CONSUMERS' WILLINGNESS TO PAY FOR THE COLOR OF SALMON: A CHOICE EXPERIMENT WITH REAL ECONOMIC INCENTIVES

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Abstract

We designed an experimental market with posted prices to investigate consumers' willingness to pay for the color of salmon. Salmon fillets varying in color and price were displayed in 20 choice scenarios. In each scenario, the participants chose which of two salmon fillets they wanted to buy. To induce real economic incentives, each participant drew one unique binding scenario; the participants then had to buy the salmon fillet they had chosen in their binding scenario.

Key words: choice experiment, color, mixed logit, salmon, willingness to pay.

During the last decade, economists have used experimental markets to investigate consumer preferences and willingness to pay (WTP) for food quality attributes. The most popular method has been the second-price sealed-bid (Vickrey) auction where the participants submit sealed bids for the product and the price is determined by the second-highest bid (Vickery, Shogren et al., Alfnes and Rickertsen). The Vickrey auction is an incentive compatible method for eliciting WTP; however, it is an unfamiliar market mechanism for most consumers. Consumers are more familiar with markets where the seller posts the prices and they, as consumers, have to choose which products to buy.

Lusk and Schroeder designed an experimental market with posted prices to investigate consumers' WTP for food quality attributes. They had five types of beef, and ask the participants to choose which of the five types they would prefer to buy in 17 pricing scenarios. To induce real economic incentives, one of the price scenarios was randomly drawn as binding. The participants had to buy the type of beef they had chosen in the binding scenario and pay the respective price posted in that scenario. The choice task in such an experiment is relatively close to the choice tasks consumers face in grocery stores every day. Furthermore, it is in the participants' own interest to choose the alternative they prefer in each scenario, and their incentives to reveal true preferences is relatively transparent. We will refer to such *non-hypothetical choice experiment with posted prices* as *real choice* (RC) experiments.

We have conducted a RC experiment to investigate consumers' WTP for salmon with various degrees of flesh redness, and to investigate whether information on the origin of the color influence consumers' WTP. Salmon are recognized for their pink-red flesh color, which distinguishes them from other species. Consumers use intrinsic cues such as color to infer the quality of food products. In surveys as well as focus groups, consumers have stated that they see the color of salmon as an indicator of flavor and freshness, and it has been shown that redness contributes significantly to the overall enjoyment of cooked salmon (Anderson, Sylvia et al.).

Consumers' WTP for the color of farmed salmon is interesting for at least two reasons. While wild salmon get their characteristic red color from the crustances they eat in the sea. Farmed salmon get the color from synthetically produced feed additives.

However, the feed additive is expensive and the marginal return in form of color is decreasing. Improved information on consumer WTP for salmon with various degree of redness will help producers optimize the coloring. A second issue is the ongoing debate of the “color added” label on farmed salmon. In recent years, consumer focus on food safety, ethical production, and animal welfare has increased, and food additives used partly or purely for cosmetic reasons are subject to considerable debate. The US Food and Drug Administration require grocery stores to label farm-raised salmon so that consumers are aware of the presence of artificial coloring. The fish should be labeled in the retail case and on individual packages with the words “color added” or “artificially colored”. In a survey of grocery stores in Iowa, we found that several stores still sold farmed salmon that were not labeled with color added and we found none with color added labeling on the retail cases. Furthermore, of the ones that did label the farmed salmon, several used the less negative expression “the feeding process enhances the color” instead of color added.

In 2003, consumer groups in the US filed a lawsuit against three major grocery chains to force them to label the farm salmon as color added (Smith and Lowney). In a class action complaint, it was stated: *As a result of Defendant’s misbranding, concealment and nondisclosure, consumers are misled to purchase the artificially colored salmon and/or to pay a greater price than they would otherwise pay. Defendant has been unjustly enriched at the expense of these consumers* (Smith and Lowney). Hence, Smith and Lowney argue that consumers’ WTP for farmed salmon would decrease if they knew the origin of the color.

