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The Effects of Framing on Consumers' Choice of GM Foods

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In this article, we explore the effect of framing statements on perceptions and choices of genetically modified vegetables (GMVs). In two experiments, consumers were exposed to either positive or negative statements about GMVs; asked to indicate the extent to which they agree or disagree with these statements; and, finally, choose between genetically modified (GM) and conventionally grown vegetables. We show that consumers are affected quite easily by the framing (positive/negative) of statements.

The results of our experimental survey suggest that framing affects the perceptions of GM technology, the weight given to health benefits versus taste, and likelihood of selecting GM bell peppers (a hypothetical product). In particular, the results suggest that negative framing of the properties of biotechnology not only affected perception but also increased the weight assigned to health and decreased the weight assigned to taste. We further show that the main effects of knowledge and non-negative perceptions of the contribution of GM products to health increased consumers' willingness to purchase GM bell peppers. Environmental and moral considerations were found to have little impact on GM selection, and gender was insignificant.

The actual choice of GM versus non-GM bell pepper was significantly affected by price. Negative framing tends to reduce the likelihood of choosing GM and positive framing tends to increase it. The last point suggests that wording and presentation of a genetically modified trait matter.

The concluding insights may help policymakers in formulating their campaigns aimed at increasing adoption of GM technology, which has the potential to solve food scarcity and nutritional deficits.

Key words: food, gender, genetically modified.

Introduction

There is a large body of evidence showing that consumers prefer conventional food to GM food (Gaskell, 2006; Gaskell et al., 2004). It is reflected by significant discounts that express consumers' willingness to accept (WTA) GM products instead of traditional products. Conversely, the predisposition of GM as hazardous to humans and the environment, as well as a lack of understanding its benefits (with the exception of lower production costs), caused consumers to express their willingness-to-pay (WTP) premium price for food labeled "GM free" (Lusk & Coble, 2005) or "organic" even if, in terms of food safety, products labeled as such have not been proven safer. Since these dispositions are usually not strongly grounded, then if the risk is not very high, a price discount will sway some consumers to choose GM food products over traditional food products (Huffman, Rousu, Shogren, & Tegene, 2004). If the perceived risk of genetic modification is high or the discount is low (and vice versa), then consumers may prefer GM-free food products (avoid GM food products). Exposure to tendentious information (Rousu, Huffman, Shogren, & Tegene, 2007), along with fear and resistance to "earth-changing innovation" (Slovic, Fischhoff, & Lichtenstein, 1980), form a negative predisposition toward GM food products (Gaskell, Bauer, Durant, & Allum, 1999; Poortinga & Pidgeon, 2004; Townsend & Campbell, 2004).

Consumers are heterogeneous and their willingness to trade risk and income *with respect to GM food* varies significantly as evidenced by studies on consumer choice of GM food. These studies found that consumer choice is a function of education and knowledge (Costa-Font, Gil, & Traill, 2008), culture (McCluskey, Grimsrud, & Wahl, 2006), gender (Heiman, Agmon, Fleisher & Zilberman, 2011), the proportion of GM ingredients to traditional ingredients (Rousu et al., 2004), and the method that was used to elicit WTA (Lusk, Jamal, Kurlander, Roucan, & Taulman, 2005). For example, consumers' WTA food items labeled "GM" varies from 14% (Huffman et al., 2004, 2007; Huffman, Shogren, Rousu, & Tegene, 2003) to more than 50% (McCluskey, Grimsrud, Ouchi, & Wahl, 2003). The later study (McCluskey et al., 2003) found that 86% of the Japanese responders would not consider GM food even at a 50% discount. Although this extremely high discount was elicited using the contingent valuation (CV) method, which provides higher estimation of WTA than other methods (e.g., experiments, experimental surveys), this high figure is a threat to GM food adoption. There is evidence of heterogeneity and inconsistency when it comes to price/risk trade-offs in other food choices. Hamilton, Sunding, and Zilberman (2003) found that approximately 30% of consumers are willing to pay more than 15% for pesticide-free GM produce while the other 70% would be willing to pay much less. Moreover, some consumers with the highest WTP for pesticide-free food will not vote to ban genetically modified foods (GMFs), while people with low WTP for pesticide-free food will vote to ban them (Aerni, Scholderer, & Ermen, 2011). The results also suggest that some consumers do not show much familiarity with the impact and cost of pest control in food production. With a few exceptions (e.g., papaya), most of the GMF products are fed to animals and not consumed by humans. The introduction of GM products to feed people directly will depend on enhancing the acceptance of these products as well as their WTP for them.

