

# Food Demand Survey (FoodS)

## Technical Information on Survey Questions and Methods

May 22, 2013

Jayson L. Lusk

The purpose of FoodS is to track consumer preferences and sentiments on the safety, quality, and price of food consumed at home and away from home with particular focus on meat demand. FoodS is a monthly on-line survey with a sample size of at least 1,000 individuals, weighted to match the US population in terms of age, gender, education and region of residence. This document contains details on wording of survey questions along with information on data analysis.

### Meat Demand and Willingness to Pay

Each subject answered nine choice questions, like the one below. Preceding the questions was the verbiage: “Imagine you are at the grocery store buying the ingredients to prepare a meal for you or your household. For each of the following nine questions that follow, please indicate which meal you would be most likely to buy.”

Which of the following would you purchase?

	Hamburger \$2.00/lb	Beef Steak \$6.50/lb	Pork Chop \$3.75/lb	Deli Ham \$2.65/lb	Chicken Breast \$3.25/lb	Chicken Wing \$1.75/lb	Beans and Rice \$0.50/lb	Tomato-Pasta \$2.50/lb	If these were the only options, I would buy something else.
I would choose...	 <input type="radio"/>	 <input type="radio"/>	 <input type="radio"/>	 <input type="radio"/>	 <input type="radio"/>	 <input type="radio"/>	 <input type="radio"/>	 <input type="radio"/>	<input type="radio"/>

Each of the questions was identical except the prices varied across each question. Each question had nine options (two beef, two pork, two chicken, two non-meat, and one “no purchase”) and the price of each option was varied at three levels. The price of hamburger varied between \$2 and \$5; steak varied between \$5 and \$8; pork chop varied between \$2.25 and \$5.25; ham varied between \$1.15 and \$4.15; chicken breast varied between \$1.75 and \$4.75; chicken wing varied between \$0.25 and \$3.25; rice and beans varied between \$0.5 and \$3.5; and pasta varied between \$2.5 and \$5.5. The third price levels for each option were set to the mid-point of the aforementioned ranges. The prices appearing in each choice were determined by a main effects orthogonal fractional factorial design. A perfectly orthogonal design (in which prices of each choice alternative were uncorrelated with each other alternative) required 27 choices. The 27 choices were blocked into three sets of nine, and each person was randomly assigned to one of the three blocks.

The choice data were analyzed using a multinomial logit model with alternative-specific brand and price effects. In particular, a random utility framework is used in which it is assumed individual  $i$  derives utility  $U_{ij}$  from choice option  $j$ :

$$(1) \quad U_{ij} = V_{ij} + \varepsilon_{ij}$$

where  $V_{ij}$  is the deterministic portion of utility described by the attributes of choice option  $j$  and  $\varepsilon_{ij}$  is an unobserved stochastic element. The product attributes include price and “brand” effect.

We empirically define  $V_{ij}$  as:

$$(2) \quad V_{ij} = \beta_j + \alpha_j(\text{Price})_{ij}$$

where  $\beta_j$  is the utility of food type  $j$  ( $j$ =hamburger, steak, pork chop, etc.) and  $\alpha_j$  the marginal (dis)utility of price for alternative  $j$ , and  $\text{Price}_{ij}$  is the price faced by individual  $i$  for option  $j$ . For specification purposes, we normalized the utility of the “no purchase” option to zero. Due to this normalization  $\beta_1$  is, for example, interpreted as the utility of having hamburger relative to not buying a meal at all.

The probability of individual  $i$  choosing alternative  $j$  is:

$$(3) \quad \text{Prob}\{V_{ij} + \varepsilon_{ij} \geq V_{ik} + \varepsilon_{ik} \quad \forall k \in C_i\}$$

where  $C_i$  is the choice set for individual  $i$  and  $C_i = \{1, 2 \dots 9\}$ . The eight choice options include the eight meal options listed previously and the “no purchase” option. If the random errors in equation (3) are independent and identically distributed across the  $j$  alternatives with a type I extreme value distribution, then the probability of consumer  $i$  choosing alternative  $j$  is given by the multinomial logit model:

$$(4) \quad \pi_{ij} = \text{Prob}(j \text{ is chosen}) = \frac{\exp^{V_{ij}}}{\sum_{k \in C} \exp^{V_{ik}}}$$