We use a modified version of Lusk and Schroeder's RC design. Lusk and Schroeder had the same five types of beef in all 17 price scenarios and used a fractional factorial design to vary only the prices among the scenarios. They drew one binding scenario for the whole group, so the choices where between types of beef and not between specific packages. We used scenario specific products and used a fractional factorial design to vary all product attributes among the scenarios. In each scenario, we displayed two salmon fillets with varying colors and prices and the participants chose which of the two salmon fillets they wanted to buy. To induce real economic incentives, each participant drew one unique binding scenario. The participants then had to buy the salmon fillet they had chosen in their binding scenario. The modified design is very flexible and can easily be expanded to include a number of quality attributes.

To our knowledge, this is the first study using experimental markets to investigate consumers' WTP for seafood attributes. Only a few studies using various survey methods has previously been conducted (Holland and Wessells, Johnston et al.; Wessells, Johnston, and Donath). The remainder of the paper proceeds as follows: first, we give some background information on farmed salmon, followed by a presentation of the experimental procedure, products, design of choice scenarios, sample, and the econometric model, the results and discussion, and last summary and conclusion.

Background

During the last few decades, the production of farmed salmon has experienced a growth surpassed by few other primary production commodities. Global production increased from about 12,000 metric tonnes in 1980 to well above 1 million metric tonnes in 2003. However, such a large increase in production has significantly altered the structure of several markets, and affected the pattern of international salmon trade. This has led to a series of trade disputes, and the larges producers of farmed salmon, Norway and Chile, have been subject to dumping complaints in both the US and the EU. See Anderson and Fong, Asche, Bremnes and Wessels and Asche for discussions of some of the salmon trade dispute cases.

The increase in production of salmon has been accompanied by a substantial decline in prices. The main factors behind reduced production costs are improved productivity and technological change. Fish farmers can today to a larger extent control growth, sexual maternity, and quality parameters such as fat content, texture, taste, color etc. However, while better control have reduced cost and improved the final product, the industrialization of the salmon farming industry has at the same time lead to critical voices among some researches, consumer groups and environmentalists (see for instance Naylor et. al).

One of the issues of special concern among the above-mentioned group is the salmon color. The characteristic color is caused by depositions of carotenoids in the muscles. In the wild, salmon absorb carotenoids from the crustaceans they eat. The most important carotenoid for the color of salmon is astaxanthin. Salmon are unable to biosynthesize astaxanthin, and thus without astaxanthin in their diet, the salmons' flesh would range from gray or khaki to pale yellow or pale pink. Farm-raised salmon do not have access to natural sources of astaxanthin. To impart the pink-red color in farmed salmon, synthetically produced carotenoids, mainly astaxanthin, are added to their feed. However, astaxanthin is expensive, and in conventional salmon farming astaxanthin accounts for approximately 15 percent of the feed costs. Feed cost again accounts for nearly 50 percent of total production costs (Guttormsen). Hence, coloring is a relatively important cost in salmon farming. "In 2003, the total cost of producing 1 kilogram slaughtered and gutted salmon in Norway was approximately NOK 20 and the cost of producing one kilogram of salmon fillet was approximately NOK 34.[1]

The internationally recognized method for salmon color measurement is comparing the salmon fillet flesh with the colors in the *SalmoFan*™. The SalmoFan is a color fan developed on the basis of the color of salmonid flesh pigmented with astaxanthin. The color of conventional farmed salmon fillets sold in the Norwegian market normally range from 23 to 30 on the SalmoFan, and most common are fillets ranging from 25 to 27. In a consumer study conducted by Roche Vitamins, the producer of astaxanthin for the salmon farming industry, they used the color 26 as their base product (Fish Farming International).

