Determinants of Decision to Pay a Price Premium for Modified Food by Consumers of the Republic of Korea

Oz Kaya[1]
University of Georgia

Wojciech J. Florkowski[2]
University of Georgia

Dong-Kyun Suh
Rural Development Administration, Republic of Korea

Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2010 AAEA, CAES & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010.

[1] Email: oz@uga.edu
[2] Email: wojciech@uga.edu

Determinants of Decision to Pay a Price Premium for Modified Food by Consumers of the Republic of Korea

Abstract

The knowledge of the overall willingness-to-pay and the specific price premiums consumers accept when buying foods with less fat, saturated fat, sodium, sugar and more fiber shapes food manufacturer and distributor marketing strategies and supports the development of public health strategies. This study applies survey data collected in Korea to identify consumer profiles associated with the expressed willingness to pay a premium for foods with nutritionally desired attributes and, next, estimates the influence of consumer and household characteristics on the WTP a particular premium level for such foods. Results indicate the importance of socio-economic variables such as location, income and education, variables representing the risk of health problems (stroke, certain cancers), food being organic, support for food genetic modification or research, and attributes related to food preparation (cook fast, prepared with little waste or can be processed at home).

Introduction

The health effects of the suboptimal, adequate in the energy content, diet have become a global phenomenon. Even in societies strongly attached to their culinary traditions, such as in the society of the Republic of Korea (South Korea), the so called 'western' diet has become increasingly adopted by the population. Although the consumption of vegetables has been traditionally high in Korea and the fruit consumption increased manifold in the past few decades, the consumption of fat, saturated fat, and sugar also increased. Sodium consumption has been high and results from the tradition of eating pickled vegetables, seafood, and condiments such as the soy sauce.

The objective of this study is to investigate the influence of consumer and household characteristics on the decision to choose to pay for foods with changed content of fat, saturated fat, vitamin, protein and fiber. Next, the study examines characteristics that influence the

consumer selection of a specific size price premium to pay for food with a single nutritionally-desired ingredient change. Results are needed to make the crucial decisions about changes in product formulations and, subsequently, in communicating with consumers about the modified, nutritionally improved foods. Ultimately, healthier foods improve consumers' well being, lower the health care burden, while allowing food manufacturers and distributors to sustain their activities.

The Data

The data used in this study were collected through interviews with 1,100 females in September 2007. The respondents were primary meal preparers and resided in seven major urban areas of the Republic of Korea. The survey instrument was prepared by a team of Korean and American researchers and the survey was conducted by a commercial survey agency. The sample was representative of the Korean population by women, by eight age categories, residing in the seven urban centers.

In respect of traditional gender roles, only women were interviewed given their key role as food buyers and meal preparers in Korean households. Questions probed for views and opinions about various food attributes, shopping habits, perception of food production technology, food choices, and the willingness-to-pay for food attributes. A separate set of questions collected information about the demographic and socio-economic characteristics of respondents. The survey was implemented in Seoul, Inchon, Busan, Ulsan, Daejeon, Daegu and Kwangju. Seoul is the largest urban center and its population share is about 20 percent. Residents of Seoul are considered trend setters and, consequently, the empirical analysis compares choices of respondents of other urban areas to those living in the capital city. The remaining urban centers form three regions. Busan, Ulsan and Daegu constitute Eastern region (East), Incheon

and Daejon represent the Western region (West), and Kwangju resident comprise the Southwestern region (Southwest).

The largest share of interviewed female consumers was 35 years old to 48 years old, nearly 60 percent, followed by those between 49 years old and 59 years old, 20 percent. About 34 percent of the respondents received a high school or university degree, while the majority, 60 percent, completed the middle school. Monthly household income was reported by category. From among five categories used in this study, the highest category was chosen as the benchmark category. The share of households reporting at least one child 18 years old or younger was 64 percent. The general characteristics indicate that the respondents represented the core food consumer segment.

The Empirical Model

The food choices are influenced by numerous factors, but in applied studies the choice is attributed to a particular attribute or function of a product. This study examines the food choice with regard to five attributes important from the public health standpoint with far reaching consequences for food manufacturers and distributors on one hand, and plant breeders and farmers on the other. This study distinguishes between the consumer decision to pay for a product with the changed attribute and the subsequent decision how much more, if at all, to pay for the modified product. The two-step decision process requires two distinct estimation techniques because each step differently defines the dependent variable. First, the decision is limited to the yes/no selection and, then, to the selection of a premium placed above the price of an existing product once its modified variant becomes available at retail.

