DISCUSSION PAPER

No 186

Salience and Health Campaigns

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May 2015

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Salience and Health Campaigns

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May 2015

Abstract

Motivated by current topics in health economics, we apply the theory of salience to con-
sumer policy. If a government intends to stifle healthier diets without harming consumers
by raising taxes, it could initiate information campaigns which focus consumers' attention
either on the healthiness of one item or the unhealthiness of the other item. According
to our approach, both campaigns work, but it is more efficient to proclaim the unhealthi-
ness of one product in order to present it as a "bad." Our findings imply that comparative
advertisement is particularly efficient for entrant firms into established markets.

JEL-Classification: I18, D11, D03

Keywords: Salience, Health Policy, Information Campaign, Comparative Advertise-
ment.

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1 Introduction

One major issue within health politics is the question how consumers can be enticed into healthier diets. As the World Health Organization recommends consumption of five portions fruit or vegetable a day, countries like the US and the UK launched the "5-a-day" campaign and the national public health initiative "Fruits & Veggies - More Matters." These campaigns have in common that they promote the consumption of healthy food products.[1] Healthy nutrition, however, does not only mean the consumption of healthy food products. It also includes abstaining from junk food and those products which contain a lot of sugar due to their various detrimental health effects.[2] Typically, governments could impose higher taxes on unhealthy food in order to change people's nutrition. While such taxes may fail to change people's consumption decisions, in addition they cause dead-weight losses. Therefore, information campaigns might be an appealing alternative. As empirical studies have found, information campaigns can "successfully change [...] dietary behavior" (see Snyder, 2007). Chetty *et al.* (2009) have shown the impact of the saliency of information on decision making and found that consumers underreact to taxes that are not salient, while salient tax reminders may have substantial effects on consumption decisions. Thus, by making information more salient, information campaigns might improve the quality of people's nutrition.

Within the theoretical framework of salience (Bordalo *et al.*, 2012a,b), we analyze the effect

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[1]For assessments of the campaign's effects see for example Havas *et al.* (1995), Baranowski and Stables (2000), Perry *et al.* (1998).

[2]For example, the Bulletin of the World Health Organization from August 28, 2003 states that "Populations with high sugar consumption are at increased risk of chronic disease" and the New York Times asks "Is sugar toxic?" (April 13, 2011). Recently, a broad debate about the significant negative effects of sweet food was initiated in Germany, supported by title stories by Der Spiegel (36/2012), BILD am Sonntag (8th July 2012) and other important newspapers and magazines. Overall costs of unhealthy nutrition like obesity and overweight are huge. For evidence, see for example the Nutrition Report 2004 by the German Nutrition Society; "The Economic Costs of Overweight, Obesity and Physical Inactivity Among California Adults - 2006" by the California Center for Public Health Advocacy; or Colagiuri *et al.* (2010) for an estimation of obesity's overall costs in Australia.

of two information campaigns which are designed to shift consumers' demand between hetero-geneous goods. We consider a market with two products, one of which is "healthy" while the other one is "unhealthy." In order to shift demand toward the healthier product, the government can choose between a *promotion* campaign of the healthy product (similar to the "5-a-day" program) and a *demotion* campaign of the unhealthy alternative. According to Bordalo *et al.* (2012a)'s salience mechanism, people overrate whatever aspect especially pronounced, whereas they tend to neglect less salient ones. Various information campaigns for certain goods may emphasize different features and therefore induce different valuations of the available items. In particular, a consumer's consumption decision may be reversed through governmental infor-mation campaigns. An information campaign which highlights a good's upsides may increase its overall evaluation as it shifts the consumer's attention toward the advantage and away from the good's disadvantage. Similarly, an information campaign which stresses a good's downside may lower its perceived value as the consumer's attention is focused on the disadvantage. This campaign may induce consumers to value the unhealthy product as a "bad," i.e., as a product providing a disutility consumers would like to refrain from.

Several studies have analyzed the effect of health campaigns on consumption behavior, such as Hamilton and Snyder (2002), Evans *et al.* (2009), Randolph and Viswanath (2004) and Hornik (2002). Furthermore, there is a broad literature on "social marketing," see Lefebvre and Flora (1988), Grier and Bryant (2005), Smedley and Syme (2001) and Glanz *et al.* (2008). However, empirical results on the effectiveness of promoting and demoting health campaigns are very heterogeneous (see Capacci *et al.*, 2012). Another strand of research has compared gain- and loss-framed health messages. Gain-framed messages emphasize the gains resulting from a certain behavior, such that they are related to the promotion campaigns in our approach. In contrast, loss-framed messages stress the potential losses resulting from specific actions, such that they are related to our demotion campaign. Empirical findings on gain- and loss-framing are mixed, too. For instance, a meta-analysis by Gallagher and Updegraff (2012) has analyzed the impact of gain- and loss-framed messages on preventory actions. According to this study,

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gain-framed messages are significantly more effective for domains such as smoking, but not for nutrition (the objective of the present paper). Pakpour *et al.* (2014) report that loss-framed messages are more effective in inducing preventory actions concerning oral health. Brug *et al.* (2003) find no significant effect of the frame on preventory action at all. Wansink and Pope (2015) conditioned the effectiveness of gain- and loss-framed messages on people's involvement into the issue and found that loss-framed messages are especially effective if people are highly involved. To sum up, the existing empirical literature does not allow for a clear prediction in the setting which we analyze theoretically. In particular, to our knowledge, the effects of demotion and promotion nutrition campaigns have not been directly compared, neither theoretically nor empirically.

First, we find that both campaigns work as each of them shifts demand toward the healthier product. *Second*, guiding consumers' attention on a product's downside results in a stronger shift of demand than the promotion campaign. The latter result is based on the assumption that people are especially susceptible to information on familiar goods.[3] Consumers are familiar with such items which they have consumed prior to the information campaign, that is, the unhealthy product for the target audience of the campaign. Consequently, consumers' purchase behavior is more affected by a demotion than by a promotion campaign.

