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The effect of attribute framing on consumers' attitudes and intentions toward food: A Meta-analysis

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Abstract. This paper analyzes the existing literature on the effect of attribute framing on consumers' attitudes and intentions with regard to food products. Attribute framing includes a broader interpretation of gains and losses when a product attribute is presented in a dichotomous way, such as fat vs. lean or harm vs. benefit. Meta-analysis results for the whole sample indicate that product attributes framed as gains have a higher effect on attitudes and intentions than product attributes framed as losses. Grouping studies by outcome variables, the meta-analysis demonstrates a larger effect size for studies that assess consumer attitude while for studies dealing with consumer intention, the effect size is close to zero and insignificant. We observe from the meta-regression results that the gain frame, the use of interaction terms, a specific product, and a student sample significantly influence consumers' attitudes and intentions.

Keywords: attribute framing, food products, meta-analysis.
JEL codes: D91, I12.

INTRODUCTION

The framing effect shows that decisions depend on the way in which outcomes are presented. In their seminal contribution, Kahneman & Tversky (1979) developed the prospect theory that serves the analysis of decisions under risk. According to the evidence they accumulated, choices depend on the gains and losses compared to the current situation rather than to absolute outcomes and the theory postulates that people dislike negative characteristics associated with a choice more than they value positive aspects. That is, the value function in prospect theory is S-shaped and steeper for losses than for gains, meaning that displeasure from a loss is stronger than the pleasure from an equivalent gain (see Figure 1) (Kahneman & Tversky, 1979). Thus, people choose differently depending on which characteristic of the choice is emphasized – gains or losses. This discrepancy creates a framing effect initially introduced in Kahneman and Tversky's 1981 paper with an example of an Asian disease (Kahneman & Tversky, 1981). In the exam-

ple, participants of the experiment are confronted with the following problem: "Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the program is as follows". Then, participants in one group are presented with choices A and B: "If Program A is adopted, 200 people will be saved. If Program B is adopted, there is a 1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved". And participants in another group are presented with the choices C and D: "If Program C is adopted 400 people will die. If Program D is adopted there is a 1/3 probability that nobody will die, and 2/3 probability that 600 people will die". The choices in the original experiment were distributed as follows: Program A – 72%, program B – 28%, program C – 22%, program D – 78%. Results of the experiment demonstrated that the choice of the program depends on how the outcome is described, in terms of losses (deaths) or gains (survivals), and that people prefer risky outcomes when it comes to losses and certain outcomes when it comes to gains – an effect called loss aversion.

The framing effect serves as a means to describe decision anomalies where people seem to deviate from consistent choice behavior because of various framings of outcome, context and goal. Presenting or communicating attributes of products in diverse ways came to be referred to as attribute framing, and presenting the goal of behavior in diverse ways – as goal framing (Levin et al., 1998). In this study we are particularly interested in attribute framing and thus goal framing is not discussed any further.

Although the framing effect was initially applied to explain decisions under risk, its meaning extended since then to broader interpretations, for example, when meat is presented as lean or fat (Figure 1) (Levin et al., 1998). The concept has, according to some, subsequently come to embody a widely understood, generic definition that stands for the conflicting reactions to information presented in disparate ways (Braun et al., 1997). Several authors stretched the definition and study concepts to merely positive versus negative, strengths versus risks, or even more versus less information framing (Levin et al., 1998). The framing effect has been studied in various fields, including medical decisions, auditing evaluations, public health, environmental valuation, marketing, and consumer choice (Levin et al., 1998; Rothman & Salovey, 1997; Jin & Han, 2014; Kragt & Bennett, 2012; Svenningsen & Thorsen, 2021).
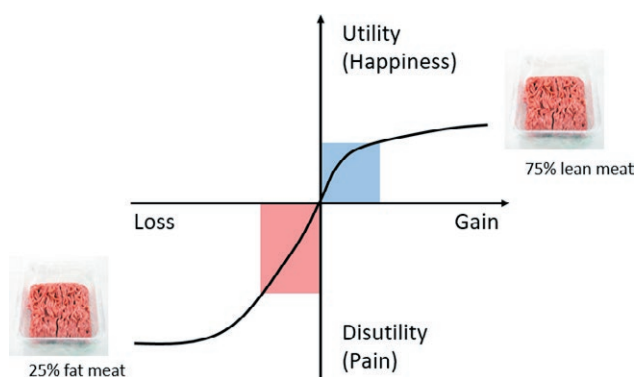
When applied in a marketing context, attributes are often not presented in bipolar, dichotomous ways and emphasize certain aspects to make them salient. For example, the benefits of meat substitutes that are framed in terms of "societal benefits", "high tech", and "same meat" in persuasive appeals are considered as attribute framing (Bryant & Dillard, 2019). Different from risk framing or goal framing which represents loss and gain associated to an expected outcome, attribute framing selects an attribute of a product and describes it in a dichotomous way, such as fat vs. lean, tax vs. offset, and harm vs. benefit. Attribute framing, which is usually delivered in the forms of labels, advertisement, and communications, has considerably influenced people's choice preferences. For example, people are willing to pay more for a burger described as 75% lean than one described as 25% fat (Levin & Gaeth, 1988). They show a higher preference for 80% fat-free chocolate compared to 20% fat chocolate (Braun et al., 1997).