The dependent variable selection in this study addresses the nutritional attributes of foods with implications for the long-term well being of consumers. We focus first on the examination

of the consumer yes/no decision and, next, on the chosen price premium for foods with attributes expected to prevent or delay the onset of chronic diseases (e.g., containing less saturated fat or fat), or essential to maintain good health (e.g., an increased fiber, protein, or vitamin content). A logit technique was applied to estimate the respondent's decision to choose the payment of a premium for foods with less saturated fat, and an increased fiber, protein, fat or vitamin content. The second stage focused on estimating the actual level of premiums consumers indicated they were willing to pay for a food product with the changed amount of fat, vitamin, protein or fiber. The dependent variable, for this stage, was a category corresponding to a premium measured as a percent above the price respondent paid at the time of conducting the survey. The list of premium choices presented to respondents included ten even size ranges (i.e., 1%-10%, 11%-20%, …, 91%-100%). Given the actual distribution of respondents' selections, the number of premium categories was reduced to three, 1%-10%, 11%-20% and 21% or more. The collapse of premium values in excess of 20% supported earlier WTP studies because the number of those WTP more than 30% premium was typically quite small. Such preference has been confirmed by the actual consumer behavior reflected, for example, in the contraction of the organic food market in the United Kingdom, where consumers affected by the recession, refused to pay a premium of 60% as compared to conventional foods (Montague-Jones, 2010b).

In the absence of clear theoretical guidelines of explanatory variable selection, applied studies choose variables that influence attitudes, beliefs and preferences, and, ultimately, food selection. The set of unique explanatory variables to the sample of Korean female primary food preparers include socio-economic variables such as income, age, household size and education. Such measures are transparent and shape food preference and influence choices. Because the household's physical surroundings vary and affect the accessibility, local food culture, and

availability, the household location in a specific urban area was captured by a binary variable indicating each surveyed city. To avoid mis-specification, the decisions of respondents were compared to those of Seoul residents. The specific objectives of this study called for measures about beliefs relevant to considered food attributes and the perceived risk of having heart disease, stroke, or certain cancers. In addition, perceptions of healthiness of organic food as compared to conventional foods and the support for food genetic modification or food research in general, were also included, along with attributes that are considered important related to household food preparation practice (i.e., cook fast, prepared with little waste or processed at home). To place food choices with desired attributes in the context of public policy, the variable reflecting the degree of trust in the claims made by public health officials was inserted. The final measure included in the empirical specification was the body mass index (BMI). The Korean society registered the growth in unhealthy weight gain in recent decades and, although the overall share of overweight or obese consumers is small in comparison to many western societies, it poses a public health challenge. The BMI measure was calculated from self-reported height and weight data and accounts for the possible link between the choice of food with nutritionally desired attributes.

The First Stage: The Decision to Pay a Premium for Foods with Modified Attributes

The dichotomous nature of the decision variables suggests the use of the logistic regression to estimate the factors that might influence consumer choice to pay for food with an altered attribute. The dependent variable equals 1 if a respondent chooses to pay more for food with an altered or modified attribute and 0 otherwise. Thus, the logit technique permits an estimation of the probability of the dependent variable to be 1 (WTP = 1), i.e., the decision to pay a premium.

The logistic slope coefficients are the effect of a unit change in an explanatory variable on the predicted logits, while other variables in the model are held constant. However, this interpretation is not intuitive. The odds ratios, where the coefficients are the effect of a unit change in an explanatory variable in the predicted odds ratio, while the other variables in the model are held constant, carry more practical information. The odds greater than 1 suggest that the event is more likely to happen than not to happen (if the odds ratio exceeds 1, then the odds of WTP=1 increases) and if the odds are less than 1, the opposite is true (if 1 exceeds the odds ratio, then the odds of WTP =1 decreases).

The log likelihood ratio, LR chi-squared and percent correctly estimated measures indicate the statistically meaningful specifications of all five models. Table 1 shows the estimation results of the decision to pay a premium for foods with altered nutritional attributes. Age had no significant affect on the decision to pay the premium with the exception of respondents 49 years old to 59 years old who were more likely to pay more for foods that are modified to contain less saturated fat. This latter result is consistent with expectations because the incidence of heart disease increases with age and older female consumers were likely exposed to information about the relationship between saturated fat consumption and heart problems either through their own or a close family member experience. Evidence from other studies indicates that the rapid increase in consumption of dairy products, especially cheese, ice cream and butter, all high in saturated fats, was particularly among young Koreans (Wyne et al., 2007). According to results of this study, none of younger groups of respondents was willing to pay a premium for any of the considered attributes including less saturated fat.

