Willingness-to-Accept and Willingness-to-Pay for GM and Non-GM Food: UK Consumers

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Introduction

Controversy over GMOs has originated from the EU, a part of the world already devastated from food-related scares such as mad cow disease. European Union (EU) responded to negative consumer sentiment of GM foods by imposing a moratorium in 1998 that precluded approval of new GM varieties. However, evidence available thus far does not support alleged health or environmental hazards attributed to GMOs. Further, US and other countries announced in May, 2003 that they would file a formal WTO dispute to abolish the moratorium which they believe distort agricultural and food trade. Finding it increasingly difficult to rationalize its position, European Parliament approved mandatory traceability and labeling legislation with a 0.9 % tolerance level in July 2003 as a measure to replace the current moratorium.

This measure apparently transfers the burden of acceptance/rejection of GM technology from regulatory authority to the market mechanism. Yet, for consumers to ultimately exercise the sovereign power of determining acceptance/rejection of GM technology, food manufacturers and retailers in Europe need to put labeled GM products in the supermarket shelves (Carter and Gruere, 2003; Gaskel et al, 2003). Thus far, they have avoided food products that contain any GM ingredients, in line with the prevailing popular sentiment there against agrobiotechnology. That is, European food supply chains strategically decided to focus on non-GM foods instead of allowing consumers to choose between GM and non-GM foods. Hence, there has been no need to segregate non-GM from GM foods.

The critical question is whether European food industry takes the new measure as a favorable signal that GM food can be marketed in the EU and decide to offer GM food

to consumers. Carter and Gruere (2003) suggest that lack of economic incentives for food industry to offer labeled GM food coupled with political pressure by anti-GM activists have prevented mandatory labeling from providing consumer choice between GM and non-GM food. That is, under current negative sentiment against agrobiotechnology, the mandatory labeling regulation acts as a market barrier, rather than facilitating consumer choice. They suggest that two factors underlie the food industry's position whether or not to offer GM labeled food: (i) the share of consumers who are willing to buy GM labeled food, and (ii) the profitability per unit of final product sold.

Previous research elicited willingness-to-pay (WTP) as a measure of behavioral intentions with respect to non-GM foods in Europe (Burton et al, 2001; Moon and Balasubramanian, 2003). These studies presented some insight into European consumer's preferences about GM and non-GM food that could be useful in estimating the size of market for non-GM food. Nonetheless, eliciting willingness-to-pay for non-GM food is not sufficient in determining whether and to what degree GM food is substitutable with non-GM version. Knowledge about such substitutability is the key to determining the strength (or weakness) of demand for GM food.

The minimum amount of discount that consumers would be willing to accept in return for purchasing GM food products (WTA) is the relevant concept that can shed light on the strength of demand for GM food and its substitutability with non-GM version. While the standard economic theory predicts that these two measures (WTP and WTA) would converge with small income effects (Willig, 1976; Randall and Stoll, 1980; Walters, 1979), WTA is expected to be significantly greater than WTP under two conditions: (i) when endowment effect exists or when the good in question does not have

close substitutes (Kaheman and Tversky, 1979; Haneman, 1990). Therefore, there is a considerable need to investigate willingness-to-accept (WTA) in addition to willingness-to-pay (WTP) in order to provide more detailed information on behavioral intentions with respect to GM and non-GM food and substitutability between them.

Objectives

Our research aims to elicit willingness-to-accept (WTA) of UK consumers along with willingness-to-pay (WTP) to shed light on the size of market for GM food and to determine substitutability between GM and non-GM foods. Specifically, this study measures on the one hand the maximum premium that consumers would be willing to pay (WTP) for a box of breakfast cereals made of non-GM ingredients and maximum additional weekly food expenditures that consumers would be willing to pay to avoid foods that contain GM ingredients. On the other hand, we measure minimum discount that consumers would be willing to accept (WTA) for a box of breakfast cereals made of GM ingredients and minimum percentage decrease in weekly food bill that consumers would be willing to accept (WTA) to consume GM food products.