In the area of health-related decisions, framing of the choice outcomes provided some controversial results. Rothman & Salovey (1997) examined a number of framing studies related to the public's health-related decision-making and found evidence of framing effects in hypothetical choice situations. They concluded that the effectiveness of choice frames depends on the illness-detecting or health-affirming function of a message. Gallagher & Updegraff (2012) in their study of message framing in health communication, found that gain-framed messages are more effective in encouraging prevention behaviors than loss-framed messages. Two subsequent meta-analyses of messages regarding disease prevention behaviors also demonstrated conflicting results. O'Keefe & Jensen (2007) reported that the persuasiveness in disease-prevention communication is higher for gain-framed messages than for loss-framed messages. However, their behavior-specific meta-analysis in 2009 reported

Figure 1. Lean-fat framing of meat products with regard to gain-loss framing.

that loss-framed messages are slightly but significantly more persuasive than gain-framed messages (O'Keefe & Jensen, 2009).

Food choices can be associated with potentially negative consequences for health including the development of obesity and other non-communicable diseases. Public policy interventions that attempt to influence consumer choices in the food domain use different communication methods to inform consumers about potentially damaging consequences of consuming certain kinds of foods. Communicating the nutritional properties of foods can take the form of attribute framing. In this case, product attributes are described in two different ways: a) by emphasizing positive characteristics (e.g., dietary fibers and vitamins), or b) by presenting negative characteristics of foods (e.g., sugar and fat). The effectiveness of different communication strategies is typically measured in the form of consumer behaviors, intentions, or attitudes (Gallagher & Updegraff, 2012).

This paper aims to provide a systematic review of the use of gain-loss attribute framing on food products. We want to investigate and quantify the extent to which other external factors affect the overall framing effect on people's food choices across different countries. We are specifically interested in what kind of framing results in more positive consumer attitudes and increased intention to purchase healthy and environmentally friendly food products. Although our initial approach suggested the inclusion of studies with actual behavior as an outcome, no such studies were identified through our search. We perform a meta-analysis to determine the effectiveness of a gain vs. loss framing and then use a meta-regression to explore study heterogeneity. The remainder of the paper is organized as follows. It starts with a detailed walkthrough of how the literature for the systematic meta-analysis is collected and selected. The next part presents the methods employed to code the data and build the final data frame for analysis. The result section includes the meta and regression analysis results. The major findings and noteworthy points are discussed in the following discussion section and the paper concludes.

METHOD

A systematic screening of existing literature was first performed to collect and analyze published articles in peer-reviewed journals and conference proceedings via four academic search engines (ScienceDirect, Web of Science, EBSCO host, and AgEcon Search), followed by additional random searches on Google Scholar, resulting in a final set of 25 articles published between 1987 and May 2021. The procedure of publication collection and selection is shown in Figure 2.

Given the broad coverage and the various terms associated with the topic, we used a long Boolean search query with an intersection set of "framing", "food", and a union set of "consumer behavior", "consumer decision making", "consumer choice", "consumer preference", "consumer perception", "consumer willingness to buy", "consumer willingness to accept", "consumer willingness to pay", "consumer buying behavior", "consumer purchase intention", and "consumer buying intention". Then, the abstract of each article was first examined in order to include only those articles that cover attribute framing in the food domain. We also set conceptual boundaries to only incorporate dichotomous framings (i.e., promotion vs. prevention, harm vs. benefit) on food choices. In other words, framing effects on other consumer behaviors related to food, such as food-wasting, recycling, and so on, were not considered relevant. Furthermore, to systematically analyze the effect sizes of the main intervention (bipolar framing) and other explanatory factors, we needed the mean and standard deviation of each data point. Hence, we excluded studies that did not report the means of the dependent variables and whose standard deviations of dependent variables are not computable from the information being reported. The final collection of studies included in this review is listed in Table 1.

