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Why can calorie posting be apparently ineffective? The roles of two conflicting learning effects

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ABSTRACT

We investigate why the aggregate effect of calorie posting on calorie consumption can be insignificant by decomposing the learning effect into two conflicting components: a calorie-decreasing effect of learning that one was underestimating caloric content (LUE), and a calorie-increasing effect of learning that one was overestimating caloric content (LOE). Our lab snack-order experiments demonstrate the existence of the LUE effect (−8.3%) and the LOE effect (+4.8%), where the aggregate learning effect is −5.8%. Our results also imply that the LUE can be cancelled out by a positive saliency effect, while the undesirable saliency effect may be mitigated by combining the calorie posting with information about daily calorie needs.

1. Introduction

Providing calorie information in general, and calorie posting and labeling in particular, is one of the key policy tools used worldwide to promote healthier food consumption and mitigate the growing obesity epidemic. However, it is still controversial whether and how providing calorie information has any beneficial effect on calorie consumption. While some previous studies found that calorie posting can be beneficial (e.g., Burton et al., 2006; Bassett et al., 2008; Wisdom et al., 2010; Bollinger et al., 2011; Streletskaya et al., 2016), other recent studies argue that it has only insignificant effects or even calorie-increasing effects (e.g., Downs et al., 2009; Nelson and McCluskey, 2010; Giesen et al., 2011; Loewenstein, 2011; Girz et al., 2012). These findings cast doubt on the effectiveness of improving people's calorie knowledge (i.e., learning effect), which is a key justification from economic theory for the efficacy of calorie posting and labeling.

There are at least three factors that determine the effectiveness of calorie posting. First, the effectiveness depends on whether people check and learn from the posting, i.e., the existence of learning (e.g., Nayga, 2000; Drichoutis et al., 2005; Loureiro et al., 2012; Visschers et al., 2013). Second, it depends on whether people really change their behaviors based on what they learn from the posting, i.e., the effect of learning (e.g., Kim et al., 2000; Teisl et al., 2001). Third, there may be two types of learning effects that counteract each other, and thus the effectiveness of the posting may depend on the relationship between the two types of learning effects (e.g., Bollinger et al., 2011). More specifically, people may decrease their calorie consumption by learning that they were underestimating caloric content (learning-underestimation (LUE) effect); however, people may also increase their calorie consumption by learning that they were overestimating caloric content (learning-overestimation (LOE) effect). In other words, within a sample, calorie posting may have the LUE effect for some people and the LOE effect for other people. Thus, without distinguishing the two types of learning effects, the LUE and LOE effects can counteract each other; and the average effect of calorie posting for the sample appears to be insignificant.

This paper aims to answer the following questions: Do the LUE and LOE effects really exist? If any, how large the effects are? Does the LOE effect explain the ineffectiveness of calorie posting? To answer these questions empirically, the paper decomposes the effect of calorie posting into three components: the LUE effect, the LOE effect, and the saliency effect (i.e., the effect of increasing attention to calories without learning). This possibility has been examined by few studies but only one study: Bollinger et al.

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(2011) argue that consumers actually overestimate the calories in beverages. However, they could not directly estimate the magnitude of the LUE and LOE effects separately due to data limitation.

We first present a basic conceptual model that allows the existence of the LUE and LOE effects (note that, in a standard consumption model, food consumption is always optimized and never be over or under the optimal level). For our basic model, we simplify the model proposed in Just and Wansink (2011) which is used for analyzing overeating at all-you-can eat restaurants. In this basic model, the LUE and LOE effects can occur equally, and thus the LOE effect may explain the ineffectiveness of calorie posting.

In our empirical analysis, a main difficulty is in measuring a change in consumers' calorie knowledge following calorie posting (i.e., learning from calorie posting); this is particularly troublesome in field experiments and surveys. To overcome this difficulty, this paper employs lab snack-order experiments where the treatment is posting calorie information on a menu of four snack items, and participants are asked to select snacks under a fixed budget. There are two slightly different designs (Study 1 and Study 2) that provide two distinct measures of learning from calorie posting, where the two measures complement each other. While previous studies commonly employ the experiments that mirror what consumers see in the real market, our experiment employed a very different approach to decompose the learning effect of calorie posting by controlling for as many factors (e.g., packages and relative prices) as possible. Although this approach has a clear limitation (i.e., less realistic), it has an advantage that it provides clearer implication about how calorie posting influences people's learning and calorie consumption, which has been understudied in the literature.

