our results in Section 3, before concluding in the last section.

2. The field experiment

2.1. The offsetting program

For conducting the field experiment, we collaborated with one of the pioneering bus operators in the German long-distance bus market.² The company had not offered or participated in any carbon offsetting program before the experiment was launched in October 2013. We introduced the program without any advertising or pre-announcement. It was designed to be a part of the usual online booking system at the company's official website. The booking system allows buying either one-way or return

tickets, for up to four passengers at a time. After passengers had chosen their individual trips, the possibility to offset carbon emissions was offered in neutral words, including price (in €) and amount (in kilograms of CO₂) of the compensation.

Based on individual carbon emissions of 47 g CO₂ per passenger kilometer³ and a price of 17.90 € per ton CO₂ charged by the collaborating offsetting provider, offsets were sold at 8 cents (in €) per 100 passenger kilometers. Passengers were required to make a binary choice by clicking either "yes" or "no". They also had the opportunity to obtain detailed information on the offsetting program on request.⁴ After having made their decision, passengers received a list of the items they intended to buy (including their offsetting expenses), were asked to add their personal data (no additional information beyond the usual booking process was requested) and to enter payment details.

The questionnaire data collected after the experiment suggest that the vast majority of passengers were between 16 and 35 years old, and most of them had an academic background. Men and women were equally represented.⁵

2.2. Experimental design and procedure

We introduced different interventions to the offsetting program in three subsequent stages. In stage 1, which also coincided with the introduction of the carbon offsetting program, we varied informational settings by holding relative prices and amounts constant. In stage 2, matching grants and price rebates were introduced in order to hold the informational setting constant. Finally, in stage 3 we reproduced the conditions from stage 1 in order to study decision behavior of passengers over time. After the end of stage 3, the offsetting program continued to exist in a fixed setting. In this paper, we focus on the interventions in stage 2. Moreover, we use data from stage 3 to investigate potential spillover effects after the removal of the treatment.

To study the effects of price rebates and matching schemes on offsetting behavior, we ran a control condition and six treatments where we varied the incentives keeping wording and the general framework as similar as possible. Both types of subsidies were presented as a temporal offer given by the bus company to support individual offsetting contributions. Rebates directly reduced the passenger's offsetting price, whereas matching grants resulted in additional carbon offsets being paid by the company (see translated screenshots in Fig. B1). In particular, we considered three levels of price rebates reducing the costs for offsets by 25% (*r*-25%), 50% (*r*-50%) and 75% (*r*-75%), as well as corresponding matching grants (1/3:1, 1:1, 3:1). It should be noted that the price per unit CO₂ is identical in *r*-50% and 1:1 (8.95 €/t CO₂) while the amount of CO₂ covered in 1:1 is twice as high as in *r*-50%. Similar considerations hold for *r*-25% and 1/3:1 (13.45 €/t CO₂), and *r*-75% and 3:1 (4.50 €/t CO₂), respectively. In contrast to many experimental settings on charitable donations, individuals did not have the opportunity to adjust their contribution levels independently, but had a binary choice in our experiment. Emission quantities were derived from the underlying travel length. The total amount of CO₂ that can be offset is therefore always higher in the matching treatments than in the price rebate schemes. At the same time, costs of participation are always lower

³ Carbon emissions include both direct carbon emissions from fuel consumption (36 g CO₂/km) and the life-cycle-assessment for the vehicle based on the GEMIS database (IINAS, 2013).

⁴ For those interested, the bus service provided the information that greenhouse gas emission reductions were achieved by supporting an energy efficiency project in the public sector dealing with improved household charcoal stoves in Accra/Ghana. Those reductions were certified as voluntary emissions reductions (VER) according to the Gold Standard which is considered to be the most rigorous international certification benchmark for quality and compliance of carbon offsetting program. Using data from an online platform with more than 280 offsetting projects from 97 providers, Conte and Kotchen (2010) show that offsets being labeled as a Gold Standard project allow for a price premium of 30%–65%.

⁵ Questionnaires were distributed both in the bus of the collaborating operator, during randomly determined bus rides, and online, using the operator's email list of customers, yielding 403 observations.

¹ In related work, Huck and Rasul (2011) and Huck et al. (2015) combine matching schemes with lead donations and show that, in the presence of a lead donor, higher matching rates increase donations including the match but reduce net contributions prior to the match.

² In January 2013, Germany lifted its ban on long-distance bus operations. An amendment to the German Passenger Transportation Act (Personenbeförderungsgesetz, PBefG) ended the existing ban on additional scheduled national transport services if a corresponding railway service was already established.

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