To estimate willingness-to-pay (WTP) for meal type  $j$ , we determine the price amount that would make the representative consumer indifferent to buying the particular meal type and not-buying. Given that the utility of the “no purchase” option is normalized to zero, willingness-to-pay for meal type  $j$  is determined by:

$$(5) \quad \text{WTP}_j = -\beta_j/\alpha_j.$$

## Food Expenditures

The food expenditure questions were worded similarly to those used by the Bureau of Labor Statistics in the Quarterly Consumer Expenditure Survey (the CAPI instrument – see section 20 part A). One difference is that we provided ranges for response categories whereas the BLS survey simply asks an open-ended question with no response categories. The exact wording of the questions is shown below.

Now, we are going to ask you about your expenses for food you and you household have purchased since the first of the month. Think carefully about where you have shopped and what you have eaten in the past two weeks.

What has been your (or your household's) usual WEEKLY expense for food bought during grocery shopping?

- less than \$20
- \$20 - \$39
- \$40 - \$59
- \$60 - \$79
- \$80 - \$99
- \$100 - \$119
- \$120 - \$139
- \$140 - \$159
- \$160 or more

What has been you (or your household's) usual WEEKLY expense for meals or snacks from restaurants, fast food places, cafeterias, carryout or other such places?

- less than \$20
- \$20 - \$39
- \$40 - \$59
- \$60 - \$79
- \$80 - \$99
- \$100 - \$119
- \$120 - \$139
- \$140 - \$159
- \$160 or more

To determine the mean expenditure in the sample, an interval censored regression approach is used. The questions above provide a range on respondent's "true" expenditure. In particular, let  $EX_i^*$  be respondent  $i$ 's true expenditure.  $EX_i^*$  can be expressed as:

$$(6) \quad EX_i^* = \beta + \varepsilon_i$$

where  $\beta$  is a constant representing the mean expenditure and  $\varepsilon_i$  is a stochastic error term.

Let  $t_{i,low}$  and  $t_{i,high}$  indicate the range of individual  $i$ 's expenditures (note in the case of \$160 or more,  $t_{i,low} = \$160$  and  $t_{i,high} = \text{positive infinity}$ ). Now, we know that  $t_{i,low} \leq EX_i^* < t_{i,high}$ . If  $\varepsilon_i$  is independently and identically distributed according to a Normal distribution with a standard deviation of  $\sigma$ , then the log-likelihood function for individual  $i$  is:

$$(7) \quad LLF_i = \ln\left(\Phi\left(\frac{t_{i,high}-\beta}{\sigma}\right) - \Phi\left(\frac{t_{i,low}-\beta}{\sigma}\right)\right),$$

where  $\Phi$  is the cumulative standard normal distribution function. The maximum likelihood estimate of  $\beta$  across the entire sample of respondents reveals the mean expenditure, which is the key statistic of interest.

In addition to asking respondents how much they spent in the past, we also asked how they plan to change expenditure in the coming weeks as shown below. Data from these questions was also analyzed in the interval censored regression framework to determine the mean projected expenditure change.

Now, we are going to ask you about your expenses for food, you and you household plan to purchase in the next two weeks.

**Do you expect to spend more or less on food bought during grocery shopping in the next two weeks as compared to the previous two weeks?**

- I plan to spend about 10% less
- I plan to spend about 5% less
- I plan to spend about the same
- I plan to spend about 5% more
- I plan to spend about 10% more

**Do you expect to spend more or less on meals or snacks from restaurants, fast food places, cafeterias, carryout or other such places in the next two weeks as compared to the previous two weeks?**

- I plan to spend about 10% less
- I plan to spend about 5% less
- I plan to spend about the same
- I plan to spend about 5% more
- I plan to spend about 10% more

The following question on expenditure-related issues was also asked:

**To what extent do you agree or disagree with the following statements regarding your purchases in the next two weeks as compared to the previous two weeks?**