Experimental Procedure

The experimental session included a survey[2], a stated choice experiment, and an RC experiment. The RC experiment consisted of three-times 10 choice scenarios.[3] In each choice scenario, the participants chose between two salmon fillets with posted prices. If none of the alternatives was of interest, they could also select a *none-of- these* (NOT) alternative. See table 1 for an example of the choice scheme. In this article, we will analyze the first 20 RC scenarios that focused on the color of salmon.[4]

The RC experiment had nine steps. Step 1: The experimental procedure was explained to the participants. Step 2: The participants studied the alternatives in scenarios 1 to 10, and marked on a choice scheme which of the alternatives in each scenario they wanted to buy. Step 3: The participants were informed about the origin of the color. Step 4: The participants studied the alternatives in scenarios 11 to 20, and (as in Step 2) marked on a choice scheme which of the alternatives in each scenario they wanted to buy. Step 5: The participants were informed about organic and ecolabeled salmon. Step 6: The participants studied the alternatives in scenarios 21 to 30, and (as in Steps 2 and 4) marked on a choice scheme which of the alternatives in each scenario they wanted to buy. Step 7: After all participants had completed all scenarios, each participant drew one card determining his or her binding scenario. The drawing was done without replacement, so that only one participant was assigned to each scenario. Step 8: Each participant got the salmon fillet he or she had chosen in his or her binding scenario. Step 9: The participants went to the cashier and paid for their salmon fillets.

The design of our experiment follows Lusk and Schroeder with some important modifications. First, we used scenario-specific products. We had 30 boxes filled with ice on three large tables. Each of the boxes represented one scenario. In each box we displayed two consumer packages of salmon fillets. The prices of the two alternatives were posted on laminated paper in the back of the box. This setup is very flexible and allowed us to vary not only the price but also the products among the scenarios. Second, the participants chose between the exact product packages they could obtain. Each participant randomly drew his or her exclusive scenario, and the participant that drew scenario four would obtain the fillet he or she had chosen in box number four. The salmon fillets they evaluated were the exact same fillets they would buy. For this to be possible, the number of participants in each session had to be smaller or equal to the number of choice scenarios. Third, the two alternatives in each box were referred to as *Alternative 1* and *Alternative 2*. The only information that was posted in our experiment was the price. The consumers had to infer the quality from intrinsic quality cues such as color. Extending the design to include other types of information such as labeling is straightforward. Fourth, the color, as well as the price, was a part of the fractional factorial design, as was the positioning of the products as *Alternative 1* or *Alternative 2*. Any left or right hand side bias would therefore have no effect on the relative utility of the alternatives. Fifth, before the first 10 scenarios we did not give the participants any information about how the salmon fillets differed. We said that we had various types of farmed salmon fillets, and asked the participants to study the alternatives and choose the alternative they would like to buy, given the price. Only after the first 10 scenarios, we informed the participants about the origin of the color. Sixth, to reduce any systematic ordering effects the participants could start at any of the 10 scenarios on each table. This also speeded up the process and we avoided a queue in front of the first scenario.

Our modification of the design was inspired by the growing literature on stated choice (SC) surveys. Lusk and Schroeder include all alternatives in every scenario, and varied only the prices among the scenarios. This limits the number of alternatives that can be included in the experiment. In the SC literature, consumers choose among alternative product descriptions in hypothetical scenarios. In SC surveys it is common to include a large number of quality attributes, both existing and nonexisting. To elicit consumer preferences for the attributes efficiently, fractional factorial design is used to vary all attributes among the scenarios. To lessen the cognitive burden on the participants, usually only two or three alternatives are included in each scenario. For a thorough survey of SC methodology and applications, see Louviere, Hensher and Swait.

As a result of the modification of the design, fewer products are needed. In a choice experiment where all products are available in each choice scenario, it is possible that all participants end up with the same product. Assuming that we have n alternatives and m participants, we would then need m products of each of the n alternatives, $m*n$ products. Including only two alternatives in each choice scenario and allowing each participant to draw his or her exclusive scenario, reduces the total number of products necessary to $2*m$, or $2*m/n$ products of each alternative.