An interesting example is a recent campaign by Coca Cola. In order to prevent threatened regulatory action in the United States and the EU to restrict consumption of sugar-containing soft drinks (see New York Times, May 30, 2012 or Handelsblatt, January 16, 2013), Coca Cola started an own information campaign. Fearing harsh governmental interventions in order to demote soft drinks, Coca Cola initiated a campaign which instead promotes a healthy lifestyle and doing sports. However, according to our model, a governmental campaign which demotes an unhealthy diet is more likely to stifle a healthy way of living than Coca Cola's promotion

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[3]It is derived from the crucial assumption by Bordalo *et al.* (2012a) according to which people overweight information related to a product they are endowed with. It is also supported by empirical studies such as Johnson and Russo (1984) which finds that "greater familiarity increased learning during a new purchase decision." Dropping this assumption, both campaigns have an equally sized, positive effect on the healthiness of consumers' diets.

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of a healthy lifestyle. Thus, Coca Cola's initiative is advantageous for the soft-drink industry while regulatory authorities should doubt its efficiency.

Also related to this topic is the introduction and the failure of the Danish fat tax, which had to be abolished only one year after its introduction (The Economist, November 17, 2012). It failed to incentivize people to live healthier, but increased sales of unhealthy food items in neighbor countries. However, modifying consumers' attitudes toward unhealthy nutrition by demotion campaigns does not just relocate consumption, but may truly change consumption behavior as we argue in this article.

We proceed as follows. Section 2 introduces our behavioral model. Section 3 presents our analysis of the different campaigns' effects. In Section 4, we present various extensions of our model with respect to broader choice sets and weaker symmetry assumptions. However, our previous results remain largely valid. Finally, Section 5 concludes.

2 The Model

Suppose a market with two goods, one of which is healthy (*apple*, represented by the index "*A*") and one is unhealthy (*chocolate*, represented by the index "*S*" as it contains a lot of sugar). Each consumer has to choose one of these two products.[4] In our basic model, the price for each good is normalized to zero, while we extend this setup and include prices in Section 4.2. Good t can be described by a two dimensional quality vector $(q_{1t}, q_{2t}) \in \mathbb{R}^2$, where q_{1t} describes the tastiness of good t and q_{2t} describes good t's healthiness, measured by the amount of contained sugar. Positive values describe that a product is tasty or healthy, while negative values indicate that it does not taste well or is unhealthy. A consumers' utility v inferred from good t is additively separable and linear in its quality parameters. It is given by

$$v(q_{1t}, q_{2t}) := wq_{1t} + (1 - w)q_{2t},$$

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[4]Allowing purchase of multiple goods does not change our results as long as the subject's preference for diversity is not too strong.

where w and $1-w$ denote the decision weights assigned to each of the attributes. Each consumer is uniquely described by the parameter w, which we assume to be uniformly distributed on the interval $[0, 1]$. The overall mass of consumers is normalized to one. Therefore, consumers are located on a Hotelling line between zero and one, and the exact position gives weight w she assigns to the attribute "tastiness".

We assume that chocolate is given by the vector $(q, -q)$ for $q \in \mathbb{R}^+$, while the apple is defined by the vector $(-q, q)$. Therefore, the former is tasty, but unhealthy, while the latter is healthy (value q), but does not taste well (value $-q$). We define a consumer's healthiness as the health parameter of the food she currently consumes: a consumer of chocolate has healthiness $-q$, while a consumer of apples has q. We assume that consumers are familiar with the product which they prefer, i.e., which gives the highest utility v.[5] Consumers with $w > 1/2$ are familiar with chocolate and those with $w \leq 1/2$ are familiar with apples.

The government has the objective to maximize healthiness among the consumers and, therefore, designs an information campaign in order to induce healthier nutrition. Note that the government does not maximize consumer surplus in our setup. Our analysis presupposes that the government stifles healthy consumption, without taking consumers taste into consideration. This assumption is justified by the substantial negative externalities unhealthy diets induce, for instance, on health care expenditures. Such externalities have been known for a long time (see for example Rubin *et al.*, 1994), but a recent study by Cawley and Meyerhoefer (2012) implies that the negative externalities are even larger than previously assumed. Therefore, it is plausible to assume that the positive impact of better tasting food on a consumer's surplus is outweighed by the negative externalities her unhealthy diet imposes on society. Therefore, overall healthiness might well be aligned with social welfare. Then, a government which internalizes the negative externalities of unhealthy nutrition (which we neglect in our model) maximizes social welfare by maximizing the share of consumers opting for healthy diets. We assume that the

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[5]In particular, we assume that consumers have consumed that product in the past, i.e., prior to the information campaigns which we are analyzing in the following. Therefore, consumers are familiar with that product.

government has a fixed budget such that it can either promote the healthiness of the apple or demote the chocolate by focusing public attention on its unhealthiness. Each campaign has a fixed intensity, which cannot be affected by the government.[6]

We analyze if and how consumer decision making responds to such governmental campaigns. Prior to the campaigns, the indifferent consumer is located at $\widehat{w} = 1/2$ and every consumer to the right ($w > \widehat{w}$) consumes chocolate, whereas those to the left consume apples. Define C_I as the set of those consumers who consume chocolate prior to the campaign and C_A as the set of consumers who consume chocolate after the campaign. Then, the government maximizes the set $C_I \backslash C_A$. We call a campaign the more effective the more consumers are in $C_I \backslash C_A$, i.e., the more people switch to apples.

In the following, first we introduce the salience mechanism by Bordalo *et al.* (2012a). In Section 2.2 and 2.3, we apply this mechanism to two different governmental information campaigns.

2.1 Salience Theory

First, for each situation where a product is to be valued by a consumer there is a consideration set C which comprises all options which are mentally available at that point in time. These mentally available items do not have to be truly available. Instead, they may be fictional goods or historical goods the decision maker has in mind while making a choice.[7] Suppose that the consideration set comprises $n \in \mathbb{N}$ items, each of which is uniquely described by the values it takes in the two attributes. Then, each good t is given by a vector $(q_{1t}, q_{2t}) \in \mathbb{R}^2$, where q_{1t} (and

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[6]In the extension we endogenize the efficiency of a campaign by assuming that a more efficient campaign comes at higher costs, but has a higher effect on the consumers' valuations of products.