Uzogara (2000) and Colson, Huffman, and Rousu (2011) suggest that the development and introduction to the market of vegetables and fruits with enhanced benefits produced by biotechnology is an avenue to accelerate GMF acceptance. In studies where consumers had a choice between a traditionally grown agricultural product and a GM product with a specific benefit (such as enhanced nutritional value), consumers elected to purchase the GM product and pay a price premium (Colson & Huffman, 2011). Even non-hypothetical experiments have their hypothetical assumptions. Consumers need to be informed about the new traits, read nutritional information on the back of packages, and spend cognitive time in processing and evaluating the trade-off between risks and benefits in order to establish a starting point in WTP (WTA) experiments. Consumers generally do not read nutritional information (Kiesel, McCluskey, & Villas-Boas, 2011) and do not get involved in complex decision-making; these characterize the trade-offs between two super goals such as improving health and spending time when making food choices. Rather, they base their choice on heuristics (Thaler & Sunstein, 2008).

This study focuses on the effect of framing of information of GMFs without specified benefits and aims to show that even subtle manipulation of the information, which is done by the framing of a statement, can change WTA for GMVs. Here, the term 'framing' refers to the way in which a statement is made or a question is worded.

The framing of statements (positive/negative) about the nature of events or qualities of products—where health and environmental effects are uncertain—affects judgment and choices. Previous literature has suggested that framing affects overall perception and judgment (Kahneman & Tversky, 1984; Rothman & Salovey, 1997; Tversky & Kahneman, 1986). Namely, positive framing of an action or a product tends to increase the level of support of this action or product and vice versa. Terminology like 'franken-food,' actions by activists, and reports in the media have generated negative predispositions of GMFs (McCluskey & Swinnen, 2004). Providing information on the benefits of genetic modification in order to correct these predispositions caused by inaccurate information is no simple task. The interaction between unfavorable prior ideas and positive statements generates incongruity that may increase the likelihood that the positive statements will be rejected in a low-involvement setting. Low involvement is defined as a situation where the decision maker decides to allocate few cognitive resources to the task of decision making (Chaiken, 1980; Johnson & Eagly, 1989). When the new information comes from a strong source, the incongruity between strongly held prior ideas and the new information may cause consumers to adopt systematic (reflective) choice processes (Lynch & Srull, 1982). Therefore, if the statements provide new and convincing information, individuals may change their minds. However, if consumers do not hold strong prior ideas about GMF, even weak information may either change their minds or cause them to ignore incongruent information.

In this article, we explore the effect of framing of statements on perceptions and choices of GMF products. In two experiments, consumers were exposed to either positive or negative statements about genetically modified vegetables, then were asked to indicate the extent of their dis/agreement therewith and to choose between GM and conventionally grown vegetables. Perceptions and choices were compared to those of a control group, and we show that, despite more than a decade without significant evidence of GM health risk or environmental hazards, consumers are easily swayed by negative or positive framing.

Behavioral Model and Hypotheses Formulation

Previous literature has suggested that framing of statements affects consumers' perceptions and choices; positive framing triggers favorable appraisal while negatively framed statements trigger unfavorable judgments. This phenomenon has been explained by information models (Lehman, Krosnick, West, & Li, 1992) and, in particular, by the notion of availability heuristic (Bargh, Chaiken, Govender, & Pratto, 1992; Gillund & Shiffrin, 1984). Research on availability heuristic suggests that consumers estimate the likelihood of risk by relating it to the ease with which risky/hazardous events come to mind. The wording of a statement creates an effect vis-à-vis the product (Cohen, Pham, & Andrade, 2008) and is used as information for decision making (Schwarz, 1990; Schwarz & Clore, 1983).