Products

To ensure a large variation in color, we bought salmon from four different production sites: three conventional salmon farms that utilize synthetically produced astaxanthin and one organic salmon farm that only uses astaxanthin from natural sources. The salmon fillets were cut into portions weighing approximately 400 grams[5], put into packaging familiar to consumers, exactly weighted, and we recorded if the fillet portions were from the front or tail of the fillet. The fillets were categorized into color categories using the internationally recognized method for color measurement for salmon, the *SalmoFan*™. Fillets from the conventional salmon farms ranged in color from 23 to 30 on the SalmoFan, and those from the organic salmon farm ranged from 20 to 22. The fillets were grouped into five color categories, hereafter referred to as alternatives R21, R23, R25, R27, and R29.

The price attribute took the levels NOK 24, 30, 36, 42, and 48. This corresponds to a price per kilogram of NOK 60, 75, 90, 105, and 120, respectively. The week before the experiment, the prices of salmon fillets in the three largest grocery stores in the area were NOK 79, 89, and 119 per kilogram. Thus, all prices except for that of NOK 24 were within a familiar price range for salmon fillets in Norway.

Non-processed food products such as salmon fillets are heterogeneous in so many ways that we cannot obtain products that are uniform in all characteristics. Allowing the color categories to be represented by more than one product gives a better representation of the categories than selecting one product from each category. In our experiment, we had eight sessions, 20 color scenarios with two fillets in each scenario. Each color category was included eight times in each session. We replaced the fillets every day, and the fillets sold in the first session each night were replaced with new fillets. The total number of fillets displayed in the color experiment was 197, divided into five color categories. On average, each color category was represented by almost 40 salmon fillets in the experiment. This relative high number of salmon fillets in each color category reduce the effect on the WTP estimates of any unrecorded attributes of one specific salmon fillet.

Design Choice Scenarios

We used a SAS macro to generate a fractional factorial design with 40 choice scenarios. Each scenario had two alternatives described by color and price, both five-level attributes. To avoid clearly dominated alternatives we limited the design to scenarios where the color of the two alternatives differed. There were, however, no limitations on the price attribute, and several scenarios had the same price for both alternatives. The scenarios were divided into four blocks, and randomly arranged within the blocks. SAS reported a D-efficiency of 96.85 for the design. Each block of scenarios was used once as scenario 1 to 10, and in another session as scenario 11 to 20. For a description of the SAS macro, see Kuhfeld.

Sample

The experiment was conducted at MATFORSK, The Norwegian Food Research Institute, during four nights in February 2004. We conducted two sessions each night, and the sessions lasted approximately one and a half hours each. Each session had between 13 and 16 participants. In total, 115 participants were recruited through various local organizations, including choirs and soccer teams, in southeastern Norway. In each organization, the contact person was instructed to provide a sample of regular consumers, between 25 and 60 years old, with an approximately equal division of sexes. The organizations were given NOK 200 for each participant they recruited, and the participants were given NOK 300 to take part in the experiment.

Table 3 presents the descriptive statistics for the sample. The participants' ages ranged from 20 to 63 years, with an average of 39 years. Fifty eight percent of the participants were women. The average household income was NOK 562,000. One participants that said he did not eat fish, and 15 participants that chose the NOT alternative in all choice scenarios were excluded from the analysis. The sample used in the estimation consists of the remaining 99 respondents.[6]

Econometric Model

We analyzed the RC data with a mixed logit (also known as a random parameter logit) model. The mixed logit obviates three of the limitations of the standard logit model by allowing for random taste variation, unrestricted substitution patterns, and correlation in unobserved factors over time (Train). Furthermore, McFadden and Train show that under mild regularity conditions, any discrete choice model derived from random utility maximization has choice probabilities that can be approximated as closely as one pleases by a mixed logit model.