The statistically significant effect of household income was established only in the decision to pay a premium for the increased vitamin or protein content of foods. Moreover, the

significant effect was associated with the middle level of income represented by 20 percent of the respondents. This group likely represented the second largest segment of food consumers and showed a particular preference for desired attributes, but of secondary importance from the standpoint of public health policy. Although increased vitamin content, especially if of natural origin and contained in food, might enhance an individual's health and prevent some diseases, the increase of the consumption of all vitamins is not desired because the effects of high vitamin doses on the human body are not fully understood. The preference for increased protein content could result from the past limited consumption of protein, especially of animal origin. Perceptions shaped by the past experience are likely to persist and might have affected respondents' choice of answer.

Results indicate the existence of differences in the decision to pay premium for the five nutritional attributes across major urban locations in comparison to residents of Seoul. The most striking was the finding that residents of all regions choose to pay more for foods with less saturated fat, whereas Seoul residents were expected to make such a choice. Either Seoul residents already make their food choices with saturated fat in mind and did not see a need to pay a premium, or consumers outside Seoul heeded the message of public health providers.

The identified differences with regard to the decision about paying for other attributes likely result from specific conditions including natural resource endowment, local food preferences and eating habits. The most willing to pay more for food with the desired attributes were residents of East (Daegu, Busan and Ulsan) ready to pay a premium for the increased content of all food attributes. Location-based differences have been confirmed between Seoul metropolitan area, the base region, and Southwest (Kwangju) and West (Daejeon and Inchon), whose residents choose to pay more for food with more fat. Interestingly, although respondents

who resided in West (Daejeon and Inchon) choose to pay more for modified food with more protein as compared to Seoul residents, they are less likely to pay a premium for increased dietary fiber in foods as compared to Seoul residents. Dietary fiber has been linked with the reduction of coronary disease (cholesterol reduction) and some types of cancer (Wolk et al., 1999: Terry et al., 2001).

Although fat consumption is perceived as a major contributor to weight gain in western societies, among urban residents of Korea, the decision to pay for increased food fat content has been positively influenced by the presence of children 18 years old or younger. Nutritional requirements of children are different than those of their parents or grandparents and the obtained results seem to support such interpretation. The past limited availability of fat, especially of animal origin, might have influenced preference for fatty foods in Korea. During their growth, children require certain amount of fat (and fat soluble vitamins) to assure proper development and growth and the results capture this association.

Three explanatory variables measure the association between respondents' beliefs that eating more fruits and vegetables help reduce the risk of heart disease, stroke and certain cancers, respectively, and the decision to pay more for the five selected attributes. Those believing that eating more produce reduced the risk of incidence of certain cancers chose to pay more for foods with additional fiber and protein. The result is in concert with the evidence from epidemiological studies that linked the fiber in the diet with the lower risk of some types of gastrointestinal cancers. However, in one case, i.e., respondents who associated the eating of produce with lower risk of stroke incidence, decided to pay less for additional protein in foods. There is increasing evidence that increasing the intake of vitamin D, which is in many dairy products, protects

against some types of cancers and diabetes, which raises the risk of stroke but such a complex explanation of consumers' decision is very tentative.

Respondents who thought that little or no risk was involved in eating foods that had been modified through breeding to increase vitamin content were more likely to pay a premium for food modified to contain additional dietary fiber, vitamins or protein and less saturated fat. This is an interesting result although it should be verified in future studies. It implies that those choosing to pay a premium might be aware of the potential benefits that can be achieved through breeding and may support specific breeding programs leading to development of new plant varieties or animals whose products would have less saturated fat.

The previous result was supported by the statistically significant association between the respondent's lack of opposition to use genetic modification to change the fruit vitamin content and the decision to pay a premium for food with additional dietary fiber, vitamin or protein. A similar effect in case of the use of genetic modification to change the vegetable vitamin content were more likely to pay a premium for food containing additional fat.