When properly designed, estimates of willingness-to-accept (WTA) can present the following information: (a) strength of demand for GM food (GM-technology embracing or who prefer GM and non-GM equally), (b) who are willing to consume GM food at some discount (price-conscious group), (c) who will never consume GM food, and (d) who are not sure. Estimates of willingness-to-pay (WTP) can provide four types of information: (a) strength of demand for non-GM food, (b) protest respondents, (c) GM-technology embracing, and (d) who are not sure. While both measures can commonly identify GM-embracing, protest and uncertain group of consumers, price-

conscious group who are willing to consume GM food at some discount can be identified only by willingness-to-accept (WTA) measure. Information on such price-conscious group is critical to determining the degree of substitutability between GM and non-GM food.

Divergence between WTA vs. WTP

Our research proposes to elicit willingness-to-pay premium for non-GM food and willingness-to-accept discount to forgo such an opportunity. Accordingly, the good to be valued in our research is the non-GM property of food products: i.e., consumers are required to pay a premium to obtain it and offered a discount to give it up (to consume GM food products). Willingness-to-pay measures the value that consumers place when they purchase goods, whereas willingness-to-accept measures the price that consumers ask when they sell goods. In our study, consumers hypothetically buy non-GM property of food products (revealing willingness-to-pay), while selling it and hypothetically consuming GM food as a result (revealing willingness-to-accept).

The theoretical convergence between WTP and WTA indicates that the intensity of demand for non-GM food as represented by mean WTP (the larger the stronger) should not differ from the intensity of demand for GM food as represented by mean WTA (the smaller the stronger). For example, if consumers would be willing to pay on average $0.50 more to avoid purchasing breakfast cereals made of GM ingredients, they would be expected to be willing to accept on average $0.50 as a discount in return for giving up the opportunity to purchase non-GM breakfast cereals.

A number of field contingent valuation research and lab experiments, however, have consistently shown that there is a significant discrepancy between willingness-to-

pay (WTP) and willingness-to-accept (WTA) measures of value for public goods (e.g., Knetsch and Sinden, 1984; Brookshire and Coursey, 1987; Kahneman, Knetsch and Thaler, 1990). Two explanations have been advanced to rationalize the divergence between theory and empirical findings.

First, Kaheman and Tversky (1979) and Thaler (1980) suggested that WTA values be higher than WTP due to endowment effect. The endowment effect proposes that people value goods more highly once they own them, a plausible result of loss aversion indicated by prospect theory (i.e., losses are weighted substantially more than objectively commensurate gains in the evaluation of prospects and trades). In fact, Kahneman, Knetsch and Thaler (1990) demonstrate in their lab experiments using coffee mugs that such endowment effect persists even after controlling for transaction costs and the opportunities to learn.

Second, Haneman (1990) illustrates that, for consumer theory involving quantity changes, WTP and WTA do not need to converge and the difference between the two measures depends not only on an income effect but also on a substitution effect. Further, he shows that substitution effects could exert a far greater effect on the relation between WTP and WTA than do income effects. That is, he indicates that the convergence of WTP and WTA is expected only when the good in question has a very close substitute. When the good has an imperfect substitute, a value divergence will arise. In support of Haneman's argument, Shorgren et al. (1994) present evidence of the significant role of substitutability in the divergence between WTP and WTA using experiments involving private and public goods. They found that the divergence of WTP and WTA value

measures disappears for private goods with a close substitute whereas, for a private non-market good with no close substitute, the divergence was robust and consistent.

Given the generally negative sentiment against GM food in Europe, we expect that UK consumers are likely to have emotional attachment to traditional non-GM food and consequently bidding between GM and non-GM foods would be associated with endowment effects. Further, non-GM foods are hypothesized to be less than perfectly substitutable with GM food to some consumers and consequently GM-free property can not be perfectly exchanged for money. This hypothesized imperfect substitutability suggests that a frictionless intermediate monetary exchange is not feasible between GM and non-GM food. These two hypotheses would cause WTA to be greater than WTP. Hence, in addition to analyzing protest, uncertain and GM technology-embracing respondents from WTP and WTA responses, our research test the equivalence between mean WTP (intensity of demand for non-GM food) and mean WTA (intensity of demand for GM foods).