In preparation of the data, besides extracting means and standard deviations, we also target variables that have been reported to influence consumers' behaviors in the existing systematic reviews in the food realm. The literature review on vegetable consumption by Nørnberg et al. (2016) revealed that an overall main effect might not display. The domain- and individual-specificities of the
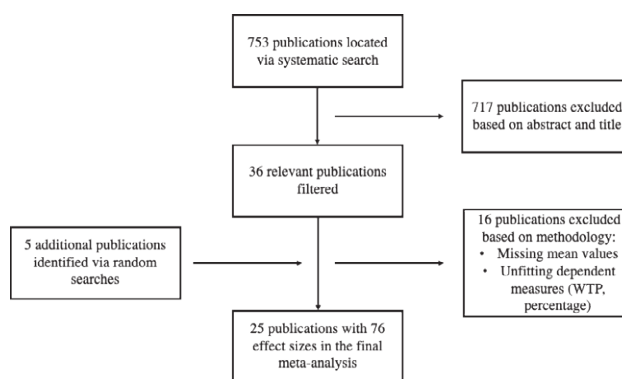

Figure 2. Flowchart of publication gathering and selection process for the meta-analysis

Table 1. Products and attributes of the studies included in the analysis (by year of publication)

N	Author(s) (year)	Product	Attribute	Interaction
1	Levin, I. (1987)	Ground beef	Lean/fat	N/A
2	Levin, I., Gaeth, G. (1988)	Ground beef	Lean/fat	N/A
3	Loke, W.H., Lau, S. (1992)	Hamburger patty	Non-fat/fat	N/A
4	Braun, K. et al. (1997)	Milk chocolate bar	Fat-free/fat	Gender: female vs. male
5	Van Assema, P. et al. (2001)	Low-fat diet/fruits and vegetables	Positive/negative consequences	Dietary behavior: fat vs. fruit & vegetables
6	Levin, I. et al. (2002)	Ground beef	Lean/fat	N/A
7	Orth, U. et al. (2007)	Apples, bottled water	Positively/negatively framed advertisements	Nation
8	Kees, J. (2011)	Healthy/unhealthy food	Advantages/disadvantages of healthy/unhealthy foods	Regulatory focus: promotion vs. prevention; Time orientation: present vs. future
9	Van't Riet, J. et al. (2013)	Fast food	Nutrition information	N/A
10	Jin, H.J., Han, D.H. (2014)	Beef tallow/cow milk	Food safety	Prior knowledge: low vs. high
11	Abrams, K. (2015)	Chicken products	Environmental benefits, animal welfare	N/A
12	Bosone, L. et al. (2015)	Healthy diet	Vitamin and nutrient content	Regulatory focus: promotion vs. prevention
13	Chang, M.-C., Wu, C.-C. (2015)	Organic food	Environmental benefits	Environmental motivation: low vs. high
14	de Bruijn, G.-J. et al. (2015)	Fruit	Fruit intake benefits	Descriptive majority norm: low intake vs. high intake
15	Yan, C. (2015)	Junk food	Advantages/disadvantages of junk food	Attitudinal ambivalence: univalent vs. ambivalent
16	Britwum, K., Yiannaka, A. (2016)	Beef products	E.coli vaccination	Media story: included vs. not included
17	Chen, M.-Y. (2016)	High-fiber oat milk	Health benefits	Self-construal: independent vs. interdependent; Temporal construal: proximal vs. distant
18	Koenigstorfer, J., Baumgartner, H. (2016)	Trail mix	Dietary permitted or dietary forbidden	Fitness label: included vs. not included; Dietary restraint: with vs. without; Gender: female vs. male
19	Tran, V. et al. (2016)	Food products	Benefits/risks of nanotechnology	N/A
20	Hilverda, F. et al. (2017)	Organic food	Advantages/disadvantages of organic foods	Interaction partner: expert vs. peer vs. anonymous
21	Lundeberg, P. et al. (2018)	Variety of food products	Healthfulness	N/A
22	Kuo, K. et al. (2019)	Fat-free yoghurt, ice cream	Advantages/disadvantages of yoghurt/ice cream	Food categorization: virtue vs. vice; Regulatory focus: promotion vs. prevention
23	Vidal, G. et al. (2019)	Snack food	Nutrition information	N/A
24	Cui, H.J. et al. (2020)	Ethnic foods	Advantages/disadvantages of ethnic foods	Regulatory focus: promotion vs. prevention
25	Shan, L. (2020)	Organic food	Benefits/losses of buying organic food	Price anchor: low vs. high; Product knowledge: low vs. high

persuasive effect of loss vs. gain framing are often considered, especially in the food domain (Britwum & Yiannaka, 2016). Due to the lack of evidence of the general effectiveness of the framing effect on consumers' food choices, we decided to also look into other covariates.

