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Analysis

Carbon Label at a University Restaurant – Label Implementation and Evaluation

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ABSTRACT

Changes in human diets hold significant greenhouse gas emissions mitigation potential. In this paper, we use a field experiment to analyze the effects of implementing a label with greenhouse gas emission information for each dish at a restaurant. The traffic-light colored label was implemented in a student catering facility with 300–600 servings every day, and covered all seven dishes on offer. Individual level sales data including an anonymous identification number, gender, and age was collected both during the label phase and during a five-week control phase prior to the introduction of the label. We found that sales of green labeled (low emission) meat dishes increased by 11.5% compared to the control phase, whereas sales of red labeled meat dishes were reduced by 4.8%. Although the label had an effect on consumer behavior, emissions decreased modestly by 3.6%. We did not find evidence for different reactions to the label based on gender or age.

1. Introduction

Deep cuts in global greenhouse gas emissions will be required to keep global average surface temperatures from increasing by > 2 °C above pre-industrial levels (UNFCCC, 2010). Mitigation efforts so far have mainly focused on CO_2 emissions from fossil fuel and land use, and although these sources are responsible for more than three quarters of total greenhouse gas emissions (Edenhofer et al., 2014), focusing on their reduction alone may not be enough. Mitigation strategies aimed at reducing methane and nitrous oxide emissions from agriculture may also become necessary in order to meet the two degree target (Hedenus et al., 2014).

Demand for agricultural products, shaped by human diets, substantially affects greenhouse gas emission levels, because the range between high and low emitting diets is large (Stehfest et al., 2009). Especially the choice between different sources of protein has a big influence. Protein sources of vegetable origin are generally low emitting compared to protein sources of animal origin (González et al., 2011). In particular products from ruminant animals, both meat and dairy products, cause emissions much higher than most other types of food (Bryngelsson et al., 2016). Therefore, large scale changes in human diets hold a significant theoretical mitigation potential. This has been shown in a number of studies (e.g. Risku-Norja et al., 2009; Berners-Lee et al., 2012; Saxe et al., 2013; Westhoek et al., 2014). However, less is known about practical restrictions, such as the challenge of breaking long-term habitual practices and consumer preferences for price, health, taste and other sensory qualities.

Strategies to alter consumer behavior can take different forms. Price-based policy instruments such as consumption taxes that give financial incentives to consumers may be effective and efficient (Wirsenius et al., 2011), but environmental taxes can be politically difficult to put into place. A politically less controversial instrument, nudging, aims to foster more desired behaviors through positive reinforcement and indirect suggestions, while education and information provision seek to have a long-term effect on people's conscious choices. One means of information provision is through labels. Past experiences with environmental and ethical product labels, such as energy-efficiency labels on consumer electronics, organic and fair trade labeled grocery items, as well as consumer surveys, suggest that labels have a potential, however small, to stimulate sustainable consumption (Shewmake et al., 2015).

A more recent and hence less researched development is that of carbon (or climate) labels, which inform consumers about the greenhouse gas emissions caused by different products. Carbon food labels have mostly been applied and studied in the grocery sector, for example, Matsdotter et al. (2014) investigated demand changes of climate-labeled milk. Vanclay et al. (2011) studied consumer reactions to a color-coded carbon label introduced to several product categories in a grocery store. A comprehensive label, in which greenhouse gas emissions are only one of the aspects covered, was tested by Vlaeminck et al.

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(2014) on selected food items. In all studies consumers showed more climate friendly behavior due to the labels.

Few studies have analyzed behavioral effects of food labeling in restaurants. As opposed to the grocery store setting, where labels inform consumers about the difference between products of the same category, labels in the restaurant setting inform about the difference between different types of food. Therefore, the emission disparity between substitutable choices is generally higher, while other factors such as popularity of different dishes also affect choices, thereby complicating the analysis. In a restaurant setting, climate labels can take different forms. Spaargaren et al. (2013) apply a climate label in a canteen where meals were composed of multiple snack-like items, which were labeled separately. In response to a comprehensive labeling and information campaign they found an average emissions reduction of < 2%. Visschers and Siegrist (2015) label two out of four daily dishes in a canteen as “climate-friendly choices” and found that sales of the labeled options increased by > 20%.

In this paper, we use a natural experiment to analyze the effects of implementing a comprehensive color-based label scheme at a university restaurant. Our label is applied to the dish as a whole and represents total emissions of each choice. Thereby we provide more detailed information than using a label for climate-friendly options only, and also allow customers to easily compare emissions between dishes. We collect individual level sales data, including age and gender, both during the label phase and five-week control phase prior to the introduction of the label.

Our experimental design enables us to investigate how the label affects consumer behavior in a natural restaurant setting. As our label communicates information on CO_2 by means of a traffic-light color scheme, we can assess if positive and negative information have different effects on the food choice. Moreover, we analyze if the effects depend on age or gender of the customers. Finally, the labels were based on detailed emission calculations that allow us to quantify the effect on greenhouse gas emissions.