Contingent Valuation Survey Design

Survey instrument was designed to measure two sets of variables of interest in this study: (1) attitudes and perceptions as related to agrobiotechnology, and (2) behavioral intentions with a focus on WTP and WTA. The survey was administered via online in the UK using web-based household panel maintained by Harris Interactive (consulting firm specializing in web-based public poll and opinion survey). Questionnaires were sent to about 2,500 participants of the online panel via electronic mails and 1,090 consumers completed the online survey within the next seven days.

The first part seeks to measure a range of psychological variables including

consumer attitudes toward application of genetic engineering to crop and food production and medicine, self-rated knowledge of agrobiotechnology, perceptions about negative and positive attributes of agrobiotechnology and opinions about the recent legislation of mandatory labeling and traceability.

We selected two product category to elicit WTP and WTA for: (i) a box of breakfast cereals made of non-GM and GM ingredients (base price of £ 2.80), and (ii) weekly expenditure on food whose ingredients are non-GM and GM (actual expenditure in £). A box of breakfast cereals represents an individual food item whose share within food budget is likely to be very small, whereas the second good represents the entire food category and will be a significant share of family budget. We test whether WTP and WTA differ across the two product categories. This testing is significant in identifying any potential discrepancy in consumer valuation due to scale effect.

Respondents were asked to consider the following situation:

[*Consumers might have to pay a higher price for nonGM foods due to the costs of segregation in the production and marketing system plus the additional costs of testing, certification and labeling GM foods. Suppose that you walk into a grocery store and want to buy food products. The grocery store carries food products of two types: (1) made from GM crops, and (2) made from conventional non-GM crops*

Table 1 presents four different contingent valuation questions asked to respondents in relation to the above hypothetical situation in the grocery store: (i) willingness-to-pay for breakfast cereals made of non-GM ingredients, (ii) willingness-to-accept for breakfast cereals made of GM ingredients, (iii) willingness-to-pay extra in the form of weekly expenditure for food made of non-GM ingredients, and (iv) willingness-to-accept decrease in the form of weekly expenditure for food made of GM ingredients.

These CV questions were asked using payment card method. Payment card

questioning technique has gained popularity in recent years to compromise the advantages and disadvantages associated with the open-ended and closed ended formats. CV questions in the form of payment card contains an ordered set of threshold values (Cameron and Huppert, 1989). The payment card for a box of breakfast cereals includes a range of premium from £0.00 to £2.10 for a box of breakfast cereals (with a base price of £2.80) made of non-GM crops and identical range of discount for WTA question. The payment card for weekly expenditure ranges from 0 % to 75 %. The card also includes "Don't know" category for respondents who are unsure about this issue. For willingness-to-accept (WTA) measures, a category is added to the list to capture respondents who will never buy GM food at any discount. In payment card approach, consumers are asked simply to go over the range of values and to circle the highest amount they would be willing to pay.

Contingent valuation method may present a problem stemming from hypothetical nature of questions posed to respondents. Hypothetical bias refers to the tendency that respondents overstate the amount that they are willing to pay for public or private goods of research interest. A number of studies present evidence that hypothetical transactions are not incentive compatible (e.g., Cummings et al 1995; Loomis et al, 1996). To test the potential hypothetical bias, our survey design incorporates cheap talk script method. The cheap talk script method explains the nature of hypothetical bias prior to administration of CV questions. Cummings and Taylor tested the effect of cheap talk method using laboratory experiments for several public goods and found that the method eliminated hypothetical bias. Using mail survey, Lusk (2002) presented additional evidence that the

cheap talk script was effective in removing hypothetical bias in measuring willingness-to-pay for Golden rice for subjects unfamiliar with this food.