[7]Historical goods may correspond to goods that have been available in the past (see Bordalo *et al.*, 2013), where "historic" refers to historic prices. An item described by (q_{1t}, q_{2t}) is mentally available as long as a consumer considers the item. For example, if a consumer believes that there exists a very tasty and healthy product described by (q, q), then this product is part of her consideration set. Also $(0, 0)$, indicating no consumption at all, may be included in the consideration set if the consumer considers the opportunity not to choose anything.

q_{2t}, respectively) denotes t's value in the first (second) attribute and the consideration set equals $C = \{(q_{1t}, q_{2t}) | 1 \leq t \leq n\}$. The *reference good* $\bar{q}$ in C is defined as

$$\bar{q} := (\bar{q}_1, \bar{q}_2) := \left(\frac{1}{n} \sum_{t=1}^{n} q_{1t}, \frac{1}{n} \sum_{t=1}^{n} q_{2t} \right),$$

where $\bar{q}_i$ gives the *reference value* of attribute i in set C for $i = 1, 2$. A consumer evaluates each item in her consideration set against this reference good. According to salience theory, the decision maker overweights such an attribute which is particularly salient in contrast to that attribute's reference value in C.

Hereby, salience of a good's attribute is assessed through a *salience function* $\sigma : \mathbb{R}^2 \to \mathbb{R}^+$, which compares good t's attribute value q_{it} with the attribute's reference value $\bar{q}_i$ by assigning each pair $(q_{it}, \bar{q}_i)$ a positive number indicating how salient q_{it} is against $\bar{q}_i$. We call product t's attribute i *salient* and its attribute j *not salient* (with respect to the salience function σ) if and only if $\sigma(q_{it}, \bar{q}_i) > \sigma(q_{jt}, \bar{q}_j)$ for $j \neq i$. If $\sigma(q_{it}, \bar{q}_i) = \sigma(q_{jt}, \bar{q}_j)$, then both attributes are equally salient. Formally, a salience function is defined via the two properties *ordering*, that is, if $[q_{it}, \bar{q}_i] \subset [q_{jt}, \bar{q}_j]$ then $\sigma(q_{it}, \bar{q}_i) < \sigma(q_{jt}, \bar{q}_j)$, and *homogeneity of degree zero*, that is $\sigma(\alpha q_{it}, \alpha \bar{q}_i) = \sigma(q_{it}, \bar{q}_i)$ for all $\alpha \neq 0$. A typical salience function is given by $\sigma(0, 0) = 0$ and $\sigma(q_{it}, \bar{q}_i) = (|q_{it}| + |\bar{q}_i|)/(|q_{it} - \bar{q}_i|)$ otherwise.

A consumer's decision weights on a good's attributes are distorted due to salience. In particular, this distortion is modelled via a *salience parameter* $\delta \in [0, 1]$ which indicates to which degree the consumer neglects the less salient attribute. If a consumer decides rationally, she has $\delta = 1$. The smaller δ is, the larger is her susceptibility to the salience bias. In particular, she values (q_{1t}, q_{2t}) as

$$v^S(q_{1t}, q_{2t}) = w_1^{LT} q_{1t} + w_2^{LT} q_{2t},$$

where her distorted decision weights are defined as follows: if attribute1 is salient and attribute 2 is not, then $w_1^{LT} = 2w/(1 + \delta)$ and $w_2^{LT} = 2\delta(1 - w)/(1 + \delta)$; if attribute 2 is salient but 1 is not, then $w_1^{LT} = 2\delta w/(1 + \delta)$ and $w_2^{LT} = 2(1 - w)/(1 + \delta)$; and if both attributes are equally salient, then $w_1^{LT} = w$ and $w_2^{LT} = 1 - w$. In the basic model, we assume that parameter δ is identical

for all consumers, while we drop this assumption in the extensions. Furthermore, we assume that $\delta \in (0, 1)$, such that people are neither rational nor do they neglect the less salient attribute entirely.

We analyze the following game. At the first stage, the government launches an information campaign on attribute i of good $t \in C$. At the second stage, consumers are affected by this campaign and form valuations of the products which are part of the campaign. At the third stage, people enter a store and assess all goods within the consideration set which comprises the truly available goods. Finally, the consumer purchases one product.

As in Bordalo *et al.* (2012a), a consumer picks the product (q_{1t}, q_{2t}) which gives her the highest final valuation $v^{S,F}$. If a good has been considered by the consumer only at the third stage, her final valuation of that product equals her third-stage valuation. If the respective good has been considered at the second and the third stage, its final valuation equals a convex combination of her second-stage valuation $v^{S,2}(q_{1t}, q_{2t})$ and her third-stage valuation $v^{S,3}(q_{1t}, q_{2t})$, that is

$$v^{S,F}(q_{1t}, q_{2t}) = \gamma v^{S,2}(q_{1t}, q_{2t}) + (1 - \gamma)v^{S,3}(q_{1t}, q_{2t})$$

for a parameter $\gamma \in (0, 1]$. Parameter γ could be understood as the probability with which a good's second stage evaluation persists. This model feature could also be interpreted as a consumer's refusal to adjust beliefs regularly, which is, for instance, the foundation for the theory of cognitive dissonance (see Akerlof and Dickens, 1982; Cooper, 2007).

We assume that a consumer's *valuation-persistency* $\gamma = \gamma(t, w)$ is a function of the advertised good t and of a consumer's preference for tastiness w. As the info campaign will center on either good A or S, we define $\gamma^A(w) := \gamma(A, w)$ and $\gamma^S(w) := \gamma(S, w)$. We assume that the persistency does not depend on the actual weights a consumer puts on the attributes, but only the good she is familiar with prior to the campaign. If $w > 1/2$, the consumer is familiar with good S, while $w \leq 1/2$ means that she is familiar with good A.[8] Then, the functions $\gamma^S(w)$

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[8]Without loss of generality, throughout this paper we assume the consumer who is indifferent between two products consumes the healthier product in each case.

and $\gamma^A(w)$ are piecewise constant with one discontinuity at $1/2$, that is $\gamma^t(w) = \gamma^t(1)$ for any $w > 1/2$ and $t \in \{A, S\}$ and $\gamma^t(w) = \gamma^t(0)$ for any $w \leq 1/2$ and $t \in \{A, S\}$. Define $\gamma_A := \gamma^A(1)$ and $\gamma_S := \gamma^S(1)$.