Let us assume that the individual's utility from each alternative can be decomposed into a linear-in-parameters part that depends on observable variables, and an error term that is independently and identically distributed (iid) extreme value. Given these assumptions, the utility of individual *n* from alternative *i* in choice scenario *s* is denoted by:

$$U_{nis} = \beta' x_{nis} + \eta_n' z_{nis} + \varepsilon_{nis} \quad (1)$$

where x_{nis} and z_{nis} are vectors of observed variables relating to alternative i; β is a vector of fixed coefficients; η is a vector of random terms with mean zero; and ε_{nis} is an iid extreme value error term. The terms in η are error components that, along with ε_{nis}, define the stochastic portion of the utility. The standard logit is a special case of the mixed logit where η has zero variance.

The density of η is denoted by $f(\eta|\Omega)$ where Ω is the fixed parameters of the distribution. For a given η, the conditional choice probability is a standard logit:

(2) $$L_{ni}(\eta) = \frac{e^{\beta' x_{ni} + \eta_n' z_{ni}}}{\sum_{j \in J} e^{\beta' x_{nj} + \eta_n' z_{nj}}}$$

Consequently, the unconditional choice probability, P, in the mixed logit model is the logit formula integrated over all values of η with the density of η as weights:

(3) $$P_{ni} = \int L_{ni}(\eta) f(\eta \mid \Omega) d\eta$$

This choice probability cannot be calculated exactly and is approximated through simulation (Brownstone and Train).

In the RC color experiment, the participants were asked to make 20 choices between salmon fillets offered at various prices. The choice data were analyzed with the following mixed logit model:

(4) $$U_{nis} = (\beta_{0i} + \beta_1 Tail_{nis} + \beta_{2i} ID_s + \eta_{ni}) Weight_{nis} + \beta_3 Price_{nis} + \beta_4 Price24_{nis} + \varepsilon_{nis}$$

where β_{0i} is the alternative specific constant for alternative *i,* ASC(*i*) (in other words, there is one constant for each color); $Tail_{nis}$ is a dummy taking the value one if the product is a fillet tail, and zero otherwise; ID_s is a dummy variable taking the value zero before the color information was given and one afterwards; η_{ni} is a error term that is triangularly distributed, heteroscedastic, independent between alternatives, and perfectly correlated over choices made by the same individual[7]; $Weight_{nis}$ is the exact weight of the alternative *i* in kilograms; $Price_{nis}$ is the price of alternative *i*; $Price24_{nis}$ is a dummy taking the value one if the price is NOK 24, and zero otherwise. The Price24-dummy is included to capture any adverse effects of offering the salmon fillets at price that is below what is normally seen in the market. For identification, the alternative-specific parameters for the palest alternative, R21, is normalized to zero. For the estimation purposes, the weight of the NOT alternative is set to one.

The mean WTP per kilogram of alternative *i* can be calculated by dividing the utility difference between the one kilogram of the varieties and the NOT alternative, with the negative of the price sensitivity parameter:

$$WTP_{is} = -100 * \frac{(\beta_{0i} + \beta_1 Tail_{is} + \beta_{2i} ID_s) - (\beta_{0NOT} + \beta_{2NOT} ID_s)}{\beta_3} \tag{5}$$

where WTP_{is} is the estimated mean WTP per kilogram of alternative *i* in scenario *s*; and all other variables and parameters are as described in equation (4). Since the price sensitivity parameter measures the utility of the price in NOK 100, we must multiply the result by 100 to get the WTP in NOK:

Results and Discussion

In our design, there were no correlation between color and price and no correlation between the price of alternative 1 and the price of alterantive2. Therefore, one would expect that on average the choice probability for an alternative increased as the price decreased. This was the case as long as the price was within the familiar price range of NOK 30 to NOK 48 per 400 grams. However, when the price was reduced from NOK 30 to NOK 24 the average choice probability for an alternative was reduced. On average, the percentages of the participants that chose an alternative with a price of NOK 48 was 30.76%, this increased to 35.98% for NOK 42, 37.71% for NOK 36 and 42.86% for NOK 30, but decreased to 36.78% for NOK 24. The NOK 24 price is below that which is normally seen in the market, and it appears that this low price is seen as a signal of low quality. Not controlling for this would give a price sensitivity parameter that was closer to zero, and thereby higher WTP values.