If individuals can find many examples of negative impacts of biotechnology, then their estimates of the likelihood of a negative event occurring are high and vice versa. The availability heuristic is mainly used because consumers pay little attention to information and judgment tasks and, therefore, rely on heuristics rather than employing a systematic judgment process (Thaler & Sunstein, 2008). Negative framing of information about health risks and environmental hazards are supposed to provoke fear, which, in turn, decreases certainty, reduces sense of control, and increases perceptions of risk (Lerner & Keltner, 2000). These emotions affect judgments and choices (Loewenstein, 1996; Schwarz & Clore, 1983; Zajonc, 1980). Exposure to events that provoke negative emotions causes consumers to retrieve and employ congruent associations in unrelated successive judgment tasks (indirect effect; Bower, 1991). This analysis suggests the following hypothesis.

> *H1: Consumers' perceptions of biotechnology attributes will be more favorable when a statement is framed positively rather than negatively.*

The effect of framing of statements is stronger when consumers have little knowledge about the judgment task or when they are uncertain about the product (technology). Thus, we expect that framing of statements about the effects of biotechnology on health, the economy, and the environment will have a weaker effect on knowledgeable consumers than they will on consumers with average or little knowledge.

> *H2: Framing of statements about biotechnology's effects on health, the economy, and the environment will have a weaker effect on knowledgeable consumers than they will on consumers with average or little knowledge.*

Thus far, we have discussed the effect of wording and negative versus positive framing of statements on perceptions. Information affects the retrieval of items from memory, thereby increasing the subject's accessibility to the manipulated attribute. This increased accessibility, in turn, increases the weight of the manipulated attribute while the weight of all other attributes decreases (Chakravarti & Janiszewski, 2004; Taylor & Thompson, 1982).

In our research design, we provide information on six attributes of GM products, in our case a bell pepper.[1] There is no GM bell pepper, so the experiment is hypothetical. Each attribute has a given weight and the weight may be altered by new information. Following Heiman and Lowengart (2009), we expect the weight of an attribute which was the subject of information manipulation to be altered in the opposite direction of the change in its perception. For example, if you learn that the product enhances your health, then the weight of health declines. Furthermore, if the new information suggests that a product contributes negatively to an attribute that was not salient in the decision process, then after communicating the information about said attribute, it may become salient, i.e., consumers will consider its trade-off with other attributes. Following the aforementioned discussion, we hypothesize that:

> *H3: The weight and the saliency of the attributes that were subject to the information will change in the opposite direction to the change in the perception. If the attribute was not considered in the choice process, consumers may consider trade-offs between this and the other salient attributes as information changes.*

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1. *GM bell peppers are a hypothetical product. Using hypothetical GM products have advantage in elicitation of consumers' willingness to accept (WTA).*

Consumers are concerned about biotechnology's effect on their health and the environment (Gaskell et al., 1999). Incongruity between prior ideas and the framing of a product's description increases the likelihood of adoption of the systematic choice process in a low-involvement setting (Maheswaran & Chaiken, 1991). People may apply several alternative decision procedures; some require low cognitive costs (Thaler, 1985), for example low involvement processes, while others—using the conscious system—require more cognitive effort. Consumers who held unfavorable beliefs about biotechnology and are exposed to a positively framed statement may either change their choice processes towards more conscious and systematic deliberation or reject the new information. If the systematic (conscious) system is employed, then it is more likely that consumers will choose products based on product-based comparison—a cognitively demanding process—rather than attribute-based selection, which is less demanding (Tversky, 1972).

Perception of risk is moderated by a sense of control (voluntary participation/choice) and by knowledge. The lower the sense of control and the less familiarity with a given technology, the higher its perceived risk (Moon & Balasubramanian, 2004). Thus, provision of unbiased and undirected information is expected to reduce uncertainties and in turn increase the level of support for biotechnology (Gaskell et al., 1999; Lusk & Coble, 2005). However, even unbiased information is frequently processed subjectively by consumers, yielding judgments that deviate from Bayesian updating rule (Hogarth & Einhorn, 1992). In addition to the subjective interpretation of information, consumers are frequently exposed to an admixture of information—some positively and others negatively framed. Negative news has a stronger effect on perceptions than does positive news, i.e., negativity bias (Slovic, 1993). A negatively framed statement can signal potential loss that is weighted more heavily than symmetric gain (Kahneman & Tversky, 1979). Therefore, the final direction change in perceptions depends on the proportions of positive and negative information and the strength of prior beliefs. In particular, if individuals' perceptions are not strong, then the negativity bias will prevail (Poortinga & Pidgeon, 2004). Therefore,

