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The Importance of Taste for Food Demand and the Experienced Taste Effect of Healthy Labels* - *An experiment on potato chips and bread*

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Abstract

This paper quantitatively analyzes the importance of taste versus health in food demand, as well as the effect on consumers' experienced taste of the non-intrinsic value of healthy labels. Our analysis is based on taste experiments and Vickrey second price auctions on potato chips and bread. Our findings imply a large positive effect on demand for potato chips from higher taste scores: when consumers' experienced taste from potato chips improves by one unit, the average WTP for a 150 gram bag of chips increases by 20 euro cents. The effect from taste on bread demand seems smaller, but may be sizeable for subgroups of consumers. Our evidence suggests that a better nutritional content, as indicated by a healthy label, may also positively affect food demand, but the effect is small and not statistically significant. Finally, we find that consumers' experienced taste of a food is unaffected by the food carrying a healthy label.

Keywords: healthy labeled food; non-intrinsic value; taste; Vickrey second price auction

JEL-classification: C91; D01; D84; I10

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1. Introduction

The prevalence of diet related illnesses, such as cardiovascular disease, diabetes, several types of cancer, as well as the conditions of overweight and obesity, has become one of the most important public health issues throughout the Western world and many transition economies. Public and private institutions are therefore making efforts to promote healthy eating, e.g., via information campaigns, food labeling and tax reforms.

In promoting healthy food choices, a major challenge is the trade-off between taste and health. The nutritional content is generally found to be second to taste in determining consumer food choices. When asking consumers, taste is typically found to be the most, or amongst the most, important determinants of food choice (Lennernas et al., 1997; Glanz et al., 1998). Taste, in turn, is enhanced by ingredients that are over consumed by most consumers – sweeteners, salt and fat (Drewnowski, 1997a,b). Consumers may even have expectations that unhealthy food (i.e. food high in fat, sweeteners and salt) tastes better: Raghunathan et al. (2006) show that consumers' experienced taste pleasantness of food is higher for food *portrayed* as unhealthy, compared to the exact same food when it is not portrayed as unhealthy. If people correspondingly experience a lower taste for food that carries labels commonly found in grocery stores and restaurants (i.e. labels indicating that food is healthier than its alternatives), labeling food as particularly healthy may even discourage people from buying that food.

The purpose of this paper is twofold. First, we aim to quantitatively analyze the importance of taste for willingness-to-pay (WTP) for food, relative to health. Second, we analyze if the non-intrinsic value of healthy labels affects consumers' experienced taste from food.[1] Our analysis is

[1] Utility from a product is generally assumed to only depend on the product's intrinsic characteristics and preferences of the consumer: taste should only depend on the ingredients in a food product and the individual

novel in three respects: this is the first study to provide quantitative measures of the importance of taste versus health in food demand, as well as to quantitatively compare the importance of taste in food demand over consumer sub groups. Finally, there are no previous studies analyzing the impact of the non-intrinsic value of health labels on consumer's experienced taste from food.[2]

Our analysis is based on experiments entailing potato chips and bread. Subjects' demand (WTP) for potato chips and bread is extracted via experimental Vickrey second price auctions (Vickrey, 1961; Shogren et al., 2001), and the impact of healthy labels on subjects' experienced taste from food is extracted via taste experiments, where the healthier alternative appears twice; once labeled and once without the label. Our results imply that food demand is strongly determined by peoples taste experience of food, and that taste is especially important in determining demand for normal weight subjects. For potato chips, taste also seems more important to low income earners than higher income groups, but our results imply the opposite for bread. We find only weak support for health (represented by healthy labels) being important for food demand, for any consumer group in our analysis. Our results also imply that consumer's experienced taste from food is unaffected by the non-intrinsic value provided by a healthy label.

The paper is structured as follows. Section 2 describes the data and experimental design, section 3 provides the results and section 4 provides a final discussion of the findings.

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characteristics and preferences of the person eating the food. However, other studies show that non-intrinsic attributes of a good (price, brand, etc) can affect reported or experienced taste (Plassman, 2008; Robinson et al., 2007; Lee et al., 2006; Allison, 1964). For instance, Plassman et al. (2008) find that consumers' experienced taste pleasantness of wine increases with the stated price of the wine, regardless of the actual quality or market price of the wine. Their results were confirmed both by stated pleasantness and measuring brain activities by a functional MRI.