Several studies suggested that consumers were willing to pay more for organic products (Werner and Alvensleben, 1984; Hay, 1989; Goldman and Clancy, 1991; O'Donovan and McCarthy 2002; Wolf, 2002). This proposition was confirmed by the current study's results. Respondents who thought that organically produced foods were healthier than conventionally produced foods were more likely to pay the premium for food with modified attributes. The result was statistically significant in all equations (Table 1) and its odds ratio ranged from 2.6 to 7.5. Those who thought organically produced foods were healthier were seven times more likely to choose to pay a premium for food modified to contain additional dietary fiber and almost three times more likely to decide to pay a premium for food containing additional fat.

The trust respondents had in the claims made by public health officials mostly mattered in their decision to pay a premium for modified foods. Respondents who trusted public health officials' claims were more likely to choose paying a premium for increased fiber and vitamin content, and for less saturated fat in foods.

The Second Stage: The WTP for Food with Modified Attributes

The second stage focused on the actual level of premiums consumers indicated they were willing to pay for a food product with the changed amount of saturated fat, fat, vitamin, protein or fiber. The dependent variable was a category corresponding to a premium measured as a percent above the price respondent paid at the time of conducting the survey. From the list of ten premium choices (i.e., 1%-10%, 11%-20%, …, 91%-100%), the number of premium categories was reduced to three, 1%-10%, 11%-20% and 21% or more, given the distribution of selections. The lowest premium category was omitted and the comparisons were made against that category

The dependent variable specification suggested the use of the ordinal logit technique. An ordinal logit regression assumes that the coefficients that describe the relationship between the lowest versus all higher categories of the response variable are the same as those that describe the relationship between the next lowest category and all higher categories, etc. The test result of this proportional odds assumption suggested that the model be estimated using a generalized ordered logit technique instead. In this approach, the parallel lines constraint is relaxed for variables where it is not justified.

The estimation results of the WTP equations indicate the relevance of the respondent's age, educational attainment and income levels. Respondents between 35 years old and 48 years old were willing to pay a premium in excess of 20% for increased vitamin content whereas those whose age ranged from 49 years to 59 years old were willing to pay such premium for increased protein content when compared to consumers from 21 years to 34 year old.

Consumers reporting having at least a high school degree were often willing to pay a 10% premium for increased fiber, protein and vitamin content, but more than 20% for the increased fat content. The strong education effect on the WTP has not always been confirmed in similar studies although in the current study it was expected to matter because of the health-related nature of the modifications.

Already the estimation results from the first stage indicated a rather weak effect of the household income, which was generally confirmed by the results of the second stage estimation. As the household income level increased, consumers were willing to pay a premium of more than 10% for the increased fiber and vitamin content. Interestingly, middle income level respondents (income ranging from $ 1,700 to $2,299) were also willing to pay a price premium in excess of 20% for less saturated fat and increased fat and protein content.

There were strong differences in the WTP across three regions as compared to Seoul residents. Residents of western region, which included Daejeon and Incheon, were willing to pay more for any food modification and the effect was statistically significant. In contrast, the residents of the southwestern region, where agriculture is an important regional sector, were unwilling to pay a premium higher than 10% for any changed nutrient level. Accordingly, residents of eastern region were willing to pay more than 10% price premium for food with changed fiber, protein and vitamin content.

Respondents who believed that increased fruit and vegetable consumption lowered the risk of stroke were willing to pay more for additional fiber in food products. Respondents who did not oppose the use of genetic modification in fruits to increase the content of beneficial ingredients other than vitamins were more likely to pay a premium more than 10% for increased fat content. However, those who did not oppose the use of genetic modification in vegetables to

increase the beneficial ingredient content other than vitamins were more likely to pay up to 10% price premium for less saturated fat and increased fat and protein content.

Interestingly, respondents who supported research on fruit production were unwilling to pay a premium of more than 10% for increased fiber, protein and vitamin content, whereas those who supported research on vegetable production were willing to pay in excess of 10% for the same attributes. Attributes related to food preparation were also significant determinants of the WTP for modified attributes. Respondents who would like food to cook fast were willing to pay more than 10% premium for all attributes except additional fat, those to whom it mattered that food be prepared with little waste would pay more for additional fiber, but not for more fat in foods, while respondents who processed foods at home were willing to pay a price premium between 11% and 20% for additional vitamin, but not a higher premium, and unwilling to pay a premium higher than 10& for additional protein.