> *H4: Negative framing will have a greater impact on consumers' perceptions than will positive framing.*

In order to test our research hypotheses, we conducted an experiment with 399 student consumers who were randomly allocated to either control or treatment groups, i.e., positive and negative framing. In order to control for knowledge, the interviews were conducted on six campuses: the Faculty of Agriculture, Food, and Environment at the Hebrew University (life science, applied biology, biotechnology, agriculture, nutrition, and agricultural economics); Hebrew University, Givat Ram campus (biology and other sciences); Hebrew University, Mount Scopus campus (art, humanities, and social sciences); Tel Aviv University (art, humanities, engineering, and social sciences); Herzliya Interdisciplinary Center (social science); and Tel Hai College (biotechnology). Of the respondents, 58% had a scientific background, while the remaining 42% had social science and humanities backgrounds. Also, 23% had life science and medicine backgrounds and 35.6% majored in agricultural economics or engineering.

Methodology

Research Design and Manipulations

Respondents were divided randomly into either one of the three groups: positive, negative, or the control group. Each respondent read seven statements regarding GMVs (bell peppers) and indicated on a five-point scale the level of agreement therewith. The seven statements were framed either positively or negatively. The manipulation was pretested in a class of 40 undergraduates that were randomly assigned to two classrooms wherein the questions were read aloud and followed by an open discussion on biotechnology and genetic modification. The subsequent atmosphere and discussion indicated that the manipulation succeeded in increasing (or decreasing) support for biotechnology.

Description of the Survey and Questionnaire

The survey sample consisted of 399 students: 216 females and 183 males (54% and 46%, respectively) who were assigned to the positive (negative) treatments randomly. Each of the interviewers received a mixed package of questionnaires (negative and positive), knowing neither the order nor the framing, and distributed them during a lunch break on predetermined days (chosen by random process). Out of 399 respondents, 99 were assigned to the control group, 148 received positively framed questionnaires, and 153 received negatively framed questionnaires. Respondents were asked to report their perceptions using a five-point scale of

Table 1. Perceptions of biotechnology and GM food comparing the control and the two manipulations.

	Control	Positive	Negative	Overall	F
GM food is healthy	0.051 (0.065)	-0.189 (0.106)	0.474 (0.121)	0.123 (0.064)	10.79*
Biotech is moral[a]	-0187 (0.05)	-0.149 (0.137)	-0.224 (0.142)	0.158 (0.085)	0.094
Biotech supports the environment	0.313 (0.095)	-0.405 (0.098)	-0.132 (0.125)	-0.123 (0.066)	9.3*
Biotech contributes to economy	1.333 (0.084)	0.784 (0.116)	0.75 (0.11)	0.907 (0.065)	7.43*
GM food reduces pesticide usage	(0.899) (0.113)	1.054 (0.114)	0.776 (0.121)	0.91 (0.069)	1.55
GM food has longer shelf life	1.505 (0.078)	1.446 (0.079)	1.197 (0.101)	1.366 (0.052)	3.33**
Biotech increase yields	1.384 (0.099)	1.203 (0.095)	1.132 (0.095)	1.221 (0.056)	1.54
GM food is tastier	-0.677 (0.117)	0.716 (0.129)	-0.224 (0.126)	0.013 (0.079)	29.72*

[a] In the control group, consumers were asked to indicate their support of the sentence "biotech is immoral= -2 …biotech is not moral and not immoral= 0"

*Key: *significant at P<0.001; **significant at P<0.05.*

Numbers in parentheses are standard errors.

The size of the control, positive, and negative groups were 99, 148, and 152, respectively.

bipolar questions, i.e., "Genetically modified vegetables (GMVs) are more healthy than traditionally grown vegetables: [2=Strongly agree…0=Neither agree or disagree…-2=Strongly disagree]."

In the negatively framed questionnaire, the same question was framed as follows: "Genetically modified vegetables (GMVs) are less healthy than traditionally grown vegetables [2=Strongly agree…0=Neither agree or disagree…-2=Strongly disagree]." Consumers were asked about their perceptions of GMVs' healthiness and tastiness and of biotech's effect on the environment; their views on biotech's moral aspects; reduction in pesticide use; GMVs' increased shelf life, contribution to the economy, and increased yields.