We investigate how the location of the indifferent consumer changes through the introduction of an information campaign. Here, we establish a critical assumption: we assume that consumers are more susceptible to information on goods they are familiar with. While a similar reasoning is exploited in Bordalo *et al.* (2012a) to establish the endowment effect, this assumption is also empirically justifiable. For instance, Johnson and Russo (1984) find that "greater familiarity increased learning during a new purchase decision", that is, people are more susceptible toward information on goods.[9] Consumers in C_I are familiar with chocolate, such that they are more susceptible to information on chocolate than on apples. This gives

Assumption 1. *Beliefs concerning the familiar good are more persistent, i.e., $0 \leq \gamma_A < \gamma_S \leq 1$. That means that for consumers in C_I, second-stage evaluations of chocolate are more persistent than second-stage evaluations of apples.*

2.2 Promotion of the Apple

Suppose that the government initiates an information campaign which promotes the healthiness of the *apple*. This may include advertisement posters or commercials on TV which stress how healthy the consumption of apples is. By the government's promotion of the apple's healthiness, consumers focus their attention on this aspect. Therefore, we assume that consumers contrast the apple, given by $(-q, q)$, with a (fictional) other good described by $(-q, \widetilde{q})$ with $0 \leq \widetilde{q} < q$. This item is not as healthy as the apple, but equally tasty as consumers are not reminded of differences in "tastiness" when confronted with an advertisement which solely focuses on "healthiness." Then, the consumer's consideration set at the second stage equals

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[9]Consumer inertia might countervail campaign-induced learning, however, for both campaigns alike. Inert consumers might be unwilling to update their valuation of both goods and unwilling to refrain from switching consumption goods, no matter which campaign they are exposed to.

$C_2^A := \{(-q, \widetilde{q}), (-q, q)\}$.[10] Any salience function σ produces the result that the apple's healthiness is salient while its tastiness is not. Formally,

$$\sigma\left(q, \frac{q + \widetilde{q}}{2}\right) > \sigma(-q, -q),$$

as the apple's healthiness q is above the average healthiness $(q + \widetilde{q})/2$ within C_2^A, while the apple's tastiness $-q$ meets the average within C_2^A, i.e., $-q$.[11] Since the salient attribute is additionally weighted by $2/(1 + \delta)$, while the other attribute is weighted by $2\delta/(1 + \delta)$, the final weights a consumer w puts on the attributes are

$$w_1^{LT} = \frac{2\delta}{1 + \delta}w \quad \text{and} \quad w_2^{LT} = \frac{2}{1 + \delta}(1 - w).$$

The valuation of the apple before making the consumption decision is a compound of the second- and the third-stage valuations, where for people in C_I, parameter γ_A gives the weight of the apple's second-stage valuation and $1 - \gamma_A$ gives the weight of the apple's third-stage valuation. At the second stage, people are affected by the government's information campaign and they value the apple as explained in the preceding paragraph. At the third stage, consumers enter a store, consider all truly available products and therefore assess the apple within $C_3^A :=$ $\{(0, 0), (-q, q), (q, -q)\}$.

2.3 Demotion of the Chocolate

Alternatively, the government might set up a similar campaign, featuring advertisement posters or commercials which focus on the chocolate's downside, that is, its unhealthiness. Such a campaign implies that the chocolate's downside can be avoided without losing its upside, the tastiness. Therefore, we assume that chocolate is compared against a fictional item which is

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[10]Our analysis here is robust with respect to other fictional items in the consideration set, as long as these render the attribute of healthiness salient. Also including $(0, 0)$, i.e., choosing no good at all, does not change any of our results.

[11]In our analysis, the explicit choice of a salience function σ is irrelevant for the results. The saliency of an attribute is independent of the explicit salience function throughout the entire paper.

similar to chocolate concerning its tastiness, but different concerning its healthiness. Thus, a consumer's consideration set equals $C_2^S := \{(q, -\widetilde{q'}), (q, -q)\}$ with $0 \leq \widetilde{q'} < q$. Then, a local thinker assigns weights $w_1^{LT} = 2\delta w/(1 + \delta)$ and $w_2^{LT} = 2(1 - w)/(1 + \delta)$ to the chocolate's attributes tastiness and healthiness.

After people have been exposed to the campaign, they enter a store and assess the chocolate within the set C_3^S which contains the truly available goods and the outside option. Therefore, $C_3^S = C_3^A =: C_3$. The final valuation of the chocolate equals the convex combination of its second-stage valuation (weight γ_S) and its third-stage valuation (weight $1 - \gamma_S$).

3 Analysis of the Effectiveness of the Campaigns

Here, we analyze in how far the two information campaigns change the location of the indifferent consumer.

3.1 Promotion of the Apple

Here, we continue the analysis started in subsection 2.2. At the second stage the apple's healthiness is salient and overrated, while its (bad) taste is underrated. Therefore, it is valued as

$$v^{S,2}(A) = \frac{2\delta}{1 + \delta}w \cdot (-q) + \frac{2}{1 + \delta}(1 - w)q.$$

At the third stage, the apple is assessed in the presence of the chocolate, such that the average healthiness and the average tastiness are zero and no attribute, neither of the apple nor the chocolate, is more salient than another. Therefore, $v^{S,3}(A) = w \cdot (-q) + (1 - w) \cdot q$ and $v^{S,3}(S) = w \cdot q + (1 - w) \cdot (-q)$ such that both products' valuations are unbiased at the third stage (as they have been prior to the information campaign).