Conclusion

Korean consumers show willingness to pay for nutritionally-enhanced foods resulting from modification of their content of selected ingredients. However, the actual premium they are willing to pay is generally no larger than ten percent, and in some cases, 20%. The largest number of statistically significant factors influencing the WTP was identified in case of increased fiber and vitamin content. Strong regional differences exist in the WTP a premium for each considered modification and cannot be ignored in the development of marketing strategies or public health education. The study contributes to the literature on the diet-health issues providing insights about the WTP for modified foods in a highly developed Korean economy, where traditional consumption pattern has been rapidly changing.

References

Golbitz P. (1995). Traditional Soyfoods: Processing and Products. *The Journal of Nutrition,* 125(3 Suppl), 570S-572S.

Goldman B., Clancy K. (1991). A survey of organic produce purchases and related attitudes of food cooperative shoppers. *American Journal of Alternative Agriculture,* 6(02), 89-96.

Hay J. (1989). The Consumer's Perspective on Organic Foods. *Canadian Institute of Food Science and Technology Journal,* 22, 95-99.

Montague-Jones G. (2010a). Cross-cultural Study Explores Limits of Health Cheese and Yoghurt. *Foodnavigator.com. http//:www.foodnavigator.com/content/view/print285429. Accessed April 9, 2010.*

Montague-Jones G. (2010b). Organic Brands Turn to Sustainability to Recapture Growth. *Foodnavigator.com. http//:www.foodnavigator.com/content/view/print299268. Accessed April 14, 2010.*

ODonovan P., McCarthy M. (2002). Irish Consumer Preference for Organic Meat. *British Food Journal, 104,* 3(5), 353-370.

Venezia A., Barba G., Russo O., Capasso C., De Luca V., Farinaro E., Cappuccio F.P., Galletti F., Rossi G., Strazzullo P. (2010). Dietary Sodium Intake in a Sample of Adult Male Population in Southern Italy: Results of the Olivetti Heart Study. *European Journal of Clinical Nutrition*.

Werner J., Alvensleben R. (1984). Consumer Attitudes towards Organic Food in Germany (FR). *ISHS Acta Horticulturae 155: VIII Symposium on Horticultural Economics.* 221-228.

Wolf M.M. (2002). An Analysis of the Impact of Price on Consumer Interest in Organic Grapes and a Profile of Organic Purchasers. *Agricultural and Applied Economics Association's 2002 Annual Meeting, July 28-31, Long Beach, CA with number 19663.* .

Wyne M., Lee M., Moon S. (2007). Dairy Product Consumption in South Korea. *Journal of Consumer Studies and Home Economics,* 17(1), 39-56.

Zittermann A. (2010). The Estimated Benefits of Vitamin D for Germany. *Molecular Nutrition & Food Research*.

Table 1. Estimation results of the decision to pay for foods with modified attributes by Korean female consumers

Variable name	More fiber	More vitamins	More protein	More fat	Less saturated fat
Age (35-48 years old)	1.381	1.379	1.396	1.000	0.748
	(0.407)	(0.397)	(0.387)	(0.296)	(0.215)
Age (49-59 years old)	1.104	1.503	0.912	1.530	**0.545**[a]
	(0.395)	(0.524)	(0.301)	(0.568)	(0.186)
Education (1=high school or more)	1.176	1.151	0.966	0.786	0.752
	(0.265)	(0.253)	(0.201)	(0.180)	(0.161)
Income (up to $1,699)	0.695	0.749	1.162	1.104	0.825
	(0.308)	(0.335)	(0.490)	(0.507)	(0.339)
Income ($1,700 to $2,299)	0.785	**0.524**[a]	**0.507**[b]	1.354	0.878
	(0.266)	(0.173)	(0.158)	(0.449)	(0.278)
Income ($2,300 to $2,899)	1.188	0.934	1.456	1.131	1.027
	(0.362)	(0.275)	(0.403)	(0.334)	(0.285)
Income ($2,900 to $3,499)	0.838	0.841	0.949	0.891	1.187
	(0.255)	(0.254)	(0.265)	(0.279)	(0.340)
East	**2.092**[c]	**2.988**[c]	**2.297**[c]	**1.879**[b]	**2.189**[c]
	(0.570)	(0.804)	(0.539)	(0.462)	(0.510)
West	**0.501**[c]	1.044	**2.062**[c]	1.234	**5.553**[c]
	(0.134)	(0.281)	(0.556)	(0.377)	(1.713)
Southwest	1.000	1.000	1.000	**6.999**[c]	**4.093**[c]
	(0.000)	(0.000)	(0.000)	(2.310)	(1.557)
Household with children	0.900	1.260	0.717	**1.634**[a]	0.811
	(0.252)	(0.345)	(0.185)	(0.463)	(0.211)
Believe eating more fruits and vegetables reduces:					
risk of heart disease	0.734	1.537	1.640	0.667	1.530
	(0.419)	(0.824)	(0.898)	(0.437)	(0.866)
reduces risk of stroke	0.683	0.613	**0.489**[a]	1.828	1.255
	(0.273)	(0.239)	(0.190)	(0.883)	(0.502)
risk of certain cancers	**4.523**[b]	3.042	**6.780**[c]	0.821	1.076
	(3.360)	(2.170)	(4.999)	(0.738)	(0.782)
Important that foods have vitamins	1.090	1.059	1.028	1.006	0.903
	(0.078)	(0.076)	(0.068)	(0.071)	(0.061)
Risk eating foods modified through breeding to increase vitamin content	**1.148**[b]	**1.124**[a]	**1.129**[a]	1.016	**1.305**[c]
	(0.079)	(0.077)	(0.071)	(0.065)	(0.083)