[2] This differs from Raghunathan et al. (2006) who analyzed if consumers' experienced taste was affected by the food being portrayed as *unhealthier* than its substitutes.

2. Data and experimental design

A market research company recruited 63 subjects from the Stockholm area, of different ages, education, income and gender. Subjects were offered a general gift card SEK 100 to participate in the taste experiment and Vickrey second price auction. All in all, the study was estimated to take between 15-20 minutes of subjects' time.

The subjects were asked a number of background questions, such as their classification of their food intake ("not healthy", "less healthy", "healthy" or "very healthy") and their weight (underweight, normal or overweight). We created a dummy variable for subjects that classified their food intake as not healthy or less healthy (not healthy or less healthy=1; healthy or very healthy=0) and a dummy variable for subjects that were underweight or normal weight (under or normal weight=1; overweight= 0). We also created a dummy variable for low income earners (low income earner=1; higher income group=0). The average taxable labor income in Sweden 2010 was EUR 26,510/year (SEK 241,000/year[3]) for those 20-64 years of age (Statistics Sweden, 2012). We define those with an income of EUR 26,510/year or less as low-income earners. For a summary of subject characteristics, see Table 1.

The taste experiments for potato chips and bread were designed as follows. Subjects were brought into a room in groups of 15-20 at the time. The subjects were asked to rate the taste of 5 different potato chips alternatives on a scale from 1 ("very poor") to 5 ("very good"). The chips alternatives were presented on several tables in the room, in equal white cups, labeled A, B, C, D and E, where alternative B was labeled "low fat, 7.5%". The order of the cups (A-E) was varied over tables and participants. Each participant was assigned a seat at one of the tables and the

[3] On 11th of September 2012, the exchange rate EUR/SEK=0.11

order of the cups on the tables across the room was varied. The chips alternatives they were asked to rate were all of the flavor sour cream and onion. Unknown to the subjects, alternative B and D were actually the same potato chips alternative (i.e. the low fat alternative), but it was only labeled as low fat when it appeared as alternative B.

For bread, the taste experiment was designed correspondingly, although here subjects had 4 alternatives they were asked to rate and alternative B was labeled with a healthy label - the Nordic Keyhole. The Nordic Keyhole is a label certified to particularly healthy food alternatives by the Swedish National Food Administration (SLV), and is widely recognized by the general public. The criteria for certification vary over food products, and for bread to be certified with the Keyhole, it needs to contain moderate amounts of sugar, salt and fat, while being high in fiber. Unknown to subjects, alternative B and D were the same (i.e. the healthy labeled, i.e., Keyhole labeled, alternative). Only alternative B was labeled with the Keyhole. The bread was cut into pieces of similar sizes for all bread types and placed in white cups labeled A, B, C, D, where the order of appearance of the cups was varied across tables and participants.

After having rated the taste of the different potato chips and bread alternatives, the WTP for each potato chips and bread product was extracted using a Vickrey second price auctions. Participants were asked to place sealed bids (in SEK) on a 150 gram bag of each type of chips and a 200 gram bag of each type of bread. The participant with the highest bid would win the auction, paying the second highest bid for the good. However, only one type of potato chips and one type of bread would be auctioned off; there would be a random draw of which chips and which bread alternative that would be auctioned off.

3. Results

The results from the taste experiment are reported in table 2. The average *taste scores* for all potato chips alternatives range from 3.158 (alternative E) to 3.429 (the low-fat labeled chips), and the average taste scores for all bread alternatives range from 2.758 (the unlabelled healthy alternative) to 3.242 (alternative A). In table 2, potato chips (bread) B and D are the same type of potato chips (bread), where it is labeled as low fat (with a healthy label – "Keyhole") when presented as alternative B, while unlabelled when presented as alternative D. As shown by table 2, the average taste scores of potato chips B and D are 3.429 and 3.174, whereas the average taste scores of bread B and D are 2.823 and 2.758.

We test the hypothesis that the population mean taste scores of potato chips B and D (and, correspondingly, the mean taste scores of bread B and D) are the same using the non-parametric Wilcoxon signed-rank test, accounting for the facts that the variables are not normally distributed and that observations are not independent of one another. The result from the Wilcoxon signed-rank tests suggest that we cannot reject the hypotheses that the average taste scores are the same (p-value=0.1559 for chips and p-value= 0.4506 for bread). We find no support for the idea that the non-intrinsic value of healthy labels affects consumers' experienced taste of potato chips and bread.

