

Working Paper in Economics No. 690

# Nudging à la carte – A field experiment on food choice

Christina Gravert and Verena Kurz

Department of Economics, Revised March 2017 (February 2017)

ISSN 1403-2473 (Print)  
ISSN 1403-2465 (Online)



UNIVERSITY OF GOTHENBURG  
SCHOOL OF BUSINESS, ECONOMICS AND LAW

# **Nudging à la carte – A field experiment on food choice<sup>1</sup>**

Christina Gravert<sup>a</sup> and Verena Kurz<sup>b</sup>

27.03.2017

## **Abstract**

We test the effect of framing of a menu on the choice of ordering climate friendly dishes in a randomized controlled experiment. Rearranging the menu in favor of vegetarian food has a large and significant effect on the willingness to order a vegetarian dish instead of meat. We show that there exists a considerable marginal group willing to change meat consumption behavior at least in the short term. Our results demonstrate both to policy makers and to actors in the food service sector that small, cheap interventions can significantly decrease carbon emissions from food consumption.

JEL classification: D12, Q50, C93

Keywords: Nudging, Field experiment, default, food choice

---

<sup>1</sup> We thank Fredrik Carlsson, Randi Hjalmarsson, Katarina Nordblom, Mitesh Kataria, and Heiner Schumacher for comments. Christina Gravert is partly funded by the Swedish Environmental Protection Agency.

<sup>a</sup> Department of Economics, University of Gothenburg, Vasagatan 1, SE 411 24 Göteborg, Sweden, Christina.gravert@economics.gu.se

<sup>b</sup> Department of Economics, University of Gothenburg, Vasagatan 1, SE 411 24 Göteborg, Sweden, Verena.kurz@economics.gu.se

## 1. Introduction

The assumption of stable individual preferences is still one of the cornerstones of consumer theory. When given a choice between a number of options consumers should choose the option that maximizes their utility regardless of how the options are presented and the context they are put in, as long as the prices stay constant. However, a large amount of work in psychology and economics shows that this assumption is often violated (Slovic, 1995; Tversky and Simonson, 1993, Thaler and Sunstein 2008).

In this paper, we show how a small change in the framing of different options can have a substantial impact on the choices individuals make. We test whether decreasing the convenience of ordering a meat dish and simultaneously increasing the convenience of ordering a vegetarian dish out of three dishes offered can decrease the sales of the meat option for vegetarian dishes.

We conduct a field experiment with a restaurant to observe consumption choices. Over the course of three weeks, customers entering the restaurant were randomly presented with one of two menus. One menu offered a meat dish and a fish dish, with a note that a vegetarian option was available upon request. The other menu offered a vegetarian and a fish dish, with a note that a meat dish was available upon request.

We find that a small decrease in the convenience of ordering the meat option, by making it necessary to ask the waiter to describe the dish, results in a significant decrease in the share of dishes containing meat sold at lunch, and an increase in the share of vegetarian and fish dishes. The share of meat dishes sold decreased from an average of 47%, before the intervention to around 21% in the treatment condition, where it was not directly displayed on the menu.

The novelty of this study is the direct relevance for policy making. What we eat is an important determinant of both our health and our ecological footprint. Food production was responsible for about 16% of global greenhouse gas (GHG) emissions in the period 2005-07 (Springmann et al., 2016). However, GHG emissions vary widely among types of foods. Diets rich in meat and dairy products entail higher CO<sub>2</sub> emissions than plant-based diets. Tilman and Clark (2014) estimate that omnivorous diets are approximately four times higher in carbon intensity per calorie consumed than healthy vegetarian diets.

Although climate benefits from reduced consumption are estimated to be large (Bryngelsson et al., 2016; Springmann et al., 2016; Westhoek et al., 2014), there are currently no policy instruments in place that target meat consumption directly. “Meat taxes” are discussed in the scientific community (Säll and Gren, 2015; Wirsenius et al., 2011) but not implemented in any country yet. Initiatives, trying to encourage individuals to reduce meat consumption, such as “Meat-free days,” are limited in their outreach and probably also in their effectiveness. Forced choice restrictions such as mandatory vegetarian days in school and canteens entail the risk of causing psychological reactance, and, ultimately, backlash (Lombardini and Lankoski, 2013).

Increasingly, researchers and policy makers call for behavioral interventions that neither change prices, choices, or the information that is given - so-called “nudges” (Thaler and Sunstein, 2008) - in order to promote sustainable consumption choices in the food domain (Girod et al., 2014; Lehner et al., 2015). While there is evidence that nudging can under some circumstances push people towards making healthier food choices (Just, 2009; Wansink, 2004; Wansink and Hanks, 2013; Wisdom et al., 2010), the evidence on the effectiveness of nudges for promoting sustainable food choices is very limited.

We close this gap in the literature by presenting the result of a simple nudge and its substantial effects on consumption. The results show that there is potential for restaurants to decrease the meat intensity of their dishes offered without banning meat items from the menu or changing prices. Our results demonstrate both to policy makers and to actors in the food service sector that small, cheap interventions can significantly decrease carbon emissions from food consumption.

The paper continues as follows. Section 2 presents the experimental design. Section 3 presents the data and the experimental results. In Section 4 we discuss possible channels through which the nudge might influence behavior and give practical policy recommendations based on our findings.

## 2. Experimental design

The experiment was conducted for three weeks in May 2016 at a restaurant located in Gothenburg, Sweden. While serving à la carte during the evening and on weekends, there is a daily changing lunch menu during weekdays, which is available for two hours. Each day, the kitchen prepares two dishes for lunch: One containing meat and one with fish. On request, the kitchen also prepares a vegetarian meal. All dishes include salad and bread and cost 110 SEK (approximately 13 USD), which puts it in the “medium-priced” category for Gothenburg restaurants according to the website TripAdvisor. The restaurant is frequented mainly by white-collar employees, working in the service sector and the arts, as the restaurant is located in the city center close to a major museum, a concert hall and a library. The restaurant has 52 seats and space for a handful of people at the bar. Our experimental treatments make use of two specific features of the restaurant setup: The architecture of the restaurant and the design of the lunch menu.