Following the questions about perceptions, respondents were asked to choose between GMVs and traditionally grown vegetables when the former's price reflected discounts of 5% and 30%. In addition to perceptions and choices, respondents indicated their genders and their majors, specifically science, social sciences, or humanities.

Results

We first describe perceptions of GM vegetable attributes, the morality/immorality of gene exchange, and possible effects on the environment. According to Hypothesis H1, consumers' perceptions of biotechnology's attributes will be more favorable when the question (statement) is framed positively than when framed negatively (Table 1).

Perceptual Differences

The valence of framing significantly affected respondents' perceptions of healthiness and tastiness of GMF. When the statements about GMVs' healthiness were positively framed, consumers disagreed therewith while, under negative framing, consumers supported the statement. While the support was stronger than the objection, neither differed greatly from zero (the natural mean). Although consumers relate the consumption of GM with higher risk of unhealthiness, the insignificant difference from the average (neither supporting nor objecting) suggests that their fear level is not very high. Consumers supported the idea that gene exchange has the potential to improve taste given positive framing and objected under negative framing about taste. These results indicate that, in general, while consumers are not very fearful about health hazards, framing increases fear and uncertainty. Consumers do believe that biotechnology has the capability to improve product taste. Framing had little effect on the perceptions of biotechnology's effect on the economy, possible reduction of pesticide use (fewer problems with pests), increased yield, and harm to the environment.

In general, negative framing results in stronger resistance to biotech. Many previous studies on the levels of—and reasons for—support for (objection to) biotechnology have ignored the fundamental issue of framing; individuals more readily agree with statements implying that biotechnology may enhance tastiness and extend shelf life, while they find it harder to agree with the statements that biotech will reduce personal and environmental risk, i.e., produce healthier food and help to protect the environment.

Experts Versus Unknowledgeable Consumers

A smaller proportion of life science students (hereinafter "experts") stated that their levels of knowledge are high relative to social sciences and non-science students (hereinafter "unknowledgeable respondents"). Agriculture students were closer to the science students in their perceptions of their knowledge. The majority of students, though, believed that their level of knowledge was low. Again, social science students were more confident of their knowledge than were the rest of the sample. The correlation between confidence and success in the actual knowledge test was weak and insignificant.

Having knowledge about biotechnology decreased the perception that biotech is immoral and increased the rate of acceptance of the statement that biotech may be effective in handling pests and increasing yields. In a negatively framed questionnaire, expertise increased agreement with the statement that GMFs are healthier while, in a positively framed questionnaire, there was no difference between experts and unknowledgeable respondents.

Individuals with knowledge were less affected by the framing. For example, 80% of the experts believed that biotech may extend shelf life regardless of whether the statement was positively or negatively framed, while 80% of the unknowledgeable respondents believed so under positive framing and 60% agreed to this argument in the negatively framed questionnaire.

Choice

Socioeconomic variables provide a shallow explanation for acceptance (choice). We estimated the following choice model wherein the explanatory variables are socioeconomics, levels of expertise (measured by study major), and self-reported knowledge. Specifically,

$$\begin{aligned} Y_{discount30\%}(0,1) = a + \Sigma b_1 X_i + \Sigma b_2 X_i \bullet frame_{1=negative} \\ + b_3 R + b_4 knowledge \\ + b_5 gender_{1=male} + \varepsilon, \end{aligned} \qquad (1)$$

Table 2. Choice of genetically modified or traditionally grown bell peppers when GM bell peppers are sold at a 30% discount.

Attribute	Marginal effect
Health	0.453* (0.162)
Moral	0.136 (0.084)
Environment	-0.037 (0.098)
Economy	-0.01 (0.103)
Pests	0.227** (0.091)
Shelf life	-0.130 (0.131)
Yield	0.163 (0.119)
Taste	0.089 (0.086)
Health by manipulation (1)	-0.547 (0.459)
Health by manipulation (2)	-0.777*** (0.45)
Taste by manipulation (1)	-0.059 (0.235)
Taste by manipulation (2)	0.384*** (0.228)
Gender	0.326 (0.249)
Education	
Education (1)	-0.086 (0.300)
Education (2)	0.209 (0.277)
Constant	0.575 (0.251)
-2 Log likelihood	*439.84*
Cox & Snell R square	*0.123*
Nagelkerke R square	*.174*

where R is a dummy variable referring to a habit of reading food labels before making choices that assumes two levels: read and do not read (1 and 0, respectively). Framing (*frame*) assumes the value of 1 under negative framing and 0 otherwise. Knowledge indicates self-perception of knowledge about biotechnology. The perceptions used in our estimation were based on the positive manipulation. Table 2 presents the estimation of Equation 1 choice when GM bell peppers are sold at a 30% discount.