Table 1. Continued

Variable name	More fiber	More vitamins	More protein	More fat	Less saturated fat
Support the use of genetic modification in fruits to change the vitamin content	**1.271**[b] (0.137)	**1.323**[c] (0.138)	**1.326**[c] (0.128)	0.889 (0.096)	1.077 (0.104)
Support use of genetic modification in vegetables to change the vitamin content	0.945 (0.103)	1.065 (0.111)	0.945 (0.091)	**1.232**[a] (0.135)	1.081 (0.105)
New agricultural and food technologies focus on assuring safe food supply	0.959 (0.094)	1.016 (0.096)	1.146 (0.102)	1.023 (0.100)	1.113 (0.102)
Organic foods healthier	**7.446**[c] (2.177)	**5.378**[c] (1.552)	**5.227**[c] (1.563)	**2.625**[b] (1.133)	**4.275**[c] (1.417)
Experienced food poisoning in the last 12 months	0.997 (0.574)	1.645 (0.993)	1.577 (0.882)	1.030 (0.575)	1.372 (0.740)
Family members experienced food poisoning in the last 12 months	0.819 (0.370)	0.831 (0.357)	0.989 (0.394)	1.082 (0.447)	1.274 (0.515)
Trust public health officials	**1.207**[b] (0.092)	**1.152**[a] (0.085)	0.993 (0.070)	0.976 (0.076)	**1.305**[c] (0.095)
Number of observations	612	625	615	641	626

Note: Standard errors in parentheses.
[a] Significant α .10;
[b] Significant α .05;
[c] Significant α .01.

Table 2.Estimation results of the equation willingness-to-pay for selected food attributes by Korean female consumers