The final valuation of the chocolate equals a convex combination of its second- and third-stage valuations, such that the apple's final valuation equals

$$v^{S,F}(A) = \gamma_A \left(\frac{2\delta}{1 + \delta}w \cdot (-q) + \frac{2}{1 + \delta}(1 - w)q \right) + (1 - \gamma_A)(w \cdot (-q) + (1 - w)q).$$

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This exceeds the final valuation of the chocolate $v^{S,F}(S) = v^{S,3}(S)$ if and only if

$$\frac{\gamma_A}{1+\delta}\left(\frac{w+w\delta-1}{1-2w}\right) + \frac{\gamma_A}{2} \geq 1.$$

If and only if a consumer's final valuation of an apple is higher than the valuation of chocolate, she consumes an apple. Thus, the indifferent consumer, whose final valuation of the apple equals her valuation of the chocolate, is located at

$$w^A := \frac{2+2\delta-\delta\gamma_A+\gamma_A}{4+4\delta}. \tag{1}$$

3.2 Demotion of the Chocolate

If the government's information campaign demotes the chocolate, its unhealthiness is salient at the second stage and the consumer values it as

$$v^{S,2}(S) = \frac{2\delta}{1+\delta}wq + \frac{2}{1+\delta}(1-w)\cdot(-q).$$

At the third stage the apple's and the chocolate's valuations are unbiased. Due to the persistence of second-stage valuations (indicated by weight γ_S), the final valuation of the chocolate is

$$v^{S,F}(S) = \gamma_S\left(\frac{2\delta}{1+\delta}w\cdot q + \frac{2}{1+\delta}(1-w)\cdot(-q)\right) + (1-\gamma_S)(w\cdot q + (1-w)\cdot(-q)).$$

Therefore, the indifferent consumer, described by weight w^S, is located at

$$w^S := \frac{2+2\delta-\delta\gamma_S+\gamma_S}{4+4\delta}. \tag{2}$$

3.3 Evaluation of the Campaigns

The larger the set $C_I \backslash C_A$ the more successful a campaign is. Let $t \in \{A, S\}$ denote the object of the information campaign, i.e., the apple or the chocolate. As long as $\delta < 1$ and $\gamma_t > 0$, the set $C_I \backslash C_A$ is non-empty for the campaign on t as the indifferent consumer has moved to the right, i.e.,

$$w^t := \frac{2+2\delta-\delta\gamma_t+\gamma_t}{4+4\delta} > \widehat{w}. \tag{3}$$

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How many people indeed switch their product through the campaign depends on δ, which indicates how susceptible consumers are toward campaigns, and on γ_t, which indicates how persistent valuations evoked by campaign t are. The smaller δ, the more consumers are manipulable by the campaign and the more people switch from consuming chocolate to consuming apples. The larger γ, the more persistent are previously formed beliefs, and thus the more effective the campaign is. These comparative statics hold for both campaigns, but due to Assumption 1 ($\gamma_A < \gamma_S$), the campaign demoting the chocolate such that this is assessed to be a "bad" is more effective. This gives

Proposition. *For exogenously fixed parameters $\delta \in [0, 1)$ and $\gamma \in (0, 1)$, the introduction of an information campaign $t \in \{A, S\}$ reduces the share of chocolate-consumers. The indifferent consumer moves from $\widehat{w}$ to $w^t > \widehat{w}$. Given $\gamma_S > \gamma_A$ (Assumption 1), the campaign which demotes the chocolate is more effective, i.e.,*

$$\frac{1}{2} < w^A < w^S \leq 1.$$

4   Extensions

In this section we extend our setup with respect to several aspects. We consider broader choice sets, goods with more attributes, asymmetric goods and endogenize the campaigns' costs.

4.1   Broader Choice Sets

If more than two products are available, then a campaign's effect on a consumer's valuation of the products is more diverse. Again, we restrict our analysis toward consumers in C_I. We assume that n balanced products $(q_{1t}, q_{2t}) \in \mathbb{R}^2$ are available, where balance means $q_{1t} = -q_{2t}$ for all $1 \leq t \leq n$. Goods with a strictly positive value (> 0) in the health attribute we call "healthy," while those with a strictly negative value (< 0) we call "unhealthy." Initially, consumers in C_I, i.e., those with $w > 1/2$, consume the most delicious product, which– due to balance– is the

unhealthiest (we call it *chocolate*). The healthier a product, the less it will be enjoyed by consumers, so that the healthiest product (let's call it *apple*) is the one consumers in C_I value lowest. As in the previous section, we investigate the effect of governmental information campaigns. *First*, we analyze an information campaign which focuses on the chocolate's downside such that consumers focus excessively on its unhealthiness. The final valuation, a weighted average of the second- and third-stage valuations, will be such that consumers with $w > 1/2$ either stay with chocolate (if the campaign was too weak to make them switch) or switch to consuming the second most delicious good (which is the second unhealthiest product). That is because the ordering of preferences for the goods the campaign does not focus on is unaffected by the campaign. *Second*, we consider a campaign focusing on the healthiness of the apple. Similarly, this campaign distorts only the consumer's valuation of the apple. On the one hand, if the campaign has any effect, then some people with $w > 1/2$ switch directly from the most unhealthy to the healthiest product, the apple. On the other hand, however, the campaign has to be particularly strong to show any effect at all as the campaign has to turn the least favorable item, the apple, into the most attractive item.

Furthermore, we shortly discuss a campaign which deviates from our previous assumptions. Therefore, we assume that the available products are

$$\left\{ \left(\frac{iq}{n}, -\frac{iq}{n} \right) \middle| i \in \{\pm 1, \dots \pm n\} \right\}.$$

As before, the unhealthiest product $(q, -q)$ is *chocolate*, while the healthiest product $(-q, q)$ we denote *apple*. The product with the lowest positive health parameter, i.e., $(-q/n, q/n)$ we call *apple puree*, while the product with the highest negative health parameter, i.e., $(q/n, -q/n)$, we call *diet chocolate*.

First, we assume that the demoting campaign does not focus on a single product's attribute, but on the attribute of "containing sugar" or "being unhealthy," such that at the second stage the health aspect of all unhealthy items is salient. Then, in order to induce consumers to change their consumption decision, the information campaign has to have such an effect that the chocolate's valuation becomes negative (that is, the chocolate is assessed as a "bad"). Then, all unhealthy

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goods' final valuation is negative (where the valuation is the more negative the unhealthier the respective product is) even though prior to the campaign and according to third-stage valuations product $(jq/n, -jq/n)$ is preferred over $(iq/n, -iq/n)$ for $1 \le i < j \le n$. This prior ranking is reversed through the campaign if

$$\gamma_S \left(\frac{2\delta}{1+\delta} \frac{iq}{n} w - \frac{2}{1+\delta}(1-w)\frac{iq}{n} \right) + (1-\gamma_S)\left(w\frac{iq}{n} - (1-w)\frac{iq}{n} \right)$$
$$> \gamma_S \left(\frac{2\delta}{1+\delta} \frac{jq}{n} w - \frac{2}{1+\delta}(1-w)\frac{jq}{n} \right) + (1-\gamma_S)\left(w\frac{jq}{n} - (1-w)\frac{jq}{n} \right),$$

which holds if and only if

$$w < x_1 := \frac{1 + \delta + \gamma_S - \gamma_S\delta}{2(1+\delta)}. \tag{4}$$