Frewer et al.'s (2013) systematic review and meta-analysis on genetically modified (GM) food choices suggests that the food type and consumers' geographic region affect the acceptance and prevalence of GM food. In Lusk et al.'s (2005) and Dannenberg's (2009) meta-analysis studies

on the valuation of GM food, it was found that geographic location of study and food product characteristics significantly influence the percentage premium that participants are willing to pay for non-GM foods. In addition, a meta-analysis on consumer's willingness to pay for farm animal welfare indicated a significant effect of socio-economic characteristics of participants (Lagerkvist & Hess, 2011). Therefore, our study considers covariates including sample characteristics, geographic location, product characteristics, means of presentation, and control for types of dependent measures

The following final list of variables were extracted from the studies: authors and year of publication, product and attribute in question, sample size, treatment type, means and standard deviations of the dependent variable, if the study included interaction terms, the type of attribute communication, if the study was conducted on a student sample, and if it was conducted online. Table 2 provides an overview of the variability of products and attributes included in the analysis for the whole sample and for the studies on attitudes and intentions. Broadly, the studies discussed attributes related to different health and sustainability issues. Health aspects framed in terms of gains and losses included nutritional information and food safety. Sustainability aspects included environmental benefits, animal welfare, and organic and ethnic foods. The sample sizes of studies included in the analysis differed between 25 and 433, with 32% of studies having

a sample size of less than 100 participants. We observed an almost equal distribution of studies on variables such as the use of frames, outcome variables, interaction terms, specific products, and student samples. Thirty-two percent of studies were conducted in the USA, 13% used product labels as means of attribute communication; and 30% of the studies were conducted online.

To determine the overall effect of gain vs. loss attribute framing, we performed meta-analysis, using means and standard deviations obtained from the studies. Missing standard deviations are a common problem in meta-analysis. We employed the computational method recommended by the *Cochrane Handbook for Systematic Reviews of Interventions* (Higgins & Green, 2011), which enables the calculation of missing standard deviation from the reported t-value and difference in means according to the following formula:

$$\sigma = \frac{Difference\ in\ Means\ (DM)}{t} \qquad (1)$$

To explore between-study heterogeneity, we used mean values of attitudes and intentions as a dependent variable (Table 2). Attitudes and intentions measured on a 7-point Likert scale are included directly. When the outcome variable in a study was measured on a 5-point Likert scale, the values were rescaled to the 7-point scale. We use the following random-effects model:

Table 2. Definitions and means and standard deviations of variables included in the analysis.

Variable	Definition	Mean (standard deviation)		
		Whole sample N=76	Attitude N=40	Intention N=36
Mean (dependent variable)	Mean values of attitudes and intentions on a 7-point Likert scale	4.40 (0.86)	4.64 (0.64)	4.12 (0.99)
Frame	1 - gain frame, 0 - loss frame	0.50 (0.50)	0.50 (0.51)	0.50 (0.51)
USA	1 - if the study is conducted in the USA, 0 - otherwise	0.32 (0.47)	0.50 (0.51)	0.11 (0.32)
Outcome	1 - attitude, 0 - intention	0.53 (0.50)		
Interaction	1 - interaction term, 0 - no interaction	0.51 (0.50)	0.48 (0.51)	0.56 (0.50)
Product	1 - specific product, 0 - product category	0.53 (0.50)	0.75 (0.44)	0.28 (0.45)
Label	1 - label is used, 0 - other communication forms	0.13 (0.34)	0.25 (0.44)	0.00 (0.00)
Student	1 - student sample, 0 - other	0.50 (0.50)	0.45 (0.50)	0.56 (0.50)
Online	1 - online study, 0 - other	0.30 (0.46)	0.33 (0.47)	0.28 (0.45)

$$Mean_i = \beta_0 + \beta_1\ Frame_i + \beta_2\ USA_i + \beta_3\ Outcome_i$$
$$+\ \beta_4\ Interaction_i + \beta_5\ Product_i + \beta_6\ Label_i + \quad (2)$$
$$\beta_7\ Student_i + \beta_8\ Online_i + u_i + \varepsilon_i$$

where $Mean_i$ is the mean value of attitudes and intentions elicited from the studies. The two error terms are $u_i \sim N(0,\tau^2)$, where τ^2 is the between-study variance, and a normally distributed $\varepsilon_i \sim N(0,\tau^2)$.