Regarding architecture, the restaurant has two areas, which are separately partly by a wall and partly by a bar acting as an almost physical border (see Figure 1 in the Appendix). The front part, where customers enter, has 30 seats. The back area has 22 seats. The lunch menu is printed each week anew on an A3 varnished paperboard and lists the options for the whole week. Proceedings during lunch are as follows: Upon arrival, customers are seated by a waiter. Regular customers were seated at their regular tables as far as possible. Non-regulars were seated according to the size of the group, if there were several free tables, the waiter pointed

out one possibility in the front and one in the back from which the customers could choose.<sup>2</sup> Once a customer or group of customers is seated, the waiter hands out the menus to the guests.

No menus are set up at the wall, at the entrance, or outside the restaurant. Our treatments build on this by letting the waiters hand out different menus to customers seated in the front area compared to customers seated in the back. If customers want to have a look at the menu before deciding if they want to eat at the restaurant or not, a waiter gets a menu sheet from the bar and hands it out to the customers. During the experiment, this was always the vegetarian / fish menu. Consequently, customers that wanted to have a look at the menu first were seated in the (slightly bigger) front area. We can rule out that customers self-selected out of the experiment, as the waiters assured that no guest left the restaurant after having looked at the menu.

Before the start of our experiment, the weekly lunch menu listed the two main options: The option containing meat and the option containing fish. A vegetarian dish was available upon request and could be customized to a vegan version. Nowhere on the original menu, which was distributed throughout the whole restaurant, was it stated that a vegetarian/vegan dish was available. We collected weekly sales data on the number of vegetarian, meat and fish dishes sold at lunch for four weeks prior to our intervention.<sup>3</sup>

During the intervention, the waiters handed out two different menus at the restaurant. One menu contained, as before, the daily meat and fish options for the whole week, but had a sentence added stating “a vegetarian option is available on request.” We added this sentence to check if simply giving information about the availability of a vegetarian dish could increase the sales of vegetarian dishes. Customers seated in the back part of the restaurant received this menu. The menu distributed to customers seated in the front differed by listing the vegetarian and fish dish, but not the meat option. The only hint towards the availability of a meat dish was the added sentence “an option containing meat is available on request.” Thus, the menu distributed in the front made it slightly less convenient to order the meat dish<sup>4</sup>: Customers had to call a waiter and ask what the dish was to be able to compare it to the options spelled out on the menu. On the other hand, the convenience of ordering the vegetarian dish increased for those customers seated in the front part, compared to the setup in the pre-experimental period and the back part of the restaurant during the experiment. The convenience of ordering the dish containing fish remained the same across periods and areas. In both menus, the fish dish was the second one presented on the menu. Consequently, the vegetarian and the meat dish were presented in the same spot. For convenience reasons, the meat and the vegetarian dish were usually the same except that the meat was replaced by a vegetable, grain or plant pro-

---

<sup>2</sup> As the restaurant only has 52 seats at 20 tables, which can be grouped together for more than two people, and is quite busy during lunch, there is not much discretion for the waiters to seat the guests.

<sup>3</sup> It should be stressed that there were no modifications made to the menu during those four weeks compared to the restaurant’s previous operations, i.e. the restaurant’s menu had listed only two dishes for a long time, although a vegetarian option was available by special request.

<sup>4</sup> The rearranging of the menu most likely influenced behavior through several behavioral channels other than pure convenience. The experimental design and the resulting data does not allow us to disentangle the different channels. However, section 4 provides a discussion on the potential mechanisms.

tein. Thus, the other components of the dish have a similar climate impact. Also, we can be sure that the side orders did not affect the choice. In addition to the lunch options, the menus also stated two desserts, which were the same across treatments and for the whole week.

The intervention lasted for three weeks, during which we collected daily sales data of the three lunch options by area in the restaurant, front and back. One advantage of the experimental design is that we have two control periods available. While the pre-experimental period mainly serves as a control to check if the behavior of the customers seated in the back part of the restaurant changes during the experimental period (which should not be the case), data from the back part itself serves the control group during the intervention period. By doing so, the control and the treatment group were subject to the same dishes available and to the same external factors, such as weather conditions, holidays and other daily variations in setting, which could otherwise act as confounding factors. A major advantage of this design is that we can control for an important event happening during our study; due to unexpectedly nice weather during May, the restaurant opened its outdoor serving already on May 9<sup>th</sup> instead of 1<sup>st</sup> of June as originally planned. The restaurant staff made sure to define different areas of approximately the same size also in the outdoor serving area to distribute the different menus. However, the outdoor serving did not feature any physical boarder between the two areas.

After the intervention, the restaurant used the control area menu (i.e., the one containing the meat and fish option only) in the whole restaurant for one week to control for trend effects.<sup>5</sup>

### 3. Data and results

The intervention took place from May 2nd until May 20th, 2016. During that time, the restaurant was not serving the lunch menu for two days (Ascension Day and the Friday following it), resulting in 13 days of sales data with separate menus. Also, we collected total weekly sales of the three options for the four weeks before the intervention (April 4<sup>th</sup>-30<sup>th</sup>) and for five days after the intervention (May 22<sup>nd</sup> – 27<sup>th</sup>). Average sales are around 64 dishes per day during the first five weeks of the experiment (the pre-intervention period and the first week of the intervention), where only the indoor area was open. During the last four weeks of the experiment (two weeks of intervention and one week post intervention), the restaurant opened its outdoor seating and sold around 114 dishes per day in the two-hour lunch period.<sup>6</sup> The complete sales data collected can be found in Table 1 in the appendix.