Note that this condition is independent of i and j. Therefore, each consumer prefers, among the unhealthy products, either chocolate $(q, -q)$ or diet chocolate $(q/n, -q/n)$, but no intermediary good. The most preferred healthy good is in each case the apple puree $(-q/n, q/n)$. Furthermore, after the demotion campaign a consumer favors the most preferred healthy good, the apple puree, over chocolate if

$$\gamma_S \left(\frac{2\delta}{1+\delta} qw - \frac{2}{1+\delta}q(1-w) \right) + (1-\gamma_S)(wq - (1-w)q) < -w\frac{q}{n} + (1-w)q$$

or, equivalently,

$$w < x_2 := \frac{1 + \delta + n + n\delta + \gamma_S n - n\gamma_S\delta}{2(1+\delta)(n+1)}. \tag{5}$$

Third, a consumer chooses apple puree over diet chocolate if and only if

$$\gamma_S \left(\frac{2\delta}{1+\delta} \frac{q}{n} w - \frac{2}{1+\delta}\frac{q}{n}(1-w) \right) + (1-\gamma_S)\left(w\frac{q}{n} - (1-w)\frac{q}{n} \right) < -w\frac{q}{n} + (1-w)\frac{q}{n},$$

which is equivalent to

$$w < x_3 := \frac{2 + 2\delta + \gamma_S - \gamma_S\delta}{4(1+\delta)}. \tag{6}$$

We obtain the ordering $x_3 < x_2 < x_1$ for all $\delta \in (0,1)$, $\gamma_S \in (0,1]$ and $n \ge 2$. Therefore, consumers with $0 \le w \le 1/2$ consume apples. Consumers with $1/2 < w \le x_3$ prefer apple puree as they prefer apple puree to diet chocolate and diet chocolate to chocolate. Consumers

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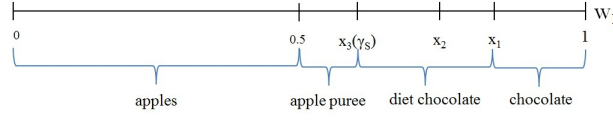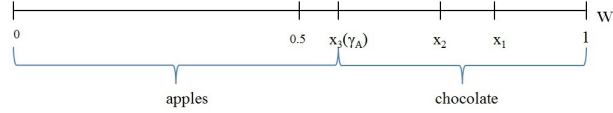Figure 1: *Consumption decision after unhealthy goods are demoted*

Figure 2: *Consumption decision after healthy goods are promoted*

with $x_3 < w \leq x_2$ consume diet chocolate as they prefer diet chocolate over apple puree and apple puree over chocolate. Consumers with $x_2 < w \leq x_1$ go for diet chocolate as they prefer chocolate to apple puree and diet chocolate to chocolate, whereas those with $w > x_1$ remain buyers of chocolate.

We compare these results to a campaign which promotes the healthiness of all healthy products, i.e., which makes all healthy goods' healthiness salient at the first stage. All consumers in C_I prefer chocolate over diet chocolate both before and after the campaign as the relative ranking between these products is unaffected by the campaign. Substituting γ_S in the equations above by γ_A, we obtain that consumers with $w < x_1$ prefer the apple over the apple puree. Subjects with $w < x_2$ prefer the apple puree over the diet chocolate, and subjects with $w < x_3$ prefer the apple over the chocolate and the apple puree over the diet chocolate. Consequently, people with $w \leq x_3$ consume apples, while consumers with $w > x_3$ go for chocolate.

Thus, without imposing *Assumption 1*, both campaigns have advantages and disadvantages (see Figure 1 and Figure 2). Fewer people change their consumption decision after the promotion campaign, but they immediately switch to the healthiest product, apples. After the demoting campaign, more people change their choice, however, not in favor of the healthiest product, but in favor of the compromising goods diet chocolate and apple puree.

Lemma 1. *Suppose a variety of n goods and two campaigns, which either (A) promote the healthiness of healthy products or (B) demote the unhealthiness of unhealthy products. The*

campaigns have two-fold effects. Campaign (A) induces less consumers, i.e., those with $w \leq$ $x_3(\gamma_A)$, to switch their choices; however, these people directly switch to the healthiest product. Campaign (B) makes more people, i.e., those with $w \leq x_1$, switch; however, they do not switch to the healthiest product, but to intermediary products.

Which campaign is more effective in raising overall health depends crucially on exogenous factors. Dropping the assumption of uniformly distributed consumer preferences, we observe that the demotion (promotion) campaign is more likely to be more effective if the variance of w is small (large). A small variance means that consumers' preferences for specific products are not very strong: the demotion campaign can induce these consumers to switch directly to the healthiest available alternative. If the variance, however, is large, many people have a strong preference for unhealthy goods. Here, it is more effective to demote these in order to make consumers aware of their bad impact on health. Even if consumers do not switch to the healthiest alternatives, the promotion campaign is more effective as it reaches those consumers which would be unaffected by the promotion campaign.

4.2 Further Attributes

In this extension, we incorporate a product's price as its third attribute. To assess salience for three attributes, we employ the more advanced model in Bordalo *et al.* (2012b). We assume that a consumer w's utility from consuming good $(q_{1t}, q_{2t}, -p)$, where q_{1t} denotes the tastiness, q_{2t} the healthiness and $-p_t$ the price, is given by

$$v(q_{1t}, q_{2t}, -p) = wq_{1t} + (1 - w)q_{2t} - p_t.$$

An attribute is the most (least) salient attribute if the discrepancy to the attribute's average value within the consideration set, as measured by a salience function σ, is the highest (lowest) among all three attributes. The additional multiplicative factor put on the most salient attribute is given by $3/(1 + \delta + \delta^2)$, on the least salient attribute by $3\delta^2/(1 + \delta + \delta^2)$ and on the attribute which is neither most nor least salient by $3\delta/(1 + \delta + \delta^2)$ (see Definition 2 in Bordalo *et al.*,

2012b). If two attributes are equally salient, the respective factors are averaged: if there is one least (most) salient attribute its additional factor is $3\delta^2/(1 + \delta + \delta^2)$(respectively, $3/(1 + \delta + \delta^2)$) and the additional factors on the other two attributes are $3(1 + \delta)/(2 + 2\delta + 2\delta^2)$ (respectively, $3(\delta + \delta^2)/(2 + 2\delta + 2\delta^2)$).