Our experiments were conducted with 463 undergraduate students in Hong Kong in 2012. Using the experimental data, we first decompose the effect of calorie posting on calorie purchase into two parts: a saliency effect and a learning effect. Then, we further decompose the learning effect into the LUE and LOE effects. The saliency effect can exist for all consumers who are exposed to the calorie positing by increasing their attention to calories, and it is ambiguous how saliency affects consumers' choices. In contrast, the learning effect can exist only if the calorie posting improves consumers' knowledge about calories. And, although it is empirically uncertain how the learning influences consumers' choices, economic models often assume that the learning helps consumers to make healthier food choices. This is why previous studies have paid a particular attention to the learning effect. We question this assumption and provide an empirical explanation for the ambiguity in the effect of learning by decomposing the learning effects into two components.

There are two main findings that contribute to the existing literature. First, we find strong evidence for a calorie-decreasing LUE effect (−8.3%) and marginal evidence for a calorie-increasing LOE effect (+4.8%). This implies that the LOE effect is not a dominant factor explaining the ineffectiveness of calorie posting. Even so, without distinguishing the two learning effects, the aggregate learning effect is understated (−5.8%). Second, the saliency effect can be a dominant factor explaining the ineffectiveness of calorie posting. On the other hand, we find the possibility that the saliency effect may be mitigated by combining the calorie posting with information about daily calorie needs, which can make calorie posting more effective.

The rest of this paper is organized as follows: Section 2 presents our conceptual models to illustrate how calorie posting can affect calorie consumption. Section 3 describes our experimental design. Section 4 presents our estimating equations. Section 5 describes the data and presents our estimation results. Section 6 offers concluding remarks.

2. Conceptual framework

To illustrate how learning from calorie posting influences people's calorie consumption, we employ a model based on Just and Wansink (2011). The key advantage of this model is that it may explain potential overeating or undereating which never happened in an ordinary consumption model. Because learning about overeating or undereating is the core of our arguments, we employ the model rather than an ordinary consumption model.

For simplification, we assume a fixed-price context in which consumers can increase or decrease their calorie consumption by changing their orders of food items without changing their total expenditure, which is consistent with our experimental design. For example, suppose there are two food items with the same price: a low-calorie item and a high-calorie item. Then, consumers can increase their calorie consumption by shifting from the low-calorie item to the high-calorie item, and vice versa. In this setting, we can focus on the utility effect of calorie consumption by excluding price and income effects. Moreover, we assume that the utility function is additively separable across dimensions (i.e., calories and price per calorie) and linear across all dimensions.

We employ a simplest model as follows: $\max_q U^c(q|\theta)$, where q is the calorie consumption, θ is the amount of calories that maximizes hedonic consumption utility $U^c(.|.)$ where it is continuously differentiable, $U^c_q(\theta|\theta) = 0$ and $U^c_{qq}(.|\theta) < 0$. People are assumed to maximize their utility by consuming θ. However, people often do not know exactly how many calories they are consuming. If people underestimate the caloric content of food items, their actual calorie consumption q^{UE} will be larger than the optimal level (i.e., $\theta < q^{UE}$). Similarly, if people overestimate the caloric content of food items, their actual calorie consumption q^{OE} will be smaller than the optimal level (i.e., $q^{OE} < \theta$).

Calorie posting affects calorie consumption q by informing people that they are underestimating or overestimating caloric content. That is, people may decrease calorie consumption from q^{UE} to θ if they learn that they were underestimating caloric content (i.e., the LUE effect); and people may increase calorie consumption from q^{OE} to θ if they learn that they were overestimating caloric content (i.e., the LOE effect). This is particularly true in the fixed-price context because there is no monetary cost associated with changing calorie consumption. Thus, this model suggests that the effect of calorie posting on one's calorie consumption depends on how one initially predicted caloric content. In other words, the average effect of calorie posting within a group depends on the initial distribution of people's predications about caloric content within the group.

If this basic model were true, people should reduce calorie consumption if they learn that they were underestimating caloric content; and people should increase calorie consumption if they learn that they were overestimating caloric content. We empirically investigate the hypotheses by conducting snack-order experiments.

3. Experimental design

To test our hypotheses, it was necessary to obtain measures of people's calorie knowledge both before and after observing calorie posting. Satisfaction of these requirements required the use of lab experiments. Thus, we needed to utilize food items that are distributable in an experiment room, with measurable consumption volume, with a serving amount per unit small enough to have enough variation in calorie consumption, and with caloric content that can be reasonably controlled. To meet these criteria, we chose snacks and conducted lab snack-order experiments.