	More fiber		More vitamins		More protein		More fat		Less saturated fat	
Variable name	1	2	1	2	1	2	1	2	1	2
Age (35-48 years old)	0.38	0.38	**0.57**[b]	**0.57**[b]	0.40	0.40	0.51	0.51	-0.22	-0.22
	(0.268)	(0.268)	(0.277)	(0.277)	(0.287)	(0.287)	(0.540)	(0.540)	(0.297)	(0.297)
Age (49-59 years old)	0.35	0.35	0.40	0.40	**0.71**[b]	**0.71**[b]	-0.34	0.94	-0.01	-0.01
	(0.335)	(0.335)	(0.343)	(0.343)	(0.355)	(0.355)	(0.806)	(0.752)	(0.371)	(0.371)
Education (1=high school or more)	**-0.86**[c]	-0.02	**-0.34**[a]	**-0.34**[a]	**-0.40**[a]	**-0.40**[a]	**0.70**[a]	**0.70**[a]	0.08	0.08
	(0.269)	(0.221)	(0.202)	(0.202)	(0.212)	(0.212)	(0.422)	(0.422)	(0.233)	(0.233)
Income (up to $1,699)	0.38	0.38	0.28	0.28	0.10	0.10	-0.48	-0.48	0.35	0.35
	(0.408)	(0.408)	(0.398)	(0.398)	(0.409)	(0.409)	(0.696)	(0.696)	(0.436)	(0.436)
Income ($1,700 to $2,299)	**0.87**[c]	**0.87**[c]	**0.74**[b]	**0.74**[b]	**0.71**[b]	**0.71**[b]	**1.10**[b]	**1.10**[b]	**0.58**[a]	**0.58**[a]
	(0.297)	(0.297)	(0.300)	(0.300)	(0.326)	(0.326)	(0.558)	(0.558)	(0.344)	(0.344)
Income ($2,300 to $2,899)	**1.07**[c]	-0.01	**0.77**[b]	-0.07	0.24	0.24	0.33	0.33	0.16	0.16
	(0.340)	(0.276)	(0.349)	(0.268)	(0.265)	(0.265)	(0.530)	(0.530)	(0.303)	(0.303)
Income ($2,900 to $3,499)	**0.50**[a]	**0.50**[a]	0.30	0.30	0.33	0.33	0.90	0.90	-0.42	0.34
	(0.261)	(0.261)	(0.261)	(0.261)	(0.285)	(0.285)	(0.551)	(0.551)	(0.381)	(0.333)
East	**1.85**[c]	**0.53**[b]	**2.59**[c]	0.23	**0.66**[c]	**0.66**[c]	-0.56	-0.56	0.43	0.43
	(0.417)	(0.236)	(0.557)	(0.230)	(0.241)	(0.241)	(0.454)	(0.454)	(0.267)	(0.267)
West	**1.27**[c]	**1.27**[c]	**2.56**[c]	**0.69**[b]	1.22[c]	**1.22**[c]	**-1.29**[b]	**-1.29**[b]	**1.04**[c]	**1.04**[c]
	(0.297)	(0.297)	(0.750)	(0.292)	(0.286)	(0.286)	(0.571)	(0.571)	(0.309)	(0.309)
Southwest	**-0.82**[c]	**-0.82**[c]	-0.49	**-1.48**[c]	**-1.00**[c]	**-1.00**[c]	**-2.25**[c]	**-2.25**[c]	**-1.31**[c]	**-1.31**[c]
	(0.308)	(0.308)	(0.367)	(0.413)	(0.325)	(0.325)	(0.532)	(0.532)	(0.359)	(0.359)
Household with children	-0.12	-0.12	-0.25	-0.25	0.09	0.09	-0.11	-0.11	0.04	0.04
	(0.231)	(0.231)	(0.234)	(0.234)	(0.246)	(0.246)	(0.503)	(0.503)	(0.258)	(0.258)
Believe eating more fruits and vegetables reduces:										
risk of heart disease	-0.25	-0.25	-0.06	-0.06	0.32	0.32	0.58	0.58	0.55	0.55
	(0.533)	(0.533)	(0.556)	(0.556)	(0.607)	(0.607)	(1.258)	(1.258)	(0.654)	(0.654)
risk of stroke	**0.74**[b]	**0.74**[b]	0.43	0.43	0.28	0.28	0.35	0.35	0.28	0.28
	(0.353)	(0.353)	(0.351)	(0.351)	(0.371)	(0.371)	(0.839)	(0.839)	(0.432)	(0.432)