As in Section 2, there are two products, chocolate, $(q, -q, p_S)$, and an apple, $(-q, q, p_A)$, and we compare the apple's promotion campaign with a campaign demoting the chocolate. The former campaign renders the apple's healthiness salient at the second stage, while the latter campaign renders the chocolate's unhealthiness salient. At the next stage, however, health and taste are equally salient while the price may be the most or the least salient attribute of the products. However, in any case our results in Section 3 remain valid. In particular, the higher a campaign's persistence γ, the more effective is the respective campaign. Therefore, the campaign which demotes the chocolate remains more effective than the promotion of the apple.

4.3   Heterogeneity in Products' Attributes

Suppose attributes, but not goods are balanced, i.e., chocolate is given by vector $(q, -q')$ and the apple is described by vector $(-q, q')$ for $q, q' \in \mathbb{R}^+$.[12] Then, the information campaign's effect depends on the difference $q - q'$. If q' exceeds q, then both information campaigns are futile as the chocolate's unhealthiness and the apple's healthiness are salient at the third stage anyway. In that case, the location of the indifferent consumer is independent from the campaign's persistence γ. Thus, in the following, we assume that q exceeds q' such that at the third stage the attribute "tastiness" is salient. If the chocolate is demoted, then the chocolate's

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[12]Under this specification, we call attributes balanced as they take, on average, the same value (i.e., 0). Goods, however, are not balanced as the sum of attribute values differs among the goods, i.e. $q - q' \neq -q + q'$ as long as $q \neq q'$.

unhealthiness is salient at the second stage, so that the indifferent consumer w^S is obtained by

$$\gamma_S \left(\frac{2\delta}{1+\delta} q w^S - \frac{2}{1+\delta} q'(1-w^S) \right) + (1-\gamma_S) \left(\frac{2}{1+\delta} q w^S - \frac{2\delta}{1+\delta} q'(1-w^S) \right)$$
$$= -\frac{2}{1+\delta} w^S q + \frac{2\delta}{1+\delta} (1-w^S) q',$$

which gives

$$w^S = \frac{q'(\gamma_S + 2\delta - \gamma_S \delta)}{2\delta q' + 2q - \gamma_S \delta q' - \gamma_S q + q \gamma_S \delta + \gamma_S q'}. \tag{7}$$

In contrast, similar calculations show that the promotion of the apple gives the indifferent consumer's location at

$$w^A = \frac{q'(\gamma_A + 2\delta - \gamma_A \delta)}{2\delta q' + 2q - \gamma_A \delta q' - \gamma_A q + q \gamma_A \delta + \gamma_A q'}. \tag{8}$$

Due to $\gamma_S > \gamma_A$ (*Assumption 1*), the demotion of the chocolate is more effective, that is, $w^C > w^A$. The derivatives of w^A and w^S with respect to γ, to q and to q' yield the intuitive results that both campaigns are more effective, i.e., $C_I \backslash C_A$ is larger if γ is larger, if q is smaller or if q' is larger (c.p.).

If the symmetry is such that goods, but not attributes are balanced, that is chocolate is given by $(q, -q)$ and the apple is given by $(-q', q')$, then both goods are assessed rationally at the third stage as all good's attributes are equally salient within $C_2 := \{(0,0), (-q', q'), (q, -q)\}$.[13] The indifferent consumers under the two campaigns are given by

$$w^S = \frac{\gamma_S q + q' + q'\delta + q + q\delta - q\gamma_S \delta}{2(1+\delta)(q+q')},$$
$$w^A = \frac{\gamma_A q' + q + q\delta + q' + q'\delta - q'\gamma_A \delta}{2(1+\delta)(q+q')}.$$

Here, the demotion of the chocolate is not always more effective, which perfectly makes sense. If the healthiness of the apple is relatively large compared to the chocolate's unhealthiness, it is reasonable to assume that a promotion of the apple has a larger influence than a demotion of the chocolate as the chocolate's attribute values are rather unremarkable. In detail, we find that the

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[13]This follows from a salience function's homogeniety of degree zero; none of the chocolate's attributes is salient, $\sigma(q, q - q') = \sigma(-q, -q + q')$, and none of the apple's attributes is salient, $\sigma(-q', q - q') = \sigma(q', -q + q')$.

demotion of the chocolate is more effective than the promotion of the apple, $w^S > w^A$, if and only if

$$\frac{q\gamma_S}{q'\gamma_A} > 1.$$

If $\gamma_S = \gamma_A$, then the information campaign should focus on the product with the more extreme attributes. If $\gamma_S > \gamma_A$ (which we impose in *Assumption 1*), then q' has to be remarkably higher than q in order to make the promotion of the apple more effective than the demotion of the chocolate.

Lemma 2. *If attributes, but not goods are balanced, the demotion of the chocolate is more effective, i.e., $w^C > w^A$ as long as Assumption 1 holds. If goods, but not attributes are balanced, the demotion of the chocolate is more effective than the promotion of the apple ($w^C > w^A$) if and only if $q\gamma_S > q'\gamma_A$.*

4.4 Endogenizing the Campaign's Intensity

Whereas in the previous analysis we assumed that the campaign's intensity (measured by δ) is exogenous, here we endogenize the campaign's intensity by assuming that the government maximizes the population's healthiness minus the campaign's costs. A campaign's costs are increasing in its intensity $\delta_I \in [0, 1]$. We assume that a consumers' susceptibility to an information campaign, denoted δ, is increasing in the campaign's intensity and can be formalized as $\delta = 1 - \delta_I$. A subject's health is defined by the health parameter of the product she consumed. The indifferent consumer after a campaign which focuses on $t \in \{A, S\}$ is given by (3), where $w^t = w^t(\delta_I)$ depends on the campaign's intensity. Therefore, the population's overall health equals $H(\delta_I) := w^t(\delta_I)q + (1 - w_1^t(\delta_I))(-q)$. An information campaign's costs are assumed to be given by the strictly monotonic increasing and convex function $C(\delta_I) = \alpha\delta_I^2$ for some $\alpha \geq q$.[14]

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[14]We make the restriction of sufficiently high campaign costs, i.e., $\alpha \geq q$, to guarantee the existence of an inner solution of the maximization problem the government faces.