RESULTS

We used the random-effects model to analyze the effect sizes due to the high heterogeneity across participants' characteristics and methodologies in selected studies. The user-written package "metan" in Stata 13 was employed. The forest plot resulting from meta-analysis is presented in Figure 3. The overall effect indicated by the standardized mean difference (SMD) is positive and significant, indicating that the gain frame results
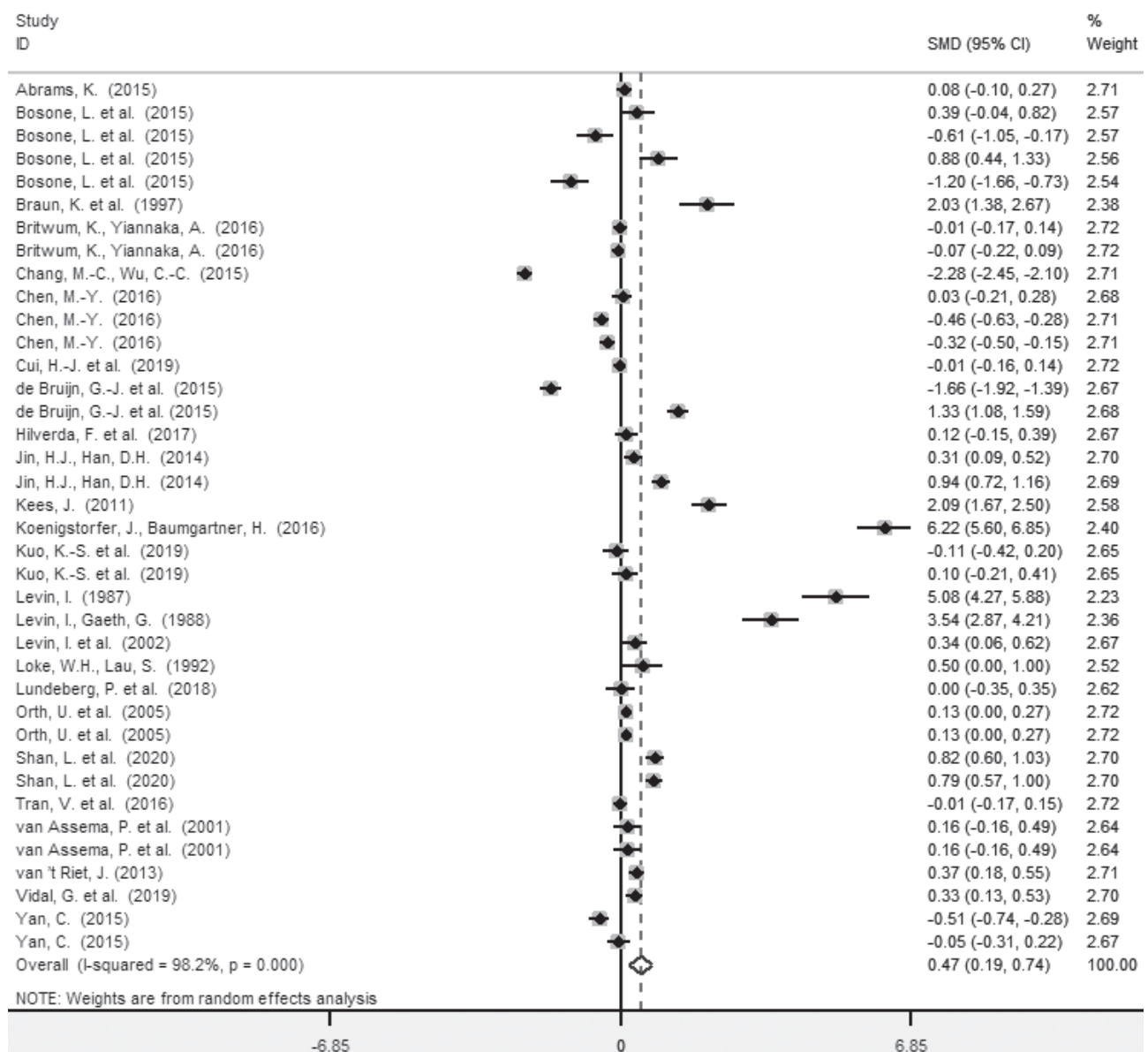