The main factors that increased consumers' willingness to purchase GM bell peppers sold at a 30% discount were the perceptions that biotechnology improves health and reduced pesticide application. Moral considerations (perceptions that GM is not immoral) increased support insignificantly. Gender and knowledge did not make a difference. Positive framing did have a statistically significant effect on the weights of health or taste, while negative framing decreased the weight attributed to of health benefits of GM consumption and increased the weight of taste in the choice process. Both cross effects are marginally significant.

The predictive power of socioeconomic factors is rather low. Summarizing the aforementioned findings suggests that, if the information is negatively framed, then the importance weight assigned to health increases and that of taste decreases. Since perceptions of healthiness and tastiness decline with negative framing, the increase in the weight assigned to health amplifies the effect of negative framing. Education (i.e., background in social science, science and engineering) did not make a difference in preference of GMVs in both cases of a 30% and 5% discount. These results did not change much when GMVs were offered at a 5% discount and motivation for acceptance of GMFs was altered to better taste, longer shelf life, and less pesticide use.

Conclusions

We found that negative framing of statements about the properties of biotechnology affected perception, as well as increased the weight assigned to health and decreased the weight assigned to taste in a negatively framed questionnaire. Respondents were affected by the magnitude of discount more than by framing. While only 40.7% showed willingness to purchase GM bell peppers given a 5% discount, when the discount was 30%, the proportion of consumers who chose GMVs increased to 69%. Although framing did not change significantly consumers' choices regarding GMVs when priced lower than conventionally grown vegetables, the direction of change (3% reduction in the choice of GM bell peppers) indicates that framing does matter. Negative framing decreased the proportion of respondents who chose GMVs sold at a 30% discount to 67% and increased insignificantly the proportion of respondents who chose GMVs (41%) when they were sold at a 5% discount. When the purchase incentive was reduced pesticide use, the proportion of consumers who chose GM was 84%; framing did not affect this pattern.

Our findings indicate that there is a trade-off between price and fear, and most consumers are willing to purchase GMVs at a discount. Given the large body of studies that argue that there is no evidence that GMF consumption increases health hazards, policymakers may choose to launch educational campaigns that inform consumers about the safety of biotechnology. Consumer behavior and psychology studies show that information aimed at reducing unjustified health-related fears is not effective and may even have a boomerang effect. Since the majority of consumers are willing to purchase GMFs at a 30% discount, a more effective strategy (compared to advertising) of inducing adoption is to reduce GM product prices. After consumers get used to GM, producers can reduce the discount.

Our study has some limitations. We studied preferences and choices of GMVs and compared them to traditionally grown vegetables. While vegetables are an important part of the Mediterranean diet, in other parts of the world, grains, corn, rice, beans, and potatoes are more relevant. Future research may test whether our findings hold in other continents and for other crop varieties.

References

Aerni, P., Scholderer, J., & Ermen, D. (2011). How would Swiss consumers decide if they had freedom of choice? Evidence from a field study with organic, conventional and GM corn bread. *Food Policy*, *36*(6), 830-838.

Bargh, J.A., Chaiken, S., Govender, R., & Pratto, F. (1992). The generality of the automatic attitude activation effect. *Journal of Personality and Social Psychology*, *62*, 893-912.

Bower, G.H. (1991). Mood congruity of social judgments. In J.P. Forgas (Ed.), *Emotion and social judgments* (pp. 31-53). Oxford: Pergamon.

Chaiken, S. (1980). Heuristic versus systematic information processing and the use of source versus message cues in persuasion. *Journal of Personality and Social Psychology*, *39*, 752-766.

Chakravarti, A., & Janiszewski, C. (2004). The influence of generic advertising on brand preferences. *Journal of Consumer Research*, *30*(4), 487-501.

Cohen, J.B., Pham, M.T., & Andrade, E.B. (2008). The nature and role of affect in consumer behavior. In C. Haugtvedt, F. Kardes, & P. Herr (Eds.), *Handbook of consumer psychology* (pp. 297-348). Mahwah, NJ: Erlbaum.