Table 2. Continued

Variable name	More fiber		More vitamins		More protein		More fat		Less saturated fat	
	1	2	1	2	1	2	1	2	1	2
Support fruit genetic modification to increase content of beneficial ingredients other than vitamins	0.06 (0.103)	0.06 (0.103)	0.11 (0.107)	0.11 (0.107)	0.18 (0.116)	0.18 (0.116)	**0.50**[b] (0.251)	0.11 (0.212)	0.09 (0.123)	0.09 (0.123)
Support vegetable genetic modification to increase the content of beneficial ingredients other than vitamins	-0.14 (0.102)	-0.14 (0.102)	-0.17 (0.107)	-0.17 (0.107)	0.01 (0.135)	**-0.31**[c] (0.117)	**-0.44**[b] (0.212)	**-0.44**[b] (0.212)	**-0.23**[a] (0.125)	**-0.23**[a] (0.125)
Support research on fruit production	**-0.43**[c] (0.135)	**-0.43**[c] (0.135)	**-0.56**[c] (0.142)	**-0.56**[c] (0.142)	**-0.36**[b] (0.159)	**-0.36**[b] (0.159)	0.07 (0.312)	0.07 (0.312)	-0.16 (0.175)	-0.16 (0.175)
Support research on vegetable production	**0.29**[b] (0.136)	**0.29**[b] (0.136)	**0.49**[c] (0.144)	**0.49**[c] (0.144)	**0.40**[b] (0.158)	**0.40**[b] (0.158)	-0.09 (0.312)	-0.09 (0.312)	0.18 (0.173)	0.18 (0.173)
Important that foods cook fast	**0.23**[c] (0.073)	**0.23**[c] (0.073)	**0.12**[a] (0.071)	**0.12**[a] (0.071)	**0.16**[b] (0.072)	**0.16**[b] (0.072)	0.23 (0.149)	0.23 (0.149)	**0.18**[b] (0.081)	**0.18**[b] (0.081)
Important that foods can be prepared with little waste (like vegetables)	**0.18**[a] (0.097)	-0.07 (0.078)	0.07 (0.073)	0.07 (0.073)	0.05 (0.074)	0.05 (0.074)	**-0.28**[a] (0.155)	**-0.28**[a] (0.155)	-0.08 (0.079)	-0.08 (0.079)
Pickle cabbage at home	0.22 (0.344)	0.22 (0.344)	**-2.43**[c] (0.830)	0.18 (0.375)	0.11 (0.355)	0.11 (0.355)	0.81 (0.555)	0.81 (0.555)	**-1.07**[a] (0.575)	0.36 (0.389)
Process vegetables other than cabbage at home	-0.50 (0.332)	-0.50 (0.332)	**1.69**[b] (0.769)	**-1.21**[c] (0.362)	**-0.63**[a] (0.348)	**-0.63**[a] (0.348)	-0.24 (0.532)	-0.24 (0.532)	-0.31 (0.352)	-0.31 (0.352)
Body mass index	0.00 (0.042)	0.00 (0.042)	0.00 (0.043)	0.00 (0.043)	0.00 (0.044)	0.00 (0.044)	-0.03 (0.085)	-0.03 (0.085)	0.06 (0.049)	0.06 (0.049)
Constant	-0.10 (1.144)	-1.33 (1.128)	0.66 (1.182)	-0.70 (1.141)	-0.54 (1.238)	-2.31[a] (1.224)	1.95 (2.644)	-0.03 (2.584)	0.89 (1.380)	-2.95[b] (1.352)
Number of observations	528	528	533	533	482	482	173	173	403	403

Note: Standard errors in parentheses.
[a] p<0.10,
[b] p<0.05,
[c] p<0.01..

Summary Statistics

Characteristic	Units/measurement	Frequency	Percentage
Age, in years	21-34	181	16.41
	35-48	661	59.93
	49-59	261	23.66
Education	Elementary school	66	6.0
	Middle school	654	59.8
	High school	362	33.1
	College degree	10	0.9
	Graduate degree	1	0.1
Monthly gross income, in $	Less than 1,699	112	10.2
	1,700 - 2,299	215	19.5
	2,300 - 2,899	303	27.5
	2,900 - 3,499	241	21.9
	3,500 and more	232	21.0
City/metropolis	Busan	172	15.6
	Daegu	125	11.3
	Daejeon	71	6.4
	Inchon	128	11.6
	Kwangju	69	6.3
	Ulsan	58	5.3
	Seoul	480	43.5
or			
Region	Seoul (Base region)	480	43.56
	East (Busan, Daegu, Ulsan)	355	32.21
	West (Daejeon, Inchon)	198	17.97
	Southwest (Kwangju)	69	6.26
Households with children 18 years old or younger	1=yes	707	64.1
	0=no	396	35.9

First Stage Dependent Variable	Units	Frequency	Percentage
Important foods contain more dietary fiber	0=no	252	26.67
	1=yes	693	73.33
Important foods contain more vitamins	0=no	264	27.33
	1=yes	702	72.67
Important foods contain more protein	0=no	313	33.09
	1=yes		66.91
		633	
Important foods contain more fat	0=no	682	76.12
	1=yes	214	23.88
Important foods contain less saturated fat	0=no	348	39.64
	1=yes	530	60.36

Second Stage Dependent Variable	Price premium	Frequency	Percentage
Important foods contain more dietary fiber	1%-10%,	100	14.47
	11%-20%	357	51.66
	21% or more	234	33.86
Important foods contain more vitamins	1%-10%,	92	13.24
	11%-20%	332	47.77
	21% or more	271	38.99
Important foods contain more protein	1%-10%,	67	10.62
	11%-20%	314	49.76
	21% or more	250	39.62
Important foods contain more fat	1%-10%,	26	12.32
	11%-20%	109	51.66
	21% or more	76	36.02
Important foods contain less saturated fat	1%-10%,	65	12.57
	11%-20%	250	48.36
	21% or more	202	39.07