Further, we analyzed if there persists prejudice of the taste of healthy labeled products within subgroups of the sample. We did so by performing non-parametric Wilcoxon Mann Whitney tests on the average difference in taste scores between the labeled and unlabelled alternatives over these respective groups (the null being that the mean scores are the same for the respective subgroups): (a) both gender groups, (b) overweight subjects and non-overweight subjects, (c)

low-income subjects and subjects of higher income, as well as for (d) subjects that believed they had a healthy diet, relative to subjects who believed their diet was generally of poor quality. In none of the cases can we reject the null hypothesis (at the 10 percent level) that the experienced taste difference between the labeled and unlabelled healthy is unaffected by gender, body weight, income or a generally healthy diet.

The results from the Vickery auction are presented in table 3. The WTP for 150 grams of potato chips ranges from SEK 8.874 (EUR 0.976) for the unlabelled low fat alternative D to SEK 10.071 (EUR 1.108) for the low fat labeled alternative D. For bread, the WTP ranges from SEK 9.280 (EUR 1.021) for the unlabelled Keyhole alternative D to SEK 10.881 (EUR 1.197) for the labeled Keyhole alternative B. Interestingly, for both chips and bread, the *unlabelled* healthy alternative yields the *lowest* willingness to pay of all potato chips respectively bread alternatives, while the *healthy labeled* alternatives yield the *highest* willingness to pay. A Wilcoxon signed-rank test was performed to analyze if the WTP is the same for low fat potato chips, if it is labeled as low fat (chips B) versus when it is unlabelled (chips D). Again, a corresponding Wilcoxon signed-rank test was performed for bread (bread B versus bread D). Here, we can reject the null hypothesis (at the 10 percent level) that the mean WTP is unaffected by the healthy label (*p*-value=0.0052) and bread (*p*-value=0.0651). I.e. when the experienced taste of a product is unaffected by the healthy label, our results imply that the healthy label increases product demand, as indicated by a significantly higher WTP for healthy labeled products.

Finally, we estimate an Ordinary Least Squares (OLS) regression model to determine to what extent taste and healthy labels affect WTP for bread respectively potato chips. The regression results are presented in tables 4 and 5. The dependent variable is WTP while the explanatory variables included in the model are the taste score and dummy variables representing the

different potato chips (bread) alternatives, where the reference alternative is the healthy labeled alternative. To explore if subgroups of consumers may differ in the importance they attach to taste in food demand, we also include interaction terms between the taste score and the dummy variables female, normal weight, eating healthy and low income.[4]

As shown by table 4, taste has a strong and statistically significant (at the 1 percent level) effect on the WTP for potato chips. In general, if the taste score increases by 1 unit, the average WTP for a 150 gram bag of chips increases by SEK 1.80 (EUR 0.198). Table 5 shows that for bread, the effect of taste on WTP is also quite large; if the taste score increases by 1 unit, the average WTP for a 200 gram bag of bread increases by SEK 0.84 (EUR 0.092), but this result is not statistically significant.

All dummy variable coefficients are negative, both for potato chips and bread, implying that the low-fat label in the potato chips case, and the Keyhole label in the bread case, positively affect the WTP for both potato chips and bread, but these results are not statistically significant.[5] Taste seems to be even more important to food demand for normal (and under) weight subjects than it is to overweight subjects. The interaction term between the taste score and normal weight has a large and statistically significant effect on the WTP for both chips and bread; being normal weight increases the positive impact on WTP from a one unit change in the taste score by SEK 0.48 (EUR 0.053) for potato chips (*p*-value = 0.053) and SEK 1.26 (EUR 0.139) for bread (*p*-value = 0.000). The interaction term between the taste score and low income also yields strong

[4] To analyze if subgroups differ in the importance of health on food demand, we estimated models with interaction terms between the dummy representing the healthy labeled alternative and the dummy variables representing female, healthy eating, normal weight and low income. There were no significant effects on WTP from those variables, though, implying that the influence of health on demand does not differ over these subgroups.