Colson, G., & Huffman, W.E. (2011). Consumers' willingness to pay for genetically modified foods with product-enhancing nutritional attributes. *American Journal of Agricultural Economics*, *93*(2), 358-363.

Colson, G.J., Huffman, W.E., & Rousu, M.C. (2011). Improving the nutrient content of food through genetic modification: Evidence from experimental auctions on consumer acceptance. *The Journal of Agricultural and Resource Economics*, *36*(2), 343-364.

Costa-Font, M., Gil, J.M., & Traill, W.B. (2008). Consumer acceptance, valuation of and attitudes towards genetically modified food: Review and implications for food policy. *Food Policy*, 33(2), 99-111.

Gaskell, G. (2006). Europeans and biotechnology in 2005: Patterns and trends. *Eurobarometer*, *64*, 3.

Gaskell, G., Allum, N., Wagner, W., Kronberger, N., Torgersen, H., Hampel, J., et al. (2004). GM foods and the misperception of risk perception. *Risk Analysis*, *24*(1), 185-194.

Gaskell, G., Bauer, M.W., Durant, J., & Allum, N. (1999). World apart? The reception of genetically modified foods in Europe and the U.S. *Science*, *85*, 384-387.

Gillund, G., & Shiffrin, R.M. (1984). A retrieval model for both recognition and recall. *Psychological Review*, *91*, 1-67.

Hamilton, S.F., Sunding, D.L., & Zilberman, D. (2003). Public goods and the value of product quality regulations: The case of food safety. *Journal of Public Economics*, *87*(3-4), 799-817.

Heiman, A., Agmon, O., Fleisher, R., & Zilberman, D. (2011). Attitude and purchasing decisions regarding genetically modified foods based on gender and education. *International Journal of Biotechnology*, *12*(1/2), 50-65.

Heiman, A., & Lowengart, O. (2009). The effects of information about health hazards in food on consumers' choice process. *Annals (special issue) of the Journal of Econometrics*.

Hogarth, R., & Einhorn, H.J. (1992). Order effects in belief updating: The belief adjustment model. *Cognitive Psychology*, *24*, 1-55.

Huffman, W.E., Rousu, M., Shogren, J., & Tegene, A. (2004). Who do consumers trust for information: The case of genetically modified foods? *American Journal of Agricultural Economics*, *86*(5), 1222-1229.

Huffman, W.E., Rousu, M., Shogren, J.F., & Tegene, A. (2007). The effects of prior beliefs and learning on consumers' acceptance of genetically modified foods. *Journal of Economic Behavior & Organization*, *63*, 193-206.

Huffman, W.E., Shogren, J.F., Rousu, M., & Tegene, A. (2003). Consumer willingness to pay for genetically modified food labels in a market with diverse information: Evidence from experimental auctions. *Journal of Agricultural and Resource Economics*, *28*(3), 481-502.

Johnson, B.T., & Eagly, A.H. (1989). Effects of involvement on persuasion: A meta-analysis. *Psychological Bulletin*, *106*(2), 290-314

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263-292.

Kahneman, D., & Tversky, A. (1984). Choices, values, and frames. *American Psychologist*, *39*, 341-50.

Kiesel, K., McCluskey, J.J., & Villas-Boas, S.B. (2011). Nutritional labeling and consumer choices. *Annual Review of Resource Economics*, *3*, 17.1-17.18.

Lehman, D.R., Krosnick, J.A., West, R.L., & Li, F. (1992). The focus of judgment effect: A question wording effect due to hypothesis confirmation bias. *Personality and Social Psychology Bulletin*, *18*, 690-699.

Lerner, J.S., & Keltner, D. (2000). Beyond valence: Toward a model of emotion-specific on influences on judgment and choice. *Cognition and Emotion*, *14*(4), 473-493.

Lynch, Jr., J.G., & Srull, T.K. (1982). Memory and attentional factors in consumer choice: Concepts and research methods. *Journal of Consumer Research*, *9*(1), 18-37.

Loewenstein, G. (1996). Out of control: Visceral influences on behavior. *Organizational Behavior and Human Decision Processes*, *65*(3), 272-292.