2. Method

2.1. Label Design

To develop the label scheme applied in this study we first reviewed literature on (carbon) food labeling and past experiences. From that we derived a number of criteria which the label design should fulfill. According to these criteria we generated three alternative design options and tested them on a focus group consisting of 13 randomly selected guests, and the managers of the restaurant. Understanding, ease of use, design preferences and suggestions for improvements were inquired. The eventually selected design (see Fig. 1) clearly dominated preferences among the focus group.

The chosen label was displayed underneath each of the seven dishes on the menu and was composed of a bar with length and color according to the amount of emissions, a footprint symbol and the numerical value of emissions in kilograms of carbon dioxide equivalent. We distinguish between eight label intervals, with higher resolution at the lower end of the scale, where most of the dishes appear (Fig. 1). Moreover, the traffic light color scheme, i.e. green, yellow and red colors (Berry et al., 2008; Upham et al., 2010; van Herpen and van Trijp, 2011; Bialkova et al., 2014; Thøgersen and Nielsen, 2016) reflects which types of food are low, medium or high emitting. This means vegan, ovo-vegetarian, fish and poultry dishes typically are labeled green (≤ 0.9 kg CO_2-eq), while pork dishes and vegetarian dishes with considerable amounts of dairy fall in the yellow to orange categories (0.9–2 kg CO_2-eq). In red color appear only dishes with beef or mutton (> 2 kg CO_2-eq).

To calculate the footprints of each dish, we used emission data from Bryngelsson et al. (2016) complemented with Winther et al. (2009), Head et al. (2011), and Opio et al. (2013). The staff in the kitchen registered the main ingredients in every dish each day to calculate the carbon footprint. Ingredients such as herbs, spices, ketchup, and mustard were not included in the calculations, as their contributions to the overall footprint of a dish are insignificant.

2.2. Experimental Design

The label was implemented at Kårrestaurangen (Student Union Restaurant), at Chalmers University of Technology's Johanneberg Campus in Gothenburg, Sweden, during the spring semester 2016. Guests could choose between seven dishes each day. Three of the dishes, meat, fish and vegetarian change daily, while the other four, meat salad, fish salad, vegetarian salad, and soup change weekly. Prices for the different options are the same (65 SEK), except that soup cost slightly less (60 SEK).

The experiment was conducted in two phases from February 1st to March 11th and April 11th to May 27th of 2016. The restaurant was closed during conferences hosted in the facilities on two days in both phases (February 2nd to 3rd and May 5th to 6th 2016). Four weeks in-between the phases were not covered because mid-term examinations and holidays led to irregular operations of the restaurant. Hence a control phase of six weeks (28 days), in which we calculated emissions for each dish but labels were not visible to guests, was followed by a label phase of seven weeks (33 days). With the start of the label phase, the menu including the labels was displayed on a screen and on print hangouts in front of the self-service pay desks at the restaurant's entrance. Along with the label itself, we provided background information on the relationship between food and climate change, on the role of consumers and on how the numerical footprint values can be put in perspective. The information formats included the restaurant's webpage, posters next to the menus and flyers on the canteen tables. The guests were not informed that their purchase behavior was observed.

The menu offers during the control and label phases were not identical. While the types of food over the seven types of dishes were consistent, the daily combination of dishes and hence of footprints and tastes differed. The average emissions per type of dish and hence the emissions baseline of the offer differed between phases (see Fig. 7 in the Appendix). Nonetheless the overall menu composition regarding label colors was similar before and after label introduction (see Table 7 in the Appendix). Not all colors appear for every dish in each phase. The meat dish and meat salad are the only options to regularly carry a red label. This is the case on more than one third of the days, with similar amounts of green and yellow labels on the remaining days. The other dishes are labeled green on most days and labeled yellow only occasionally. The fish salad carries exclusively green labels throughout the entire experiment.

2.3. Hypothesis

To assess the impact of the label on consumer behavior we focus on the effect of red, yellow, and green label colors. Although labels across all colors communicate a dish's carbon footprint, the green label conveys positive information; the red label conveys negative information and the yellow label can be interpreted relatively to the other menu options as positive, negative or neutral information.

In a theoretical analysis of carbon food labels, Shewmake et al. (2015) model the impact of a carbon label as depending on consumers' beliefs about the emissions of a product. In their model, a label will only affect a purchasing decision if consumers are concerned about the environment and the label conveys new information that helps them to update their beliefs on the environmental impact of the labeled good. Thus, labels on an item where consumers have less correct or more varied ex-ante beliefs should have a larger effect than labels on items where consumers hold on average correct beliefs.

Apart from the informational content, people's more frequent and longer attention to negative information suggest that negative