[5] We estimated alternative models, including interaction terms between the dummy representing the unlabelled healthy alternative and gender, income, education level, overweight and healthy diet. None of these were statistically significant, supporting the results from the Wilcoxon Mann Whitney tests, i.e. the WTP for the health labeled alternative, relative to the same (unlabelled) alternative, is not affected by these individual characteristics.

and statistically significant results on the WTP, but here the coefficients are of opposing signs for chips and bread: for potato chips, being a low income earner increases the positive effect on WTP from a unit change in the taste score by SEK 0.50 (*p*-value = 0.045), while, for bread, being a low income earner *reduces* the positive effect on WTP from a unit change in the taste score by SEK 0.54 (*p*-value = 0.097). I.e: for potato chips, taste seems to be even more important for low income earners in determining their demand than it is for consumers in other income groups, while for bread, low income earners seem to attach a lower importance to taste.

The interaction terms between taste score and female for potato chips and bread suggests that women do not differ much from men in the importance they attach to taste in potato chips (the coefficient of the interaction term between taste and female is both small and insignificant). For bread, women may attach a lower importance to taste when determining their demand, but, again, the effect is not statistically significant. People who generally eat an unhealthy diet seem to attach a higher weight to taste when deciding on food demand. The coefficients for the interaction term between taste and a generally unhealthy diet are relatively large both for potato chips (0.326) and bread (0.575), but statistically insignificant (*p*-value = 0.235 for chips, *p*-value=0.133 for bread). This result may imply that an unhealthy diet is partly driven by a stronger preference for taste in food.

4. Discussion

In this paper we use taste experiments and Vickrey second price auctions entailing potato chips and bread to quantify the relevance of taste, over health, for food demand. Further, we analyze if the non-intrinsic value of healthy labels (a low-fat label and the Nordic Keyhole label)

negatively affects consumer's experienced taste, thereby reducing consumer's demand for healthy food.

Or findings imply that the effect on taste on food demand is very strong and highly statistically significant. Subjects in the analysis were asked to rate the taste of both potato chips and bread on a scale from 1-5 (where 5 is the highest score), and the results suggest that as the taste score increases by one unit, WTP increases by more than 20 euro cents per 150 gram of potato chips, and by more than 10 euro cents per 200 grams of bread, for the average consumer. The effect from taste on WTP is even higher for normal weight subjects, in the case of bread it is almost double (for normal weight subjects, if the taste score increases by one unit, WTP increases by more than 20 euro cents per 200 gram bread). Our results also suggest that a better nutritional content, as implied by a healthy label, may positively affect WTP for food as well, but the effect is not as strong, and more importantly, not statistically significant.

Given the importance of taste on WTP for food, demand for healthy food could be negatively affected if consumers *believe* that healthy labeled food is less tasty than other food. Based on the results of a taste experiment on potato chips and bread we cannot reject the hypothesis that consumers find food just as tasty if it carries a healthy label as if it does not carry the label.

Taste is generally enhanced by unhealthy ingredients, such as sugar, fat and salt. Our results may therefore imply that the unhealthier the food, relative to its' substitutes, the higher the demand. If the aim is to strengthen demand for healthy food, it is crucial to ensure that healthy food is no less tasty than unhealthy food. Also, it is not clear that consumers are willing to pay more for healthy labeled food. Therefore, it is also important to ensure that the cost of healthy food is no higher than that of unhealthier food substitutes.

Finally, even though taste is the number one determinant in food demand, our results suggest that producers need not fear adding a healthy label to their products: we find that consumers do not have prejudice that healthy labeled food tastes worse than its substitutes. This result may appear to differ from previous research by Raghunathan et al. (2006) who found that food communicated to be particularly *unhealthy* yield a higher experienced taste, while our results imply no impact on consumers' experienced taste from communicating that the food is *healthier* (via food labels). The difference in results between theirs and this study could be due to a framing effect -- labeling healthy versus unhealthy food. Such a framing effect has for instance been found by Levin and Gaeth (1988), who found that beef portrayed as 25% fat was expected to taste worse than beef that was portrayed as 75% lean. Also, samples and methods differ between our study and Raghunathan et al. (2006), as well as products: they perform experiments entailing snack crackers and Mango Lassi (an East Indian "milk shake").