Table 4 shows the estimated parameters, standard errors, and *p*-values for the mixed logit model with and without the Price24 dummy. The Price and NOT parameter change considerably when we exclude the Price24 dummy. The Price parameter change because the adverse reaction to the NOK 24 price is not accounted for with a dummy, but instead is interpreted as a lack of price sensitivity. Furthermore, with a reduced absolute value on the Price parameter, the NOT parameter must increase to compensate for the loss in the NOT alternatives' relative utility resulting from its zero price.

We will from now on, concentrate the discussion on model 1. From the lower part of table 4, we can see that the mixed logit model (log likelihood of -1808) fits the data significantly better than the more restrictive standard logit model (log likelihood = -2051).

The ASC represents the utility per kilogram of the alternatives before we informed the participants about the origin of the color. It is worth noting that these color preferences were elicited without telling the participants that they should focus on color. The ASC for the colors R23, R25, R27, and R29 are all positive and significant. This means that on average the consumers preferred these colors to the paler R21. Furthermore, the alternative with the highest utility is the reddest alternative, R29. The ASC of R29 is significantly higher than the ASC of the paler R23 (*Wald*, *p* value = 0.00), and R27 (*Wald, p* value = 0.02), and higher, but not significantly, than R25 (*Wald, p* value = 0.07), No significant differences were found between the alternatives R23, R25, and R27.

The ASC plus the ID represent the utility per kilogram of the alternatives after we informed the participants about the origin of the color. None of the utilities changed significantly after the color information was presented. The utilities of the colors R23, R25, R27, and R29 are still positive and significant. This means that the average consumer prefers the redder colors to the pale R21 even when they know the origin of the color. However, the utility of the reddest alternative, R29, decreased significantly relative to the utility of R25 (*Wald, p* value = 0.05) and R27 (*Wald, p* value = 0.00), and decrease, but significantly, relative to the utility of R23 (*Wald, p* value = 0.26). After the color information was supplied, the utility of R27 is significantly higher than the utility of R23 (*Wald, p* value = 0.00), R25 (*Wald, p* value = 0.01), and R29 (*Wald, p* value = 0.01).

The number of fillet tails was unevenly distributed among the five color categories and was most frequent in the R29 category. The tail parameter was not found to be significant, although the negative value indicate that the participants preferred the thicker front part of the fillet to the tail of the fillet.

Table 5 presents the WTP per kilogram of the five alternatives. As discussed above, the participants preferred the reddest alternative, R29, when they were uninformed, and the slightly paler R27 when they were informed about the origin of the color. After the information the participants still preferred fairly red salmon, but they seemed to have become a little skeptical with respect to salmon that were redder than they were used to. This is reflected in figure 1 where the concave nature of the WTP for color is evident.

Remembering that the price of salmon fillets in the local stores ranged from NOK 79 to NOK 119 the week before the experiment, we find the level of the WTP estimates surprisingly high. The high WTP estimates indicates that the participants did not take their outside options fully into account, and thereby chose one of the salmon alternatives to often. A higher percentage of NOT choices would have increased the estimated utility parameter for the NOT alternative, and through equation (5) reduced the level of all salmon WTP estimates. It is important to understand, that including the 15 participants that chose the NOT alternative in all 20 scenarios would not help much. We have used a panel version of the mixed logit model, were all choice made by one participant are clustered together. Including 15 participants that make the same choice in all 20 scenarios would have little effect on the parameter included in equation (5), however it would significantly increase the variance of the non-iid error term associated with the NOT alternative.

An alternative explanation of the high WTP estimates is that the price sensitivity parameter that comes from the marginal changes in the product attributes, are less than the price sensitivity for the product as a whole. In other words, that the price sensitivity we find is a marginal price sensitivity that should not be used to draw conclusions about the total WTP. We the data we have from this experiment, we cannot distinguish between this two explanations. Further research is necessary before we fully understand how outside options and other framing effects influence consumers' decisions in choice experiments.