---

<sup>5</sup> We recognize the fact that one week is very short for an ex-post period. A longer observation period was impossible as the lunch menu changed completely on June 1<sup>st</sup> to the restaurant's "summer menu". Consequently, during the eight weeks data collection was possible, we collected four weeks of pre-intervention data, three weeks of intervention data and one week of post-intervention data.

<sup>6</sup> As a result of opening the outdoor serving area, the number of total sales increased considerably starting with the second week of the intervention. However, the shares of the dishes sold at the control area did not significantly change with the opening of the outdoor area. Within the treatment area, the composition of dishes sold changes significantly over the course of the three weeks intervention, see Figure 2 and the discussion.

### 3.a. The effect of menu design on food choice

First, we show the aggregate results for the whole restaurant. We conduct Chi2-tests to test for changes in ordering behavior across the two periods. Figure 1 shows the sales shares of the meat, fish and vegetarian option for the four weeks before the intervention, the three experimental weeks and the one-week post-experimental period. On average, only 2.5% of all dishes sold are vegetarian without the vegetarian option on the menu. The remaining lunches sold are distributed approximately equal across the meat and the fish dishes. In the weeks of the intervention (1-3) the share of meat dishes sold overall drops from 47% on average to 34% on average, a reduction of 38% ( $p < 0.01$ ). Especially when considering that only approximately half of the restaurant got treated, this is a large reduction and stays consistent over the three weeks of the experiment. The vegetarian dishes jump from 3% to 9% on average (a 300% increase,  $p < 0.01$ ), but with a downward trend over time. The weekly sales of fish dishes steadily increase during the intervention. On average the increase is around eight percentage points, from 50% to 57% ( $p < 0.01$ ). A Chi2-test on changes in the overall distribution of meals across the treatment confirms that meal choices differed significantly between the two periods ( $p < 0.01$ ).

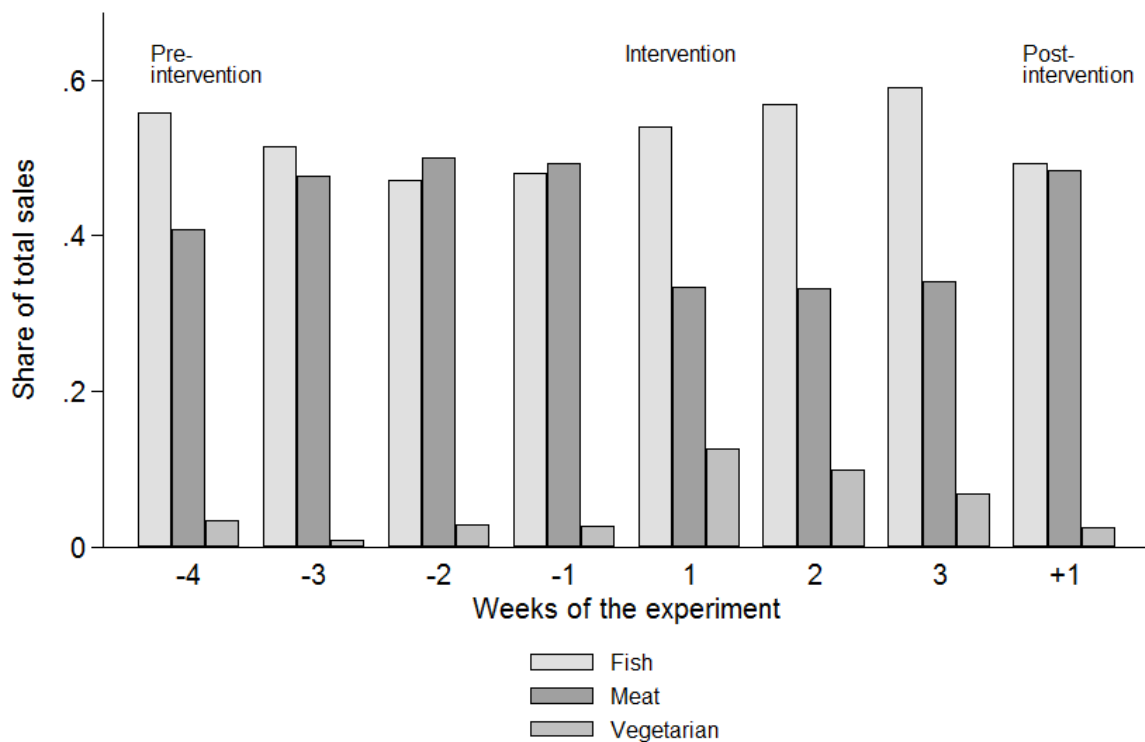


Figure 1: Shares of total sales. Intervention during weeks 1-3.

Second, we look at the sales for the two menus separately. Because absolute sales vary over days and weeks, we only show the percentage of sales in the figures for comparison, but we conduct Chi2-test using absolute values to test for differences in ordering behavior. All absolute values can be found in Table 1 in the Appendix. Figure 2 contains the sales shares for the three-week intervention period. The left panel shows the sales for the “meat” menu and the right panel for the “vegetarian” menu. Overall, meal choices differ significantly between the

treated and the control area ( $p < 0.01$ ). The average share of vegetarian dishes sold jumps from on average 3% before the intervention to 23% (an increase of 667%) in the first week of the intervention in the area with the “vegetarian” menu ( $p < 0.01$ ). It remains low (2%) in the “meat” menu area. The following two weeks, shares stay low at around 4% for the meat menu and reduce over time in the vegetarian menu area. Comparing average sales of vegetarian dishes over the whole intervention period shows that they are significantly different between the two areas of the restaurant. 15% of all dishes sold are vegetarian in the vegetarian area, while it is only around 3.5% in the meat area ( $p < 0.01$ ). The share of meat dishes sold is 46% on average in the “meat” menu area and less than half of that in the “vegetarian” menu area (21%,  $p < 0.01$ ). This drop is larger than the increase in vegetarian sales shares, and consequently, also the share of fish dishes sold increases from around 51% to 64% ( $p < 0.01$ ). Hence, approximately half of the consumers that switched away from the meat option substituted it with fish and the other half with vegetarian food.