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I plan to buy more beef	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I plan to buy more chicken	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I plan to buy more pork	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I plan to eat out more	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I expect the price of beef to be higher	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I expect the price of pork to be higher	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I expect the price of chicken to be higher	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## Awareness and Concern Tracking

To track awareness and concern over time, respondents were shown a table like the one below listing 16 issues (the order of the issues varied randomly across respondents). Initially, respondents were asked for each issue: “Overall, how much have you heard or read about each of the following topics in the past two weeks” where 1= nothing; 2= a little; 3=a moderate amount; 4=quite a bit; 5=a great deal. Following this question, a similar table appeared with the same set of 16 issues (again, shown in random order), asking “How concerned are you that the following pose a health hazard in the food that you eat in the next two weeks”, where 1=very unconcerned; 2= somewhat unconcerned; 3=neither concerned nor unconcerned; 4=somewhat concerned; 5=very concerned.

Overall, how much have you heard or read about each of the following topics in the past two weeks.

	Nothing	A little	A moderate amount	Quite a bit	A great deal
Farm animal welfare abuse	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Battery Cages	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Meat/milk from cloned animals	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mad cow disease	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Swine flu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Lean fine textured ground beef	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gestational stalls	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Greenhouse gas emissions from livestock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Genetically modified foods	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>Salmonella</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bird flu	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Antibiotic use in livestock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Growth hormones use in livestock	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
BSE	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
<i>E. coli</i>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Pink Slime	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

## General Food Values

To judge general issues and values motivating consumer behavior, two sets of questions were asked. Both sets of questions used response formats that require respondents to make trade-offs (i.e., they could not list every issue as “most important”).

One question asked respondents to *rank* seven food-related challenges as shown below. The order of the challenges was varied randomly across respondents.

**What are the biggest food-related challenges you will face in the coming two weeks?**

**(Please rank the following statements by clicking and dragging the issues up or down where 1 = most challenging and 7 = least challenging)**

Avoiding certain nutrients or ingredients (i.e. sodium, carbohydrates, trans fats, etc.)

Finding convenient, quick-to-make alternatives

Finding foods my children will eat

Losing weight

Finding time to cook at home

Avoiding foods that contain pesticides, added hormones & antibiotics

Finding affordable foods that fit my budget

Finally, we used a form of “best worst” questioning by requesting subjects to indicate how important a list of 12 issues were when purchasing food. Respondents had to place four (and only four) items in the “most important” box and four (and only four) items in the “least important” box.

A scale of importance was created by calculating the proportion of times (across the entire sample) a food value appeared in the most important box minus the proportion of times it appeared in the least important box. Thus, the range of possible values for a food value is from 1 to -1 (or 100% to 100% when converted to a percent scale), where a higher number implies more importance.

**How important are the following items to you when purchasing food?**

Items	Most Important (Place 4 Items Here)
<b>Appearance</b> (whether the food looks appealing and appetizing)	Least Important (Place 4 Items Here)
<b>Animal Welfare</b> (well-being of farm animals used in food production)	
<b>Taste</b> (the flavor of the food in your mouth)	
<b>Safety</b> (eating the food will not make you sick)	
<b>Novelty</b> (the food is something new you haven't tried before)	
<b>Origin</b> (whether the food is grown locally, regionally, in the U.S. or overseas)	
<b>Nutrition</b> (amount and type of fat, proteins, vitamins, etc.)	
<b>Environmental Impact</b> (effects of food production the environment)	
<b>Price</b> (price you pay)	
<b>Fairness</b> (farmers, processors, retails and consumers equally benefit)	
<b>Convenience</b> (how easy and fast the food is cook and eat)	
<b>Naturalness</b> (made without modern food technologies and ingredients)	

**Additional Questions**

The survey also contained questions asking about whether respondents: 1) were on food stamps, 2) had a foodborne illness in the past month, 3) farmed for a living, etc. We also asked subjects weights and heights, along with a standard set of socio-economic and demographic characteristics. As indicated the demographic variables were used to create weights to force the sample to mirror the population.