Our study tests the effect of cheap talk script in the context of web-based online survey. Note that the evidence presented above came from studies using experimental auction and mail survey methods. Moreover, our study investigates the role of cheap talk script in eliciting willingness-to-accept as well as willingness-to-pay. While the cheap talk script is designed to correct overstatement problem primarily in the context of willingness-to-pay, the overstatement problem may arise as well in eliciting willingness-to-accept because of the hypothetical nature of the questions. The cheap talk script may motivate respondents not to overstate the amount of discount they require in exchange for giving up non-GM food.

Both WTP and WTA questions are posed to the same sample of respondents. Hence, it is legitimate to suspect of potential question ordering effect on elicited values of WTP and WTA. We test whether question ordering has any bearing on elicited values of WTP and WTA. Half of the sample received survey questionnaire that presented WTP prior to WTA questions in half of the sample, while WTA questions are posed first in other half of the sample.

In summary, we conduct four experiments in our CV survey: (i) testing differences in CV responses across two product categories; (ii) comparing across WTP and WTA, (iii) testing the effect of the cheap talk script on WTP and WTA, and (iv) assessing question ordering effect on elicited WTP and WTA values.

Analysis of WTA and WTP Responses

Segmentation of Consumers

This section provides an analysis of respondents' responses to WTA and WTP questions. Table 2 presents the distribution of responses to the four contingent valuation questions across the 16 categories of response. About 21 percent (21.2 % for breakfast cereals; 20.5 % for weekly expenditure) of UK respondents selected the category of zero premium, indicating that they would not be willing to pay any premium to purchase non-GM food. Of the 21 percent, about 8 percent were protest responses, rejecting the notion of paying premium to purchase non-GM food. The remaining 13 percent preferred GM and non-GM food equally. About 21 percent of respondents indicated that they were not sure about whether to pay premium to avoid GM food. In sum, nearly 58 percent were willing to pay varying sizes of premiums to avoid GM food.

With regard to WTA responses, about 45 percent of respondents voiced their rejection of GM food by selecting the category "I'll never buy GM food at any discount." After accounting for about 8 percent of unsure respondents, nearly 47 percent of respondents were willing to consume GM food at some discount, including 12 percent who did not need any discount to buy GM food.

There is a significant discrepancy in the percentages of consumers who were unsure across WTP and WTA. We conjecture that asking willingness-to-pay premium is more offensive to consumers than asking willingness-to-accept discount. Although the survey presents a follow-up question that enables respondents (who chose zero premium) to express their protest against the notion of paying premium for conventional non-GM food, they may have not expected this option, causing a significant percent of respondents to choose the category of "Don't know."

Table 3 provides summary information on WTP and WTA responses. Four distinct groups can be identified from the table: (i) who are unsure, (ii) who fully accept GM food, (iii) who never accept GM food (some of them would be willing to pay premium to purchase non-GM food and others would protest the notion of paying premium to purchase non-GM food), and (iv) who would consume GM at some discount.

Estimating the Size of Demand for GM and Non-GM Food

We further analyze the 58 percent who would be willing to pay some premium. This is a segment of UK population determining the strength of demand for non-GM food along with protest responses (8 %) and likely to consist of two groups: (i) who indicates that they would never consume GM food at any discount, (ii) who would consider purchasing GM food if the premium for non-GM food is perceived too high. On average, respondents were willing to pay £0.57 more to purchase a box of breakfast cereals made of non-GM ingredients (base price £2.80) and willing to spend 16.5 % more as weekly food expenditure to ensure that they buy non-GM food.

The strength (or weakness) of the demand for GM food is represented by the 33.9 percent who indicated that they would be willing to accept some discount in return for buying a box of GM breakfast cereals and 36.7 % who indicated that they would be willing to accept GM food in return for some decrease in their weekly food bill. Average discount of £0.65 was needed to motivate this group to purchase a box of breakfast cereals made of GM ingredients, while 21.8 % decrease in weekly food expenditure bill on average would induce consumers to switch from non-GM to GM food. In addition, about 12 percent indicated that they would not require discount to consume GM food.

The discussion above presented information critical to assessing the potential market size of non-GM and GM food and is summarized in Table 3. In essence, behavioral intentions as measured with WTP and WTA display that there is a strong demand for non-GM food as evidenced by the 46 percent who would never consume GM food (as revealed in WTA) and 57 percent who would be willing to pay some premium to avoid GM food (as revealed in WTP).