Figure 2 shows a decrease of the treatment effect over time. While treatment effects are statistically significant when comparing the treated and the control area separately for each week (Chi2 tests,  $p < 0.01$  for each week), the share of vegetarian dishes sold decreases over time in the treated area. A Chi2 test shows that distribution of choices is significantly changes over the three weeks of the intervention within the treated area ( $p < 0.01$ ). Testing specifically for differences in the sales of vegetarian dishes per week shows that all weeks differ significantly from each other at least at a 10% level of significance (week 1 vs week 2:  $p < 0.01$ , week 1 vs week 3:  $p < 0.01$ , week 2 vs week 3:  $p = 0.10$ ). In the control area, no significant changes occurred during the intervention period.

What could cause such a trend in the treatment? One possible explanation is the presence of regular customers who have experience with the old menu. Although we might initially nudge those regular customers away from the meat, they might switch back to their old choice patterns in case they do not like the option they were nudged into. The restaurant the experiment took place in reports having a quite high number of regular customers, around 20%. Our data does not allow us to analyze the behavior of this interesting subject group for a longer period.



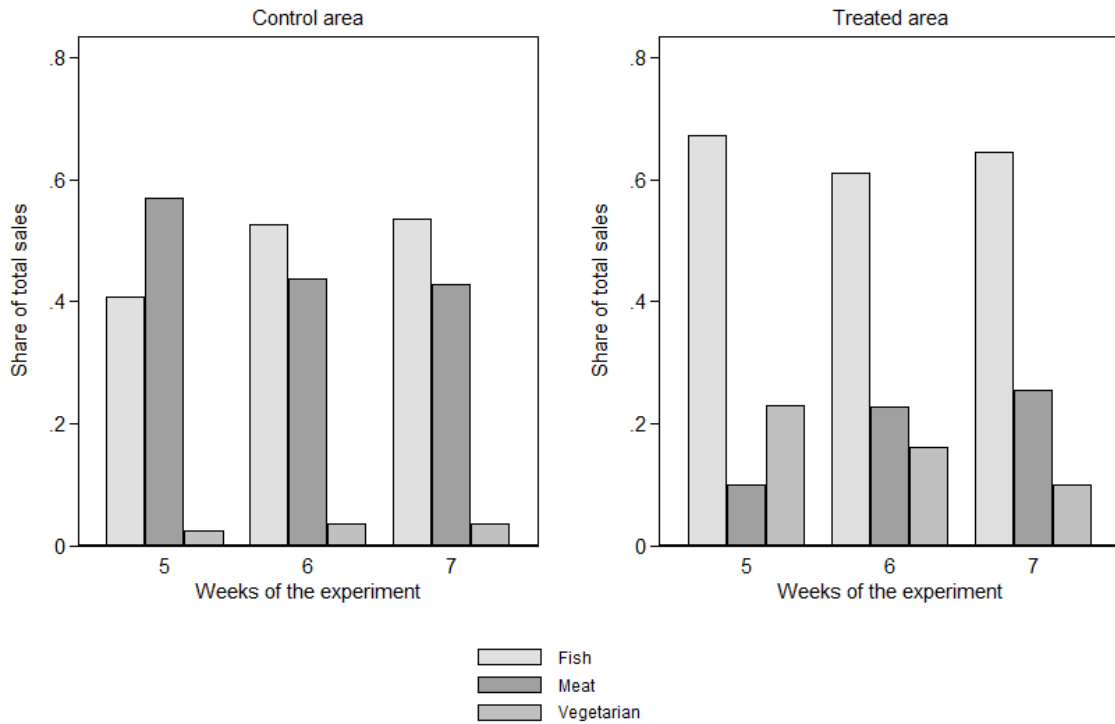


Figure 2: Share of sales for the two menus separately during the intervention period

The last three columns in Figure 1 show that switching to the old menu layout (but still keeping the note that a vegetarian dish was available) immediately restored the pre-treatment sales shares. Hence, we conclude that there are no trend effects that could explain the variation created by the experiment and there are no long-lasting effects of the intervention.

A valid concern of the experimental set-up could be spillover effects between the two areas of the restaurant, especially during the weeks the outdoor serving was opened. That could be the case, for example, if customers seated in the meat menu area observe the waiters serving vegetarian dishes to customers in the vegetarian menu area or the other way round, which could influence their choice. Spillover effects could also occur from regular customers who are once exposed to one of the menus and at a different time exposed to a different menu. Both types of spillovers would downward-bias our treatment effect. Our results can, therefore, be considered lower bounds of the true effect. Within the area and at the same table, there could also be reinforcing effects. If the first person is nudged to choose either meat or a vegetarian meal, then other at the table might follow suit. Since we have no information on the sequence that orders were placed, we cannot control for peer effects. It is, however, likely that peer effects are at play. Thus the direction of the bias is not clear. In a study with children Angelucci et al. (2015) found reinforcing choices but in a study with adults in a restaurant Ariely and Levav (2000) present evidence for a love of variety in group choices.

One point often raised when discussing nudging towards vegetarian food is that customers might not feel satiated or that they might use the healthy main course as an excuse to order an unhealthy dessert. We examined the number of desserts ordered for both groups, but as the total amount of desserts ordered are very low ( $\leq 6$  per day), it is impossible to test this hy-

pothesis. Compared to the pre-experimental period the total sale of dessert did not increase. The menu price included still water, which is what most Scandinavians drink for lunch. There was no change in the additional beverages ordered during the experimental period. We thus find no evidence for any compensational behavior in our data. We, however, cannot rule out that individuals compensated in the afternoon or evening by eating more meat.