This is the first study to quantify the effects of taste relative to health (as represented by a healthy label) on food demand, and more extensive research on this topic is needed. Our sample is small and our results are likely to be affected by the products used in the experiments in this study. For instance, respondents may regard low-fat potato chips as no healthier than its high fat substitutes, meaning that a low fat label may have a smaller effect on demand for potato chips than it would have for other products. The differences we find over consumer subgroups (e.g., normal weight versus over weight subjects, and low income earners versus other income groups) in the importance of taste for food demand are also worth further exploring. Further, the potential framing effect underlying the difference in results between this study and previous research on consumer's experienced taste from unhealthy food deserves attention from future research.

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Tables

Table 1 – Subject characteristics

Variable	Mean	Std. Dev.	Min	Max	No of obs
Female	0.484	0.504	0	1	62
Unhealthy diet	0.254	0.439	0	1	63
Normal (or under) weight	0.689	0.467	0	1	61
Over weight	0.311	0.467	0	1	61
Low income	0.143	0.351	0	1	147

Table 2 – Taste scores for potato chips and bread

Variable	Mean	Std. Dev.	Min	Max	No of obs
Potato chips (sour cream and onion)					
Type A	3.477	1.014	1	5	63
Type B (low fat, labeled)	3.429	1.043	1	5	63
Type C	3.270	1.003	1	5	63
Type D (low fat, unlabeled)	3.174	1.185	1	5	63
Type E	3.159	1.125	1	5	63
Bread (flatbread)					
Type A	3.242	0.987	1	5	62
Type B (Keyhole, labeled)	2.823	1.017	1	5	62
Type C	3.032	0.829	2	5	62
Type D (Keyhole, unlabeled)	2.758	0.900	1	5	62

Table 3 – Willingness-to-pay (WTP) in SEK for potato chips (150 grams) and bread (200 grams)

Variable	Mean	Std. Dev.	Min	Max	No of obs
Potato chips (sour cream and onion)					
Type A	9.777	7.811	0	30	63
Type B (low fat, labeled)	10.071	7.216	0	30	63
Type C	9.445	7.228	0	30	63
Type D (low fat, unlabeled)	8.874	7.127	0	25	63
Type E	9.254	7.053	0	20	63
Bread (flatbread)					
Type A	10.881	7.905	0	27	63
Type B (Keyhole, labeled)	10.428	7.748	0	25	63
Type C	10.185	7.441	0	25	63
Type D (Keyhole, unlabeled)	9.280	7.647	0	25	63

Table 4 – Ordinary Least Squares regression results for potato chips

Variable	coefficient	s.e.	*t*-value	*p*-value
Dependent variable: WTP				

Constant	1.834	1.526	1.20	0.230
Taste score	1.800***	0.426	4.23	0.000
Type A	-0.434	1.231	-0.35	0.724
Type C	-0.131	1.232	-0.11	0.916
Type D (low fat, unlabeled)	-0.579	1.233	-0.47	0.639
Type E	-0.083	1.235	-0.07	0.946
Taste score * female	0.052	0.244	0.21	0.830
Taste score * normal weight	0.485*	0.250	1.94	0.053
Taste score * unhealthy diet	0.326	0.274	1.19	0.235
Taste score * low income	0.498**	0.247	2.02	0.045

No of obs: 310, Prob > F = 0.0000, R-squared = 0.1484, *> 0.90 statistical significance, **>0.95 statistical significance, and ***>0.99 statistical significance

Table 5 – Ordinary Least Squares regression results for bread

Variable	coefficient	s.e.	*t*-value	*p*-value
Dependent variable: WTP				
Constant	5.769	1.722	3.35	0.001
Taste score	0.843	0.639	1.32	0.188
Type A	-0.039	1.346	-0.03	0.977
Type C	-0.556	1.335	-0.42	0.677
Type D (Keyhole, unlabeled)	-1.057	1.328	-0.80	0.427
Taste score * female	-0.190	0.318	-0.60	0.550
Taste score * normal weight	1.262***	0.346	3.64	0.000

Taste score * unhealthy diet	0.575	0.381	1.51	0.133
Taste score * low income	-0.539*	0.324	-1.67	0.097

No of obs: 244, Prob > F = 0.0003, R-squared = 0.1148, *> 0.90 statistical significance, **>0.95 statistical significance, and ***>0.99 statistical significance