Nevertheless, if food supply chain starts to use GM ingredients and offer labeled GM and non-GM food, the analysis shows that there would be a certain segment of UK consumers who would demand GM food: i.e., 12 percent who do not differentiate between GM and non-GM food and 34 ~37 percent who would be willing to consume GM food when offered price discounts. Moon and Balasubramanian (2003) labeled the former as a group of GM technology-embracing and the latter as a group of price-conscious consumers.

Table 4 shows mean willingness-to-pay (WTP) and willingness-to-accept (WTA) and their difference. Mean WTA is significantly greater than mean WTP for both product categories: (i) breakfast cereals and (ii) weekly food expenditure bill. This result indicates that valuation of GM and non-GM food is associated with either endowment effect or imperfect substitutability or both. Given that mean WTP and WTA represent the intensity of demand for non-GM and GM food, respectively, the larger the mean WTP, the greater the demand for non-GM food.; the larger the mean WTA, the weaker is the demand for GM food.

An implication of the rejection of the equivalence between WTA and WTP is that the weakness of demand for GM food can not be inferred from the intensity of demand

for non-GM food. In other words, these two measures are not symmetric in the case of GM food: i.e., the negative of the mean WTP is not the mean WTA. This asymmetry indicates that underestimation is likely to arise in estimating the weakness of the demand for GM food when WTP estimates are used as a proxy for WTA.

Table 5 presents mean WTP and WTA with and without the cheap talk script. It shows that mean WTPs without the script are generally higher when compared to those with the script, but the difference was not significant. Interestingly, the cheap talk script made greater difference in WTAs. This result is significant given that hypothetical bias was debated largely in terms of willingness-to-pay rather than willingness-to-accept and the cheap talk script method has been tested only on WTP questions. Our result, however, demonstrates that hypothetical bias can arise in WTA questions and explaining the nature of hypothetical bias may motivate respondents to ponder about their true minimum amount of discount that they would be willing to accept.

Regression Models for WTP and WTA

With the CV questions generating value responses in the form of intervals rather than point estimates, midpoints of the intervals may be used as approximations to the true unobserved values to fit a univariate distribution of values. The midpoints can also be used as the dependent variable in ordinary least square (OLS) regression. In consideration of the fact that expected values within the intervals are not necessarily equal to the interval midpoints, the maximum likelihood (ML) estimator proposed by Cameron and Huppert (1989) is appropriate for estimating our WTP and WTA for non-GM and GM food.

In addition, responses to WTP and WTA questions in our survey include about 13

percent of respondents who would not be willing to pay a premium for non-GM food or who would not require any discount to consume GM food. That is, efficiency may be gained by distinguishing zeros from positive observations and accounting for systematic differences in unobserved characteristics affecting the endogenous discrete decision whether or not to pay a premium. In our study, the ML estimator proposed by Cameron and James (1989) is extended to test for potential two-stage decision process involving: (i) whether to pay (accept) a premium (discount), and (ii) what size of premium (discount) to choose, contingent on the first decision. Specifically, we use a two-stage interval data model developed by Bhat (1994) incorporating Heckman-style selection rule. The two-stage model is given by,

$$D^* = Z\alpha + \tau$$
$$D = 1 \text{ if } D^* > 0$$
$$= 0 \text{ otherwise,}$$

$$Y^* = X\beta + \varepsilon,\ \varepsilon \sim N[0, \sigma]$$
$$Y = P_j, \text{ if } P_{j-1} < Y^* < P_j \text{ where } [\tau, \varepsilon] \sim N[0, 0, 1, \rho]$$

Where Y^* is unobserved true valuation; Y_i is observed only when $D^* > 0$; D is a binary indicator taking one if the latent D^* is greater than zero: **Z** is a vector of explanatory variables impacting the decision whether or not to pay a premium; **X** is a vector of variables determining the intensity of willingness to pay given the decision to pay a premium. The model accounts for potential correlation in error terms (τ and ε) between the two equations. The log-likelihood function representing two-stage model adapted to the interval data is given by,

$$\text{Log } L = \Sigma_{D=0} \log [1 - \Phi(Z\alpha)] + \Sigma_{D=1, Y=j} \log [\Phi_2(P_j - X\beta, Z\alpha, \rho) - \Phi_2(P_{j-1} - X\beta, Z\alpha, \rho)]$$

Where Φ is cumulative distribution function and Φ_2 is bivariate normal cumulative distribution function.