### 3.b. The importance of being marginal

When it comes to predicting and evaluating the success of nudging interventions, one of the most important questions is how many of the people in the target group are marginal (Coffman et al., 2014; Levitt et al., 2016). Only if enough people are sufficiently marginal, i.e. close to indifferent between two options, will a small nudge lead to a shift in behavior for a significant share of the group. Our intervention gives us some interesting information about the distribution of meat eaters in our sample population. Imagine a distribution with meat lovers on one side and vegetarians on the other side. From the pre-intervention data, we know that 2.5% of the sample population has a high preference for eating vegetarian. Even though there is no vegetarian dish mentioned on the menu, they ask for and order a vegetarian dish. Orders of the vegetarian dish do not increase much when a note that vegetarian food is available is added to the menu (3.5%). On the other side, we have the meat lovers. When meat is made less convenient to order, we still see on average 21% of customers asking for the meat dish. Most likely, the distribution is skewed, with a larger density on the side of meat eaters. When we introduce the nudge, we see that 25% of the individuals who would have chosen meat if they had been presented with the meat menu, now choose either fish (13%) or the vegetarian dish (12%). The result shows that a bit more than 1 out of 10 people in our target group are sufficiently close to the margin between fish and meat and similarly 1 out of 10 is sufficiently close to the margin between vegetarian food and meat. Without the intervention, these 2 out of 10 people would choose the meat dish.

For the first three days of the intervention, we have data on the choices of customers that have been identified by the waiters as “regulars.” These customers have all had experience with the previous menu of a choice of meat or fish and have likely tried both types of dishes at some point. It is thus unlikely that they would have been unaware of the possibility of a meat dish being available. Although the data is limited, it paints a clear picture. Of the “regulars” exposed to the vegetarian menu, 17 ordered fish and 6 ordered the vegetarian dish, and none ordered meat. From the ones exposed to the meat menu 17 ordered fish, 12 ordered the meat, and none ordered the vegetarian option. The shares match the total sales shares of that week. This finding is in contrast to Löfgren et al. (2012) who show that experienced users often override defaults and are thus harder to “nudge” by changing defaults than inexperienced users. Our results show that at least when initially exposed to a nudge, even experienced users change their behavior. However, the amount of data is too limited to draw firm conclusions on this point, and we do not know anything about the behavior of regulars that visit the restaurant more than once during our experiment. As mentioned above, experienced users could be one explanation for the declining of our treatment effect. More detailed information and long-

term data on regulars are needed to investigate this further. After the intervention, the menu effect vanishes, so the marginal people revert to their usual state of choosing meat over fish and the vegetarian dish.

#### 4. Discussion and Conclusion

We show that a simple and cheap rearrangement of the menu, introducing a small non-monetary cost of ordering meat, can contribute towards a reduction in meat consumption without any measurable negative effects.<sup>7</sup> By decreasing the convenience of ordering the meat option in a Swedish lunch restaurant, we managed to increase the share of vegetarian dishes sold significantly. This result is, however, not a one to one trade off, as around half of those customers nudged away from meat choose fish instead, but not vegetarian food. From a climate change perspective, this is still a positive change as eating fish entails less climate-relevant emissions per kg than most kinds of meat (Röös, 2014).<sup>8</sup>

How much of a climate impact does the intervention have? A short example can put it into perspective. On one occasion a piece of beef was replaced by a grilled cabbage. A conservative estimate of the CO<sub>2</sub> emission of a 150g piece of local beef is 1kg (CleanMetrics 2011). For the cabbage it is 0.05kg. That day 42% of the people exposed to the meat menu ordered the beef, but only 16% of the ones presented with the vegetarian menu do so. With roughly 50 people in each group that are 21kgs of CO<sub>2</sub> from meat in the meat menu group and only 8kgs from meat in the vegetarian menu group. To put this into perspective, average emissions from driving a car in Sweden, are around 0.16 kg of CO<sub>2</sub> per km. That means the savings from that day are enough to compensate for a car driving 81 km. Clearly, the reduction in CO<sub>2</sub> varies depending on the type of meat. Any overall evaluation of climate benefits also crucially depends on the assumption that customers do not compensate for having chosen a vegetarian lunch with indulging in meat later the day or the day after. To the best of our knowledge, there has been no experiment conducted yet that examines substitution effects of food over time. Complete information about food choices is quite challenging to obtain. Nevertheless, further research in that area is needed to identify total climate effects of nudges aiming at reducing meat consumption.

There are some psychological reasons why changing the convenience of options works so well in changing behavior. The most conservative economic interpretation is that we introduce a small non-monetary cost to the option that is not prominently displayed. The customer

---

<sup>7</sup> Anecdotally there were no complaints during the experimental period. If someone noticed a change in the menu, the staff replied that they were trying out some new dishes and this explanation was accepted by all customers. Since the sales data is dependent on weekday and weather, we cannot reliably test whether the intervention had an effect on sales, as sales only increased over time. We cannot rule out that customers who tried vegetarian and did not like it decided not to come back to the restaurant. We can, however, say that the restaurant as a result of the experiment decided to push the vegetarian menu more, i.e., they do not expect negative returns from selling more vegetarian. As mentioned above, we do know that no one left the restaurant after looking at the menu.