Summary and Conclusion

In RC experiments, consumers face choices involving real products and money in a series of choice scenarios. The choice task is relatively similar to the choices consumers face in grocery stores. The incentives for revealing one's true preferences are transparent. This makes the RC experiments an incentive compatible method for eliciting WTP for food-quality attributes. The design of the experiments and the analysis of the data are based on methods developed for hypothetical choice experiments. We modify the RC design by using scenario-specific products and unique binding scenario for each participant. This increases the flexibility, allows for incorporation of a higher number of quality attributes, and allows the participants to choose between specific product packages and not only product types.

The RC experiment presented in this article focuses on the color of salmon. The pink-red color is one of the most important quality traits for Atlantic salmon. Consumers use the color as a quality indicator and are willing to pay significantly more for salmon fillets with normal, or above normal redness, compared with paler salmon fillets. Without artificial coloring, farm-raised salmon would be difficult to market, and would command lower prices. Salmon with a color below 23 on the Roche Salmofan is difficult to sell at any price. However, there is less to gain by increasing the color above 23. Informing the consumers about the origin of the color does not affect the WTP for pale and normal red fillets. However, this information does influence the WTP for above normal red fillets, which decreases significantly. These results indicate that color-added labeling would have little effect on the demand for the most common color categories of farmed salmon.

Consumer WTP for various degrees of redness is only a part of the information necessary to find the optimal level of coloring for salmon. In addition, estimates of the cost of increasing the color and information about to what extend the producers are able to retrieve the increasing WTP are necessary to solve the optimization problem. Further research should be conducted in these areas.

Footnotes

[1]NOK 100 = EUR 11.44 = US$ 14.34. February 4, 2004. (www.oanda.com).

[2] The survey was divided into four parts. The participants answered most questions before the choice experiment, some questions after 10 choice scenarios, others after 20 choice scenarios, and the last questions after all 30 choice scenarios had been completed. In this article, we will not utilize the survey response.

[3] The instructions are available from the authors upon request.

[4] The last 10 scenarios, focusing on organic and ecolabeled salmon, will be analyzed in another article.

[5] The mean weight was 400.28 gram with a standard deviation of 40.25 gram. To avoid that the weight played an important role in the choice, we had a 10% upper limited of how much a choice pair were allowed to differ.

[6] Norway has a high organizational participation rate. In the Oslo area, for example, 49% of the population responds that they actively participate in at least one organization (Statistics Norway). Recruiting through organizations, therefore, can give a representative sample of the population.

[7] See Hensher and Greene for a discussion of various distributions on the non-iid error term.

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Table 1. Example of Choice Scheme

Scenario 1	400 grams farmed salmon		None of these
	Alternative 1	Alternative 2	
	NOK 36	NOK 48	
I would choose (check ✓one)	☐	☐	☐

Table 2. Information Given to the Participants

The fillets from wild salmon are usually pink, red, or orange. The strength of the color can vary from salmon to salmon. The color originates from carotenoids in the fish's diet. Carotenoids are widespread in living organisms.

The most important carotenoid for the color of salmon is astaxanthin. Astaxanthin is a common substance in both fresh water and marine organisms. Wild salmon get carotenoids from eating crustaceans, or small fish that themselves have recently eaten such animals.

To create similar color in farmed salmon, synthetically produced astaxanthin is added to their feed. No negative side effects have been reported from the use of astaxanthin.

Table 3. Descriptive Statistics for the Sample

Variable	Definition	Mean[a]	St.dev.
Gender	Gender of participant	1.43	0.49
	Female = 1; Male = 2		
Age	Age of participant	38.81	10.29
Income	Total income of household[b]	5.62	2.63
	(in NOK 100 000)		
Education	Highest completed education	2.54	0.67
	Elementary school = 1		
	High school = 2		
	College/University = 3		

[a]Corresponding figures for the population between 20 and 60 years old in the Oslo area are 1.49, 39.80, 5.89, and 2.41, respectively.