With regard to the specification of variables affecting WTP/WTA, we have little reason to differentiate between Z and X in the two-stage interval data models. Hence, Z and X include the same set of variables for WTP and WTA models. Empirical model specification in this study is based on the premises that WTP/WTA is determined by consumer attitude (acceptance) toward agrobiotechnology and such attitude is in turn shaped by the risks and benefits perceived by consumers. In this study, perceived risks are measured on five items: (1) health risks, (2) environmental risks, (3) moral and ethical considerations, (4) image of multinational corporations as the primary beneficiaries of biotechnology, and (5) growing control of multinational corporations over farming. Perceived benefits are measured on three items: (1) potential increase in yields in crop production, (2) reduced use of chemicals in crop production, and (3) potential improvement in nutritional contents of crops.

In addition, we hypothesize that WTP/WTA would be influenced by the degree of trust that consumers place on regulatory agencies. If consumers believe that government has adequate regulations for GM food, we expect that they would be less likely to be willing to pay premium to avoid GM food or to require discount to purchase GM food. We also anticipate that respondents' knowledge of agbiotech issues would affect WTP/WTA. Finally, we include two binary variables representing the effects of cheap talk script and question ordering between WTP and WTA, respectively.

The resulting model is captured in the vector, X = [Risk, Benefit, Trust, Knowledge, D_1, D_2] where Risk represents an index of perceived risks comprising of the

five negative attributes; Benefit represents an index of perceived benefits comprising of the three positive attributes; Trust represents the degree of trust that consumer place on government; Knowledge refers to self-rated knowledge of agbiotech issues; D_1 refers to a binary variable taking 1 if consumers were exposed to the cheap talk script; D_2 refers to a binary variable taking 1 if consumers were exposed to questionnaires presenting WTP questions prior to WTA questions.

Results

Estimated results show that risk and benefit perceptions had expected signs both in the first (zero/one) and second (positive amount) stages. When consumers perceived risks in connection with agrobiotechnology or GM food, they were more likely to decide to pay a certain amount of premium to avoid GM food or require discount to purchase GM food in exchange for giving up non-GM food. Even when they (who perceived risks) selected positive WTP/WTA, they were likely to pay larger premium or require larger discount. In contrast, when consumers perceived benefits from agrobiotechnology or GM food, they were less likely to decide to pay premium or require discount to purchase GM food. Even when they (who perceived benefits) selected positive WTP/WTA, they were likely to decide to pay smaller premium or require smaller discount.

Respondents who believe that regulatory agencies have adequate policies to assure the safety of GM food were less likely to decide to pay premium or require discount. Self-rated knowledge about agrobiotech issues, however, did not make a significant difference in the two decisions. Income was statistically significant only in determining willingness-to-pay premium in the form of an increase in weekly food

expenditure bill. Males were more likely to select zero premium (for WTP) or zero discount (for WTA) compared to females. When selected positive WTP or WTA, they were predisposed to select smaller premium or discount.

Cheap talk script did not make a difference in stated WTP values, while having a significant impact on stated WTA values. That is, respondents who were exposed to the cheap talk script were more likely to select zero discount and when they selected a positive amount of discount, it would be significantly smaller compared to that of respondents without the cheap talk script.

Question ordering between WTP and WTA had impact on stated WTP values, but not on stated WTA values. Presenting WTP questions before WTA significantly reduced the likelihood of selecting positive premium when compared to the case of presenting WTA questions first. When respondents (faced with the question ordering of WTP/WTA) selected positive premium, their amount of WTP was significantly smaller compared with stated WTP values from the ordering of WTA/WTP. A plausible reason is that when first presented with WTA questions, respondents use their WTA responses to frame answers to WTP questions, causing respondents to bid higher premium inconsistent with their true preference.