<sup>8</sup> Consuming fish entails less climate-relevant emissions than beef, lamb, pork and mixed meats (such as minced meat) and approximately equally much as chicken.

must stop a waiter to ask what the third option consists of. Since the waiter comes in any case to take the order, this is a minuscule cost, but might be enough to deter the marginal group from choosing this option. In this sense, our experiment is similar to Wisdom et al. (2010) who study sandwich choices in a fast-food restaurant. In their experiment, a set of unhealthy sandwiches was made less convenient to order by either putting them on a menu that was put into a sealed folder or by listing them on a separate page than a set of “featured” sandwiches serving as an implicit default. The authors find that both interventions affected sandwich choice, with the first one (sealing parts of the menu) having a larger effect. The benefit of our study compared to Wisdom et al. (2010) is that customers in our study were not aware that they were taking part in a study. We can thus be certain that the choices we observe were not affected by experimenter demand effects. Furthermore, we believe our intervention is more subtle and more feasible for restaurants to carry out compared to sealing menus with stickers. An alternative explanation could be that the two options that are displayed create a social norm of what is “standard” to choose at this restaurant. Deviating from this norm might come not only at a cost of asking a waiter, but also at a social image cost. Alternatively, the menu constitutes an implicit recommendation from the kitchen which dishes are the tastiest dishes (see for example Sunstein and Reisch (2014) for possible explanations of the default effect). In a laboratory experiment, Altman et al. (2013) investigate implicit recommendations and find that defaults work better when the interest of the decision maker and the default setter are closely aligned as well as when the decision maker has little information. In such a simple setting such as a restaurant, this does not seem to be very relevant. In contrary, the nudge works just as well on regulars, who have experience with the food at the restaurant and who should react less to implicit recommendations. A third channel is a decrease in the salience of the third option (Cohen and Babey, 2012; Wansink and Sobal, 2007). The two options that are written out might feature a lot more prominent in decision-making, and if individuals are inattentive when ordering, they might miss the possibility of a third option altogether. Further research is needed to identify the exact channel of how our intervention changes behavior. Neither the current experiment nor any other field experiment on defaults that we are aware of is testing for different explanations of the default effect.

We conclude that even in restaurants with a highly meat-affine population, there is room for decreasing the share of meat dishes sold for vegetarian and fish dishes without banning meat or changing prices. Adding a non-monetary convenience cost to the meat dish reduced the orders of meat dishes by half in our setting. Clearly, it would be interesting to validate the effect size in other settings and investigate more long-term effects and possible spillovers to other purchases. Kurz (2016) investigates long-term effects of a change in menu order and finds a persistent effect over the course of three months for a population with a high share of repeated customers. The sizable results in our experiment are a promising first step in reducing meat consumption in a fast, easy and profit-stable way.<sup>9</sup>

---

<sup>9</sup> According to the restaurant’s management, purchasing costs are around 30% lower for vegetarian than for meat dishes. Preparation of vegetarian dishes is slightly more time-consuming than producing the other dishes, so personnel costs are higher. However, taking all costs into account, it is not more expensive to produce vegetarian dishes than meat or fish dishes. Overall, the management deemed the intervention to have positive effects on profits, but could not quantify the magnitude of this effect.

Our results show that nudging is a promising tool to influence food choice. However, to determine whether a similar nudge will work in a different setting one needs to consider the size of the marginal group in the target population. Restaurants which are either known for catering to vegetarians or meat-focused venues such as a steakhouse will most likely see smaller effects of the same intervention due to self-selection of the patrons into the restaurant, thus having a smaller proportion of marginal customers. The most promising settings are restaurants that attract customers based on their quality of food and not on their focus of meat vs. vegetarian food. In our sample, 1 out of 10 people would switch from meat to vegetarian food if it is made convenient and salient. So for any restaurant hoping to reduce their climate impact, a clear policy recommendation is to have a vegetarian choice available and make it a prominent choice on the menu. Restaurants should not present vegetarian food as a “special diet” that customers with special needs need to inquire about in the kitchen, thus creating hassle costs which will tip the people on the margin towards choosing the “normal” meat dish instead.

The shift to vegetarian food is the strongest in the first week of the intervention. A conservative interpretation of this result leads to the conclusion that the nudge might work best in a setting with a lower share of regular customers, so more people experience the nudge as new. However, even half of the effect size that we find in this experiment would lead to significant reductions in CO<sub>2</sub> and possible health effects for the marginal group. While we cannot rule out any negative spillover effects on profits, our evidence points towards the contrary with stable sales and higher profit. Especially when comparing our intervention with a reduction of choice by banning the meat option, which would also restrict the non-marginal people to choosing a vegetarian dish, the adverse reactions will very likely be lower. Nevertheless, more research is needed to verify these hypotheses. Governments, cities or private sector agents that want to limit the climate impact of food consumption should work proactively with restaurants to develop, implement and test customized nudging strategies to realize the potential gains from this approach.