Given a campaign on product t, the government solves

$$\max_{\delta_I \in [0,1]} H(\delta_I) - C(\delta_I),$$

or, equivalently,

$$\max_{\delta_I \in [0,1]} \left(2q \cdot \frac{2 + 2(1 - \delta_I) - (1 - \delta_I)\gamma_t + \gamma_t}{4 + 4(1 - \delta_I)} - q - \alpha\delta_I^2 \right),$$

which yields the first-order condition

$$\frac{q\gamma_t}{(2 - \delta_I)^2} = 2\alpha\delta_I. \tag{9}$$

This equation has a unique solution $\delta_I^* \in [0, 1]$.[15] Reasonably, δ_I^* is increasing in the persistence γ_t.[16] Straightforward computations yield that for a fixed cost function the larger q (provided $\alpha \geq q$), the larger the respective equilibrium campaign intensity is.

To sum up, the unhealthier the product is and the more persistent valuations evoked by the campaign are, the more the government will spend on the campaign. If *Assumption 1* holds, the government will spend more on a campaign demoting the chocolate than on a campaign promoting the apple. The following lemma summarizes the results.

Lemma 3. *If a campaign's intensity is endogenous, the government will invest more in a demotion than in a promotion campaign as long as Assumption 1 holds. Furthermore, a campaign's intensity increases in the chocolate's unhealthiness and in the valuation-persistency.*

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[15]Consider $H'(\delta_I) = \frac{q\gamma_t}{(2-\delta_I)^2}$ and $C'(\delta_I) = 2\alpha\delta_I$. Since both functions are strictly monotonically increasing, continuous, convex and $H'(0) > C'(0)$, but $H'(1) \leq C'(1)$, and $H''(\delta_I) = \frac{2q\gamma_t}{(1-\delta_I)^3} < 2q\gamma_t \leq 2q \leq 2\alpha = C''(\delta_I)$ for $0 \leq \delta_I < 1$, the solution to Equation (9) exists and is unique.

[16]Note first, that the function $\delta_I(2 - \delta_I)^2$ is strictly monotonic increasing on $[0, 2/3)$. Denote by $\delta_I(\gamma_t, \alpha, q)$ the equilibrium campaign intensity given by (9). We obtain $\cup_{\gamma_t \in [0,1]}\{\delta_I^*(\gamma_t, 1, 1)\} \subseteq [0, \hat{\delta}]$ for $\hat{\delta} = 4/3 - 2/3(\sin(\phi + \pi/6) + \sin(-\phi + \pi/3)\sqrt{3}) \approx 0.14$ with $\phi := 1/3 \arctan(\sqrt{999/25})$. Provided $\alpha \geq q$, we obtain $\cup_{\gamma_t \in [0,1]}\{\delta_I^*(\gamma_t, \alpha, q)\} \subseteq \cup_{\gamma_t \in [0,1]}\{\delta_I^*(\gamma_t, 1, 1)\}$, so that for $0 \leq \gamma_t^1 < \gamma_t^2 \leq 1$ the respective equilibrium campaign intensities fulfil $\delta_I^*(\gamma_t^1, \alpha, q) < \delta_I^*(\gamma_t^2, \alpha, q)$.

5 Conclusion

We apply the theory of salience (Bordalo *et al.*, 2012a,b; 2013) to the current debate in consumer policy how to shift demand from unhealthy (chocolate) to healthy (apple) food. The government may initiate an information campaign which either stresses one product's unhealthiness (*demotion campaign*) or emphasizes the other product's healthiness (*promotion campaign*). Under the influence of the campaign, people undervalue the chocolate due to its pronounced unhealthiness or overvalue the apple due to its emphasized healthiness. Later on, confronted with all available alternatives, consumers assess products rationally. A good's final valuation, however, is a convex combination of its previous valuations such that the promotion of the apple leads to an overall overvaluation of the apple, whereas the demotion of the chocolate causes a final undervaluation of the chocolate. Consequently, both campaigns reduce the share of unhealthy diets by making some people switch to apples.

Whereas both campaigns work, the campaign focusing on the chocolate's downsides is more effective. Consumers's actual preferences determine their consumption history, and consumption experience makes consumers familiar with the respective product, i.e., with chocolate or the apple. Crucial is our assumption that people are more susceptible toward information on goods they are familiar with and which they have consumed in the past. Thus, the effect of the campaign is larger if it focuses on that product which has been consumed by the target audience in the past. Thus, for people who have consumed chocolate, the demoting campaign's adverse effect on the valuation of chocolate outweighs the promotion campaign's positive effect on the valuation of apples. It remains for future research to investigate the relative effectiveness of promoting and demoting campaigns empirically.

Our results are applicable to the realm of comparative advertising in two-product markets. In particular, they yield very different results for new and for established markets.[17] Consider

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[17]There is a broad literature analyzing the effect of counteradvertising and comparative advertising (for an empiricial investigation see Zucker *et al.*, 2000, 2001; for an experimental investigation, see Gorn and Weinberg, 1984). However, findings were mixed (see Muehling *et al.*, 1989; Pechmann and Stewart, 1990).

a firm which engages in advertising in order to gain market share. According to our model, the demotion of the competing product may be more successful than the promotion of the own good's advantages. However, this finding relies on the assumption that people are familiar with one product of the market. If people do not have a consumption history, then there is no difference in both campaign's effects. The demoting advertisement has a relatively large effect only on those consumers who are used to consuming the rival product. A comparative advertisement campaign focusing on the rival products' downsides may be particularly successful in established markets, in which an incumbent firm or a new entrant intends to gain market share by making consumers switch. This is practiced, for instance, on the German market for giro accounts, where entrant firms advertise the incumbent firms' high prices. However, on new markets, where consumers are not familiar with some product, both advertisement campaigns are equally successful. In all cases, such campaigns are most efficient which could combine features of both benchmark campaigns, i.e., which proclaim the own product's upsides and the rival's product's downsides.

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