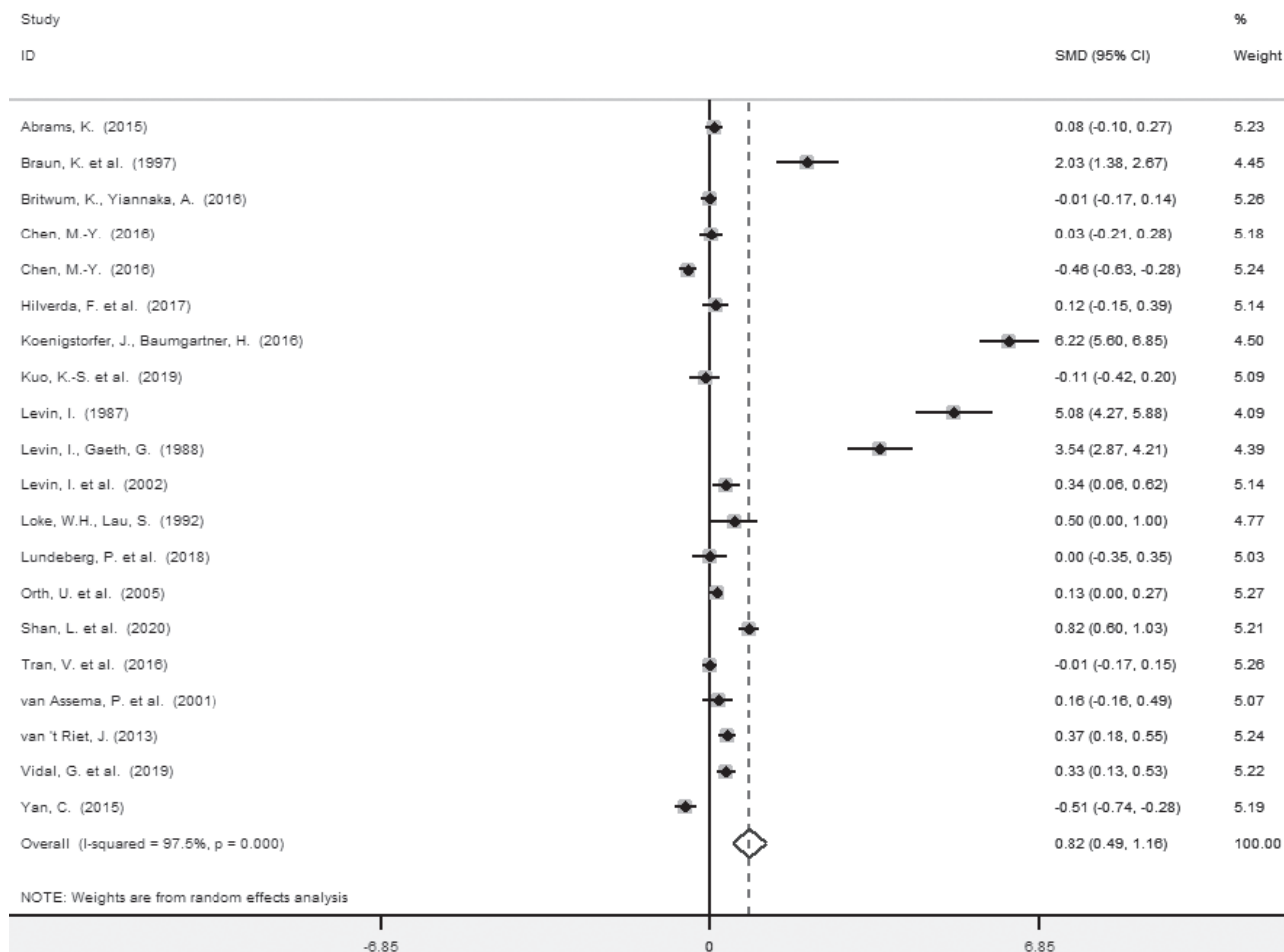**Figure 3.** Meta-analysis results (whole sample).

Figure 4. Sub-group meta-analysis results for attitude.

in higher attitudes and intentions than the loss frame. Along with the effect sizes, the meta-analysis reports a measure of study heterogeneity which is attributed to variability in the treatment effect rather than to variation in sample sizes (Higgins & Thompson, 2004). Results demonstrated $I^2 = 98.2\%$, which calls for further investigation into the studies' heterogeneity via a meta-regression and a sub-group analysis (Higgins & Green, 2011). The results of a sub-group meta-analysis showed a larger effect size for studies that assess consumer attitude (Figure 4) than for studies dealing with consumer intention where the effect size is close to zero and insignificant (Figure 5). Also, the variation of the effect sizes for studies that measure consumer intention is considerably bigger than those that measure consumer attitudes. Whereas a majority of the data points from the attitude subgroup lie on the side favoring the gain framing, the data points from the intention subgroup tend to spread out more evenly.

We used a meta-regression specifically designed for meta-analyses (Harbord & Higgins, 2008), which estimates the between-study variance and coefficients using weighted least squares. Stata 13 package "metareg" was used for the estimation. We analyzed the whole sample and then split it into separate estimations for attitudes and intentions. The list of explanatory variables together with coefficients and standard errors is provided in Table 3.