## References

- Altmann, S., Falk, A., Grunewald, A., 2013. Incentives and Information as Driving Forces of Default Effects. IZA Discussion Paper 7610, Institute for the Study of Labor (IZA).
- Angelucci, M., Prina, S., Royer, H., Samek, A., 2015. When Incentives Backfire: Spillover Effects in Food Choice (Working Paper No. 21481). National Bureau of Economic Research.
- Ariely, D., Levav, J., 2000. Sequential Choice in Group Settings: Taking the Road Less Traveled and Less Enjoyed. *Journal of Consumer Research* 27, 279–290. doi:10.1086/317585
- Bryngelsson, D., Wirsenius, S., Hedenus, F., Sonesson, U., 2016. How can the EU climate targets be met? A combined analysis of technological and demand-side changes in food and agriculture. *Food Policy* 59, 152–164. doi:10.1016/j.foodpol.2015.12.012
- Coffman, L.C., Featherstone, C.R., Kessler, J.B., 2014. Can Social Information Affect What Job You Choose and Keep? A Field Experiment in the United States (Mimeo).
- Cohen, D.A., Babey, S.H., 2012. Contextual influences on eating behaviours: heuristic processing and dietary choices. *Obesity Reviews* 13, 766–779. doi:10.1111/j.1467-789X.2012.01001.x
- Girod, B., van Vuuren, D.P., Hertwich, E.G., 2014. Climate policy through changing consumption choices: Options and obstacles for reducing greenhouse gas emissions. *Global Environmental Change* 25, 5–15. doi:10.1016/j.gloenvcha.2014.01.004
- Just, D.R., 2009. Smarter lunchrooms: using behavioral economics to improve meal selection. *CHOICES* 24, 1.
- Kurz, V., 2016. Nudging to reduce meat consumption: Immediate and persistent effects of an intervention at university cafeterias (Mimeo).
- Lehner, M., Mont, O., Heiskanen, E., 2015. Nudging – A promising tool for sustainable consumption behaviour? *Journal of Cleaner Production*. doi:10.1016/j.jclepro.2015.11.086
- Levitt, S.D., List, J.A., Sadoff, S., 2016. The Effect of Performance-Based Incentives on Educational Achievement: Evidence from a Randomized Experiment (Working Paper No. 22107). National Bureau of Economic Research.
- Löfgren, Å., Martinsson, P., Hennlock, M., Sterner, T., 2012. Are experienced people affected by a pre-set default option—Results from a field experiment. *Journal of Environmental Economics and Management* 63, 66–72. doi:10.1016/j.jeem.2011.06.002
- Lombardini, C., Lankoski, L., 2013. Forced Choice Restriction in Promoting Sustainable Food Consumption: Intended and Unintended Effects of the Mandatory Vegetarian Day in Helsinki Schools. *J Consum Policy* 36, 159–178. doi:10.1007/s10603-013-9221-5
- Röös, E., 2014. Mat-klimat-listan (Report No. 77). Uppsala.
- Säll, S., Gren, I.-M., 2015. Effects of an environmental tax on meat and dairy consumption in Sweden. *Food Policy* 55, 41–53. doi:10.1016/j.foodpol.2015.05.008
- Slovic, P., 1995. The construction of preference. *American Psychologist* 50, 364–371. doi:10.1037/0003-066X.50.5.364
- Springmann, M., Godfray, H.C.J., Rayner, M., Scarborough, P., 2016. Analysis and valuation of the health and climate change cobenefits of dietary change. *PNAS* 113, 4146–4151. doi:10.1073/pnas.1523119113
- Sunstein, C.R., Reisch, L.A., 2014. Automatically Green: Behavioral Economics and Environmental Protection. *Harv. Envtl. L. Rev.* 38, 127.
- Thaler, R.H., Sunstein, C.R., 2008. *Nudge: improving decisions about health, wealth, and happiness*. Yale University Press, New Haven.
- Tilman, D., Clark, M., 2014. Global diets link environmental sustainability and human health. *Nature* 515, 518–522. doi:10.1038/nature13959
- Tversky, A., Simonson, I., 1993. Context-Dependent Preferences. *Management Science* 39, 1179–1189.
- Wansink, B., 2004. Environmental Factors that Unknowingly Increase a Consumer’s Food Intake and Consumption Volume (SSRN Scholarly Paper No. ID 518902). Social Science Research Network, Rochester, NY.
- Wansink, B., Hanks, A.S., 2013. Slim by Design: Serving Healthy Foods First in Buffet Lines Improves Overall Meal Selection. *PLOS ONE* 8, e77055. doi:10.1371/journal.pone.0077055

- Wansink, B., Sobal, J., 2007. Mindless Eating The 200 Daily Food Decisions We Overlook. *Environment and Behavior* 39, 106–123. doi:10.1177/0013916506295573
- Westhoek, H., Lesschen, J.P., Rood, T., Wagner, S., De Marco, A., Murphy-Bokern, D., Leip, A., van Grinsven, H., Sutton, M.A., Oenema, O., 2014. Food choices, health and environment: Effects of cutting Europe's meat and dairy intake. *Global Environmental Change* 26, 196–205. doi:10.1016/j.gloenvcha.2014.02.004
- Wirsenius, S., Hedenus, F., Mohlin, K., 2011. Greenhouse gas taxes on animal food products: rationale, tax scheme and climate mitigation effects. *Climatic Change* 108, 159–184. doi:10.1007/s10584-010-9971-x
- Wisdom, J., Downs, J.S., Loewenstein, G., 2010. Promoting Healthy Choices: Information versus Convenience. *American Economic Journal: Applied Economics* 2, 164–78. doi:10.1257/app.2.2.164