Lusk, J.L., & Coble, K.H. (2005). Risk perceptions, risk preferences and acceptance of risky food. *American Journal of Agricultural Economics*, *87*(2), 393-405.

Lusk, J.L., Jamal, M., Kurlander, L., Roucan, M., & Taulman, L. (2005). A meta-analysis of genetically modified food valuation studies. *Journal of Agricultural and Resource Economics*, *30*(1), 28-44.

Maheswaran, D., & Chaiken, S. (1991). Promoting systematic processing in low-motivation settings: Effect of incongruent information on processing and judgment. *Journal of Personality and Social Psychology*, *61*(1), 13-25.

McCluskey, J.J., Grimsrud, K.M., Ouchi, H., & Wahl, T.I. (2003). Consumer response to genetically modified food products in Japan. *Agricultural and Resource Economics Review*, *32*(2), 222-231.

McCluskey, J.J., Grimsrud, K.M., & Wahl, T.I. (2006). Comparisons of consumer responses to genetically modified foods in Asia, North America, and Europe. In R.E. Just, J. Alston, & D. Zilberman (Eds.), *Economics of regulation of agricultural biotechnologies* (pp. 227-240). New York, NY: Springer/Kluwer Academic Publishers.

McCluskey, J.J., & Swinnen, J.F.M. (2004). Political economy of the media and consumer perceptions of biotechnology. *American Journal of Agricultural Economics*, *86*(5), 1230-1237.

Moon, W., & Balasubramanian, S.K. (2004). Public attitudes toward agrobiotechnology: The mediating role of risk perceptions on the impact of trust, awareness, and outrage. *Review of Agricultural Economics*, *26*(2), 186.

Poortinga, W., & Pidgeon, N.F. (2004). Trust, the asymmetry principle, and the role of prior beliefs. *Risk Analysis*, *24*(6), 1475.

Rothman, A.J., & Salovey, P. (1997). Shaping perceptions to motivate healthy behavior: The role of message framing. *Psychological Bulletin*, *121*(1), 3-19.

Rousu, M., Huffman, W.E., Shogren, J.F., & Tegene, A. (2004). Are United States consumers tolerant of genetically modified food? *Review of Agricultural Economics*, *26*(1), 19-31.

Rousu, M., Huffman, W.E., Shogren, J., & Tegene, A. (2007). Effects and value of verifiable information in a controversial market: Evidence from lab auctions of genetically modified food. *Economic Inquiry*, *45*, 409-432.

Schwarz, N. (1990). Feelings as information: Informational and motivational functions of affective states. In R.M. Sorrentino & E.T. Higgins (Eds.), *Handbook of motivation and cognition* (Vol. 2, pp. 521-561). New York: Guilford Press.

Schwarz, N., & Clore, G.L. (1983). Mood, misattribution, and judgments of well-being: Informative and directive functions of affective states. *Journal of Personality and Social Psychology*, *45*, 513-523.

Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risk. In: R.C. Schwing & W.S. Albers (Eds.), *Societal risk assessment: How safe is safe enough?* New York: Plenum.

Slovic, P. (1993). Perceived risk, trust, and democracy. *Risk Analysis*, *13*, 675-682.

Taylor, S.E., & Thompson, S.C. (1982). Stalking the elusive vividness effect. *Psychological Review*, *89*(2), 155-181.

Thaler, R. (1985). Mental accounting and consumer choice. *Marketing Science*, *4*, 199-214.

Thaler, R.H., & Sunstein, C.R. (2008). *Nudge: Improving decisions about health, wealth, and happiness*. New Haven, CT: Yale University Press.

Townsend, E., & Campbell, S. (2004). Psychological determinants of willingness to taste and purchase genetically modified food. *Risk Analysis*, *24*(5), 1385.

Tversky, A. (1972). Elimination by aspects: A theory of choice. *Psychological Review*, *97*(July), 281-299.

Tversky A., & Kahneman, D. (1986). Rational choice and the framing of decisions. *The Journal of Business, Part 2: The Behavioral Foundations of Economic Theory*, *59*(4), S251-S278.

Uzogara, S.G. (2000). The impact of genetic modification of human foods in the 21st Century: A review. *Biotechnology Advances*, *18*, 179-206.

Zajonc, R.B. (1980). Feeling and thinking: Preferences need no inferences. *American Psychologist*, *35*, 151-175.

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