Conclusions

In an attempt to enhance our understanding of European consumers' preference between GM and non-GM foods, our study elicited UK consumers' willingness-to-accept (WTA) discount in exchange for giving up non-GM food and willingness-to-pay (WTP) premium for non-GM food. Eliciting only WTP does not provide sufficient information for determining substitutability between GM and non-GM food. Survey results indicate

that there is a strong demand for non-GM food in the UK, but a non-negligible segment expressed their willingness to substitute non-GM food with GM version either without discount (12 %) or with discounts (34 %). This result suggests that there is an economic incentive for food industry in Europe to offer GM food to consumers.

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Table 1. WTP and WTA question wordings

	Willingness-to-pay	Willingness-to-accept
A box of breakfast cereals	Suppose the price of breakfast cereals made from GM crops is £2.80 per box. The price of conventional nonGM breakfast cereals will be higher than £2.80, but is not determined yet. What is the most above the current price of £2.80 you would be willing to pay to purchase a box of conventional non-GM breakfast cereals?]	Suppose the prices of breakfast cereals of both types are identical at £2.80. The grocery store offers a discount to promote the sales of GM breakfast cereals. What is the minimum amount of discount below the current price of £2.80 that would make you want to purchase a box of GM breakfast cereals?
Weekly food expenditure	Suppose that it generally costs more to purchase non-GM foods due to segregation and labeling requirements. What is the maximum percentage increase in your weekly food bill that you are willing to incur to ensure that you do not eat GM foods?	Suppose that the grocery store offers discounts to promote the sales of GM food products. What is the minimum percentage decrease in your weekly food bill that will make you want to purchase GM food products?

Table 2. Distribution of responses to WTP and WTA questions

Products	Breakfast Cereals			Weekly expenditure	
Premium/Discount	WTP	WTA	Increase/Decrease In Weekly food bill	WTP	WTA
£ 0.00	21.2 %	12.0 %	0 %	20.5 %	12.0 %
£ 0.01~£ 0.07	4	1.7	0.01% ~ 2.5 %	5.7	2.1
0.08~0.14	5.1	1.7	2.6 ~ 5	10	3.4
0.15~0.21	8.7	2.2	6 ~ 7.55	2.1	2.0
0.22~0.28	4.8	1.7	7.6 ~ 10	7.7	3.6
0.29~0.35	4.3	2.0	11 ~ 12.5	8.1	3.9
0.36~0.53	7.2	4.1	12.6 ~ 18.9	2.8	2.4
0.54~0.70	6.0	4.9	19 ~ 25	7.6	5.3
0.71~0.88	0.9	1.7	26 ~ 31	2.0	2.4
0.89~1.05	4.6	4.7	32 ~37	0.5	1.4
1.06~1.23	2.1	2.4	38 ~44	0.6	0.6
1.24~1.40	1.5	2.5	45 ~50	2.9	4.5
1.41~1.75	0.9	1.0	51 ~ 62	1.2	1.8
1.76~2.10	0.6	0.8	63 ~ 75	0.6	0.7
2.11 or higher	9.0	3.9	76 or higher	6.6	3.7
Don't know	19.54	7.5	Don't know	20.4	8.3
I'll never buy GM food at any discount	N/A	46.6	I'll never buy GM food at any discount	N/A	43.0
Sum	100 %	100 %		100 %	100 %

Table 3. Summary information from WTP and WTA responses

	Willingness-to-pay		Willingness-to-accept	
	A box of break-fast cereals (£)	Weekly food expenditure (%)	A box of break-fast cereals (£)	Weekly food expenditure (%)
Never consumer GM	N/A	N/A	46.6 %	43.6
Don't know	21.5 %	20.4 %	7.5.0 %	8.3 %
WTP premium	57 %	59 %	N/A	N/A
WTA discount	N/A	N/A	33.9 %	36.7 %
Do not differentiate between GM and non-GM	12.8 %	13.7 %	12.0 %	12.1 %
Protest responses	8 %	8 %	N/A	N/A
Sum	100 %	100 %	100 %	100 %

Table 4. Mean difference between WTP and WTA.