[b]The income question had six classes. The midpoints of classes are used in the estimation.

Table 4. Estimated Parameters for the Mixed Logit

Variable	Model 1 (with Price24 dummy) Para.	Std. err.	*p* value	Model 2 (without Price24 dummy) Para.	Std. err.	*p* value
Generic variables						
Price[a]	–3.54	0.63	0.00	-1.94	0.44	0.00
Price24	–0.49	0.14	0.00			
Tail[b]	–0.20	0.33	0.54	-0.46	0.33	0.16
Alternative specific constant for color *i*, *ASC(i)*						
ASC(R23)	3.16	0.53	0.00	3.06	0.52	0.00
ASC(R25)	3.57	0.52	0.00	3.65	0.52	0.00
ASC(R27)	3.45	0.54	0.00	3.44	0.53	0.00
ASC(R29)	4.26	0.56	0.00	4.41	0.56	0.00
ASC(NOT)[c]	–1.20	0.41	0.00	-0.50	0.36	0.16
Information dummies, ID_i						
ID(R23)	–0.59	0.72	0.41	-0.73	0.71	0.31
ID(R25)	–0.10	0.72	0.88	-0.45	0.71	0.53
ID(R27)	1.00	0.72	0.17	0.92	0.72	0.20
ID(R29)	–1.15	0.70	0.10	-1.24	0.70	0.07
ID(NOT)	–0.14	0.43	0.75	-0.22	0.44	0.61
Summary statistics						

Number of observations	1977	1977
Number of participants	99	99
LL standard logit	–2051	-2058
LL mixed logit	–1808	-1814

Notes: Estimated with Nlogit 3.0.

[a]Price in NOK 100.

[b]Tail is one if tail, zero otherwise. The variable is centralized before the estimation.

[c]NOT stands for Neither Of These.

Table 5. Willingness to Pay per Kilogram of Salmon

	Before information		After information	
Color	WTP	Std. err	WTP	Std. err
R21	36.51	9.21	38.00	8.80
R23	126.10	19.70	110.87	17.37
R25	137.62	21.87	135.68	20.01
R27	133.96	21.35	163.23	25.05
R29	156.92	25.31	125.99	20.69

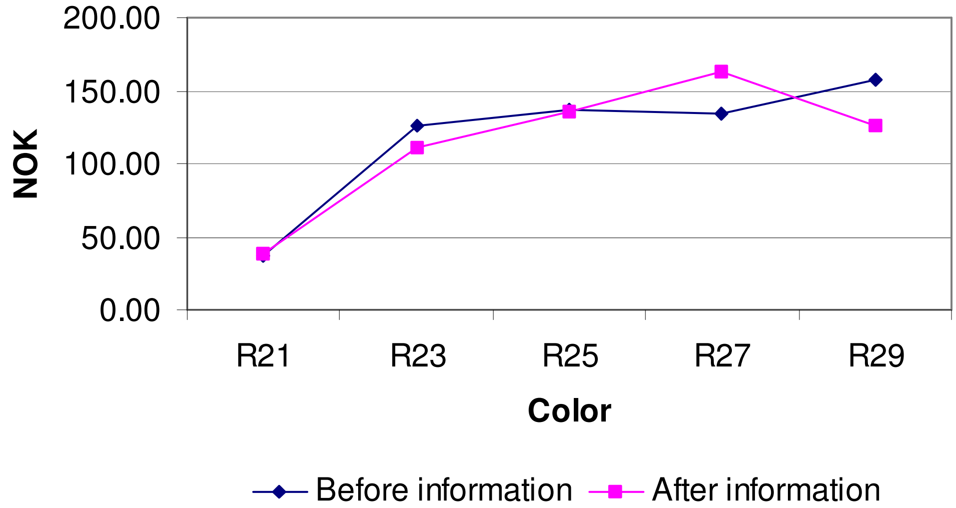

Figure 1. Willingness to pay per kilogram of salmon before and after information