## Appendix

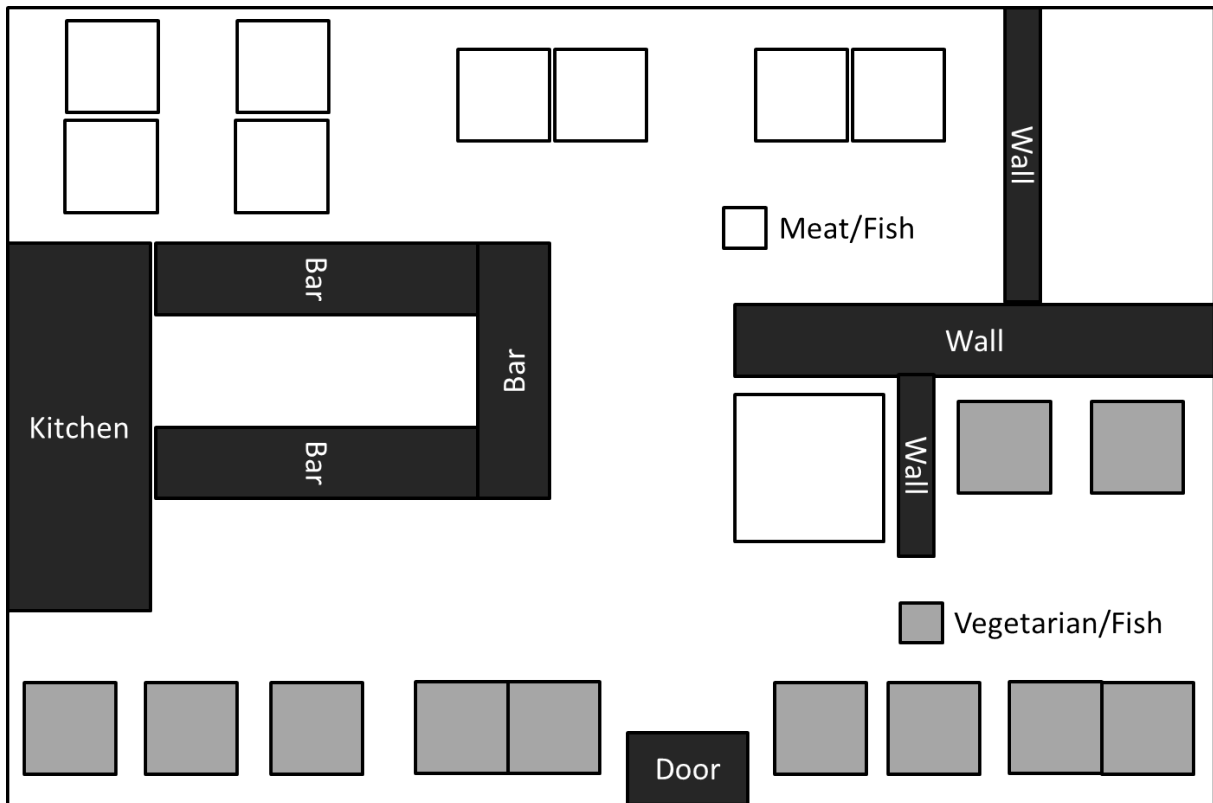
**Appendix Table 1:** Total sales and sales shares in percent of the three lunch options available across periods and treatments

<i>Convenient option to order<sup>a</sup></i>		<b>Meat</b>		<b>Fish</b>		<b>Vegetarian</b>		<b>Total sales</b>	
		<i>Meat</i>	<i>Veg</i>	<i>Meat</i>	<i>Veg</i>	<i>Meat</i>	<i>Veg</i>	<i>Meat</i>	<i>Veg</i>
Baseline period	Week 1	119		163		10		292	
		40.75%		55.82%		3.42%		100%	
	Week 2	113		122		2		237	
		47.68%		51.48%		0.84%		100%	
	Week 3	160		151		9		320	
		50.00%		47.19%		2.81%		100%	
	Week 4	187		182		10		379	
		49.34%		48.02%		2.64%		100%	
	<b>Total</b>	<b>579</b>		<b>618</b>		<b>31</b>		<b>1228</b>	
		<b>47.15%</b>		<b>50.33%</b>		<b>2.52%</b>		<b>100%</b>	
	Average sales / day	29		30.9		1.6		61.4	
Intervention	Week 1 (3 days)	70	13	50	88	3	30	123	131
		56.91%	9.92%	40.65%	67.18%	2.44%	22.90%	100%	100%
	Week 2	142	66	171	177	12	47	325	290
		43.69%	22.76%	52.62%	61.03%	3.69%	16.21%	100%	100%
	Week 3	106	69	133	175	9	27	248	271
		42.74%	25.46%	53.63%	64.58%	3.63%	9.96%	100%	100%
	<b>Total</b>	<b>318</b>	<b>148</b>	<b>354</b>	<b>440</b>	<b>24</b>	<b>104</b>	<b>696</b>	<b>692</b>
		<b>45.69%</b>	<b>21.39%</b>	<b>50.86%</b>	<b>63.58%</b>	<b>3.45%</b>	<b>15.03%</b>	<b>100%</b>	<b>100%</b>
	Average sales / day	24.5	11.4	27.2	33.8	1.8	8.0	53.5	53.2
Post-Intervention	Total (5 days)	285		280		14		579	
		49.22%		48.36%		2.42%		100%	
	Average sales / day	57		56		2.8		115.8	

<sup>a</sup> The fish option was equally convenient to order across periods and treatments and is therefore omitted from the column labeling.



**Appendix Figure 1: Layout of the restaurant.** Dark grey squares are tables with vegetarian/fish menu and white squares are tables with meat/fish menu.



**Appendix Figure 2: Examples of the Meat/Fish and Vegetarian/Fish Menu.** The boxes around the dishes and around the additional sentence were not on the menu, but have been added to ease comparison for the reader of the paper.

### Meat/Fish

#### Torsdag

Bakat lammlägg med pumpasallad, getost och aubergineris

Chillibakad kolja "Loose aioli" med bakad svamp, lotusrot och pak soi

#### Fredag

Sotad biff med refried beans, fetaost, rödkål och stekt sallad

Panerad spätta med relish "delish" aioli, libabröd och pickles

*Chokladtryffel eller en kula sorbet 35sek*

Vi har även vegetariskt alternativ.

*Lunchen kostar 110sek och då ingår en plocktallrik, ekologisk surdegsgalette samt stilla vatten.*

### Vegetarian/Fish

#### Torsdag

Kryddbakad pumpa med cruditee, aubergineris och getost

Chillibakad kolja "Loose aioli" med bakad svamp, lotusrot och pak soi

#### Fredag

Grillad kål "Rosé" med refried beans, fetaost och stekt sallad

Panerad spätta med relish "delish" aioli, libabröd och pickles

*Chokladtryffel eller en kula sorbet 35sek*

Vi har även kött alternativ.

*Lunchen kostar 110sek och då ingår en plocktallrik, ekologisk surdegsgalette samt stilla vatten.*