	Breakfast Cereals		Weekly Food Expenditure	
	WTP	WTA	WTP	WTA
Mean	£ 0.57	£ 0.65	16.5 %	21.8 %
Mean difference (WTA-WTP)	£ 0.65 – £ 0.57 = £ 0.08		21.8 % – 16.5 % = 5.3 %	

Table 5. Mean WTP and WTA with and without cheap talk script.

	Breakfast Cereals		Weekly Food Expenditure	
	WTP	WTA	WTP	WTA
Mean with Cheap talk script	£ 0.55	£ 0.60	16.27 %	20.43 %
Mean without Cheap talk script	£ 0.60	£ 0.69	16.68 %	23.42 %

Table 6. Parameter estimates from two-stage interval data model for WTA/WTP.

	Breakfast Cereals				Weekly Food Expenditure			
	Zero/One Decision		Positive Amount		Zero/One Decision		Positive Amount	
Variables	Estimated Parameter	*t*-statistic	Estimated Parameter	*t*-statistics	Estimated Parameter	*t*-statistic	Estimated Parameter	*t*-statistic
Willingness-to-Accept (WTA)								
Constant	0.7395	1.075	1.5873	4.415	0.7876	1.147	43.6321	3.553
Risk	0.5743***	8.566	0.3816***	11.32	0.5821***	8.372	13.772***	12.15
Benefit	-0.4543***	-4.554	-0.2339***	-6.676	-0.5144***	-6.124	-8.5800***	7.109
Trust	-0.1018**	-2.098	-0.1245***	-5.119	-0.0906*	-1.782	-4.5756***	5.550
Knowledge	-0.0200	0.6552	0.0094	0.593	0.0163	0.519	0.5737	1.058
Cheap Talk	0.1533	1.212	-0.2348***	-3.905	-0.2365*	-1.815	-5.7100**	-2.644
Q_Ordering	0.0652	0.518	-0.0308	0.486	-0.2228	-1.719	-1.5165	-0.704
Income	0.0276	1.022	0.0098	0.729	0.0348	1.250	0.2916	0.633
Gender	-0.0218	0.1597	-0.1215*	-1.836	-0.0510	-0.363	-2.8447	-1.265
Age	-0.0012	0.2036	0.0024	0.002	-0.0010	0.1886	0.1529	1.607
Education	-0.0256	-1.4791	-0.1254	-1.446	-0.0040	-0.2380	-0.4680	-1.5875
Willingness-to-Pay (WTP)								
Constant	-0.1269	0.2193	0.5054	1.572	-0.3317	0.574	6.3084	0.600
Risk	0.4335***	8.002	0.1789***	5.9826	0.4127***	7.682	5.2500***	5.366
Benefit	-0.1920***	-3.078	-0.0759***	-2.383	-0.1883***	-3.027	-3.107***	-3.013
Trust	-0.0831**	-2.109	-0.0294	-1.368	-0.1133***	-2.941	-0.6363	-0.907
Knowledge	0.0227	0.883	0.0227	1.591	0.0469	1.873	1.2923	1.554
Cheap Talk	-0.0412	0.392	-0.0548	-0.932	0.1081	1.057	-0.3378	-0.187
Q_Ordering	-0.3207***	-3.046	-0.5073***	-8.727	-0.1066	-1.048	-12.435***	-6.915
Income	0.0161	0.712	0.0069	0.576	0.0390*	1.793	0.5962*	1.654
Gender	-0.2274**	-2.053	-0.0179	-0.297	-0.3176***	-2.919	0.4558	0.244
Age	-0.0093	-2.076	-0.0025	-1.036	-0.0078	-1.802	-0.0612	-0.775
Education	0.0112	0.808	0.0003	0.044	0.0018	0.130	-0.1628	-0.621