For the whole sample estimation, residual variation due to heterogeneity equaled 17.84%, while the included covariates explained 72.32% of the between-study variance. The I^2 value of 17.84% can be considered as a low level of heterogeneity, according to the classification in Higgins et al. (2003). We observed from the results of this regression that the gain frame, the use of interaction terms, a specific product, and a student sample significantly influence consumers' attitudes and intentions. A gain frame increases consumer attitudes and intentions towards food products with health and environmental
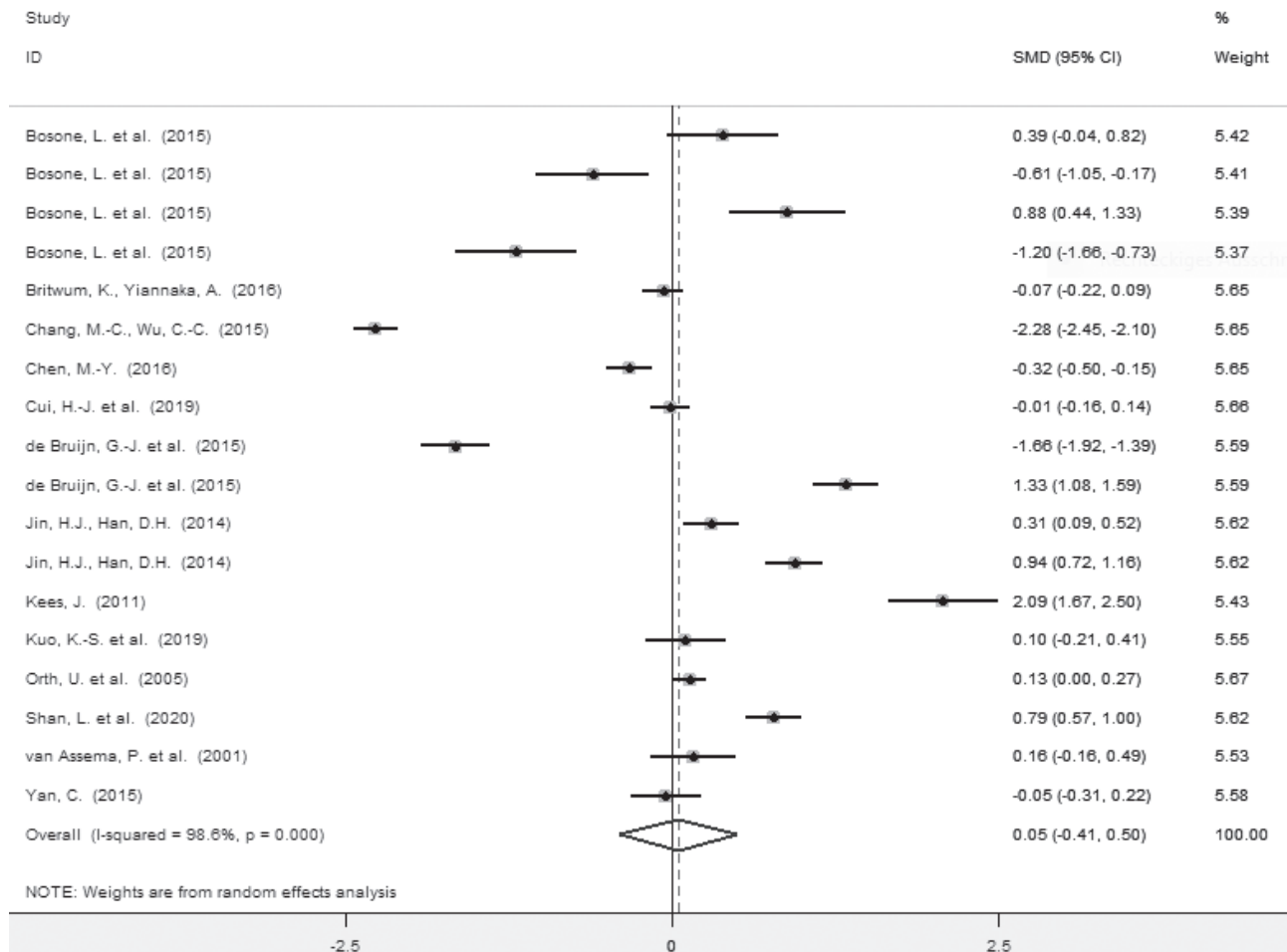
Figure 5. Sub-group meta-analysis results for intention.

benefits. When we split our sample into two sub-groups, depending on whether the papers included investigating attitudes or intentions, we observed that the gain frame is significant for attitudes but not for intentions. Interestingly, the location of the study in the USA has a different effect depending on the outcome variable. When it comes to consumer intentions, the use of an US sample increases the mean value. On the contrary, attitudes decrease when the study is not conducted in the US. The use of interaction terms positively influences the outcome variable; however, this effect is mainly attributed to the studies about consumer intentions. Unlike more general product categories, specific products negatively affect the attitudes to purchase food products with health and environmental benefits. The use of a student sample is marginally significant in the regression for the whole sample; however, this result does not replicate when the sample is split. The use of labels to communicate health and environmental benefits to the consumers

is positively associated with consumer attitudes. Studies conducted online increase consumer intention to purchase food products; however, the strength of the association is marginal.

DISCUSSION

Our results demonstrate that when it comes to food products, the use of gain frames elicits stronger responses from consumers than the use of loss frames. Previous research has already indicated that encouraging positive behaviors by evoking loss aversion is not necessarily a guiding principle when it comes to health and environmental benefits (Gallagher & Upbegraff, 2012), especially in the domain of attribute framing. Loss-framed messages are mainly effective when it comes to decisions involving significant risk. Food choices usually serve an illness/environmental harm prevention function and are

Table 3. Results of the meta-regression[1].

Variables	Coefficients (std. err.)		
	Whole sample N=76	Attitude N=40	Intention N=36
Frame	0.27 (0.13)**	0.51 (0.09)***	-0.01 (0.09)
USA	0.10 (0.20)	-0.74 (0.20)***	1.01 (0.34)***
Interaction	0.30 (0.14)**	-0.18 (0.14)	0.33 (0.14)**
Product	-0.32 (0.18)*	-0.93 (0.46)*	-0.09 (0.44)
Label	0.30 (0.20)	0.59 (0.12)***	---
Student	-0.57 (0.31)*	-0.02 (0.45)	-0.71 (0.55)
Online	0.28 (0.29)	0.83 (0.51)	0.88 (0.49)*
Intercept	4.60 (0.30)***	5.27 (0.41)***	4.14 (0.51)***
Adj. R^2	72.32%	100.00%	98.74%
τ^2	0.07	0.00	0.00
I^2	17.84%	0.00%	0.00%

*, **, *** denotes significance at 0.10, 0.05, and 0.01 level, respectively.

[1] In meta-regression R2 indicates the percentage of between-study variance explained by the covariates. The value of 100% indicates that the effect size does not vary substantially across studies.

not associated with an immediate high level of risk (Gallagher & Upbegraff, 2012).

As expected and congruent with existing literature, both types of framing (gain vs. loss) and interaction factors significantly influence the effectiveness of framing overall. Interestingly, the effect of interaction variables is only demonstrated in intentional but not attitudinal measures, whereas it is the opposite for the effect of types of framing. In other words, there is a main overall effect from the framing intervention on people's attitudes toward food choices, but the main effect of the intervention on people's intention does not manifest. The significant change in people's intention of food choices is determined by various moderators, such as individual food product knowledge, regulatory focus, temporal construal, and so on. One possible explanation, according to both the Theory of Reasoned Action (TRA) and the Theory of Planned Behavior (TPB), is that all potential external influential factors on intentions and behaviors are thought to be mediated by the attitudes and subjective norms, plus perceived behavioral control for TPB (Ajzen & Fishbein, 1980). Therefore, it is sensible that, as an antecedent factor of intentions, attitudes are more malleable and directly influenced by external interventions than intentions. The effectiveness of framing in changing people's intentions is more scenario- and individual-specific, which is explained by different interaction terms.

Consumer attitudes based on beliefs and values often surpass specific products (Purhoit, 2012). When it comes to product categories, like fast food or organic food, consumers tend to express their attitudes more readily than when it comes to specific products and labels. As consumers often lack specific knowledge about health and environmental benefits (Vermeir & Verbeke, 2006), it is easier for them to express their preferences in terms of general product categories.

The use of labels as means of conveying the attribute framing compared to other communicative vehicles, such as advertisement and text-based marketing messages, shows a significant increment in people's attitudes toward making wiser (be it healthier or more environmentally conscious) food choices. It demonstrates that labels employing few words and visuals that concisely communicate the benefits of healthier or more environmentally friendly food (or the harms of the opposite) are more effective in influencing people's attitudes toward that food. One possible explanation is that consumers are used to obtaining information about food from labels. Therefore, they are more fluent in processing information presented with labels.

Looking at the studies in the meta data by year reveals how the application of attribute framing to food consumption has been gaining research attention and interest. Before 2000, the literature on the framing effect related to food choices was, albeit influential, sparse. Studies in this domain increased considerably after 2010, in terms of both number and diversity. It was only until recently that researchers mostly focused on how framing could be utilized to influence people's food choices for the purpose of nutrition and health. Three decades after the initial study of the framing effect on food choices, topics have been broadened to cover environmental impact, animal welfare, livestock vaccination, nanotechnology, and so on. The origins of the studies also expanded from the United States to the rest of the world and changed from studies based on student samples to more demographically representative ones. The demographical and topical variability enabled examining other factors that influence the effect of attribute framing on food choices.

The benefits and harms resulting from different food choices are not immediate and consequential compared to other decision-making tasks where decisive influences from attribute framing on people's judgements and decisions have been described, e.g., in lottery and medical treatment decisions. According to temporal discounting theories, people are less sensitive to the losses and gains that manifest themselves later in time. Health-benefiting and pro-environmental decisions are typically intertemporal decisions. The disutility that people perceive to experience in the future from eating unhealthy food

now does not outweigh the utility or gratification (sensory or hedonic pleasure) they gain in consuming indulgent food (i.e., high fat and sugar). Similarly, the future negative consequences of consuming ecologically unsustainable foods are not perceived to be strong enough to counteract people's predilection for easily accessible, affordable food, which might carry high environmental costs (e.g., greenhouse gas emission and water consumption). Therefore, people are not motivated to avoid those foods that are unfavorable in the long term from a utilitarian perspective. When a time dimension is taken into consideration, people's perception of gain versus loss might not accord with prospect theory.

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