

The Influence of Signal Attribute on Willingness-To-Pay for Pasture-Raised Beef

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Abstract

Studies examine how the attributes of products lead to consumer choice and how to form their usefulness (HUBER; MCANN, 1982; LANCASTER, 1966). Signal attributes bring suggestions for other attributes while the independent attributes do not. This study aimed to identify the marginal impact of introducing a signal attribute of pasture-raised beef on consumer willingness to pay (WTP) for other independent attributes. The hypotheses of the study are that the WTP for the attribute “Guaranteed Animal welfare” is larger than the other attributes in the same steak, and the WTP for the signal attribute decreases as independent attributes are added. Besides that, WTP for the attribute tenderness is greater than that the signal attribute. The study is divided into two steps. The first, qualitative, consisted of investigating the values consumers have regarding beef production. To this end, 52 interviews with Brazilian and US consumers were conducted using laddering. In the second, quantitative, six experiments, (face to face and online) with 267 consumers of beef were performed. As a result, the main value found for the Brazilians was security, while for the Americans was self-direction. For consumers, the willingness-to-pay for animal welfare was the most important in the choice experiments where this information was present. As attributes were presented, the WTP for the most important attributes decreases. Furthermore, consumers are willing to pay more for tenderness than for animal welfare. The three hypotheses were validated.

Keywords: Attributes; Beef; Consumer; Experiment; International Marketing.

1. Introduction

A single product has several attributes. A product contains not only nutritional but also aesthetic characteristics. Besides that, meals present these attributes in different relative proportions. It is not the product itself that produces utility to the consumer, but the features that this good has (LANCASTER, 1966). The number of studies confirms the importance of identifying how the attributes of products lead to consumer purchasing decision (EVANS, 2007; HUBER; MCCAN, 1982). Attributes are pieces of information that consumers use to form their quality expectations. Some create in consumers a strong sense of preference that affects their purchasing intentions (STEENKAMP, 1990). The attributes can be classified as independent or signal. The difference between them is that signal attributes are those that provide information about other attributes or the overall quality of the food, while independent do not (GAO, 2007).

The choices that people make towards food affect production systems (FURST et al, 1996). With income growth and the decrease of the share spent on food, consumers have exhausted their basic needs for food and began to consider additional factors as important (BECKER, 2000). In a highly volatile market and with different trends in consumer preferences, the “exploration of consumer perceptions of new differentiated products for each process is critical” (EVANS et al, 2011, p. 247).

Food quality is identified as a determinant of national competitiveness and is important both for producers and for consumers (STEEMKAMP, 1990). On quality issues, the pasture-raised beef has benefits for human health, environment and animal welfare (EVANS, 2007).

Thus the demand for beef and cow's milk produced on pasture has grown. The reasons for this increase are: the perception of benefits related to health; the concern regarding where and how the cattle were produced; the intention to support small and medium producers; and the view that animals raised on pasture have an important role in the preservation of soil and water (PIROG, 2004).

By observing the relevance of this context where the consumer starts to demand more for products that have good environmental practices and that provide security, which make them change their decision making, the research problem is: Does consumer preference for other attributes (independent attribute) change when introducing animal welfare (signal attribute)? Thus the general objective of the study was to identify the marginal impact of introducing a signal attribute of pasture-raised beef in the consumer willingness to pay (WTP) for other independent attributes. The specific objectives were: i) Investigate the values of consumers towards livestock production; and ii) determine whether, with additional information, consumer willingness to pay for the signal attribute changes.

2. Theoretical Foundation

Lancaster (1966) considers that consumer reactions to new products and quality variations are among the most important aspects related to consumer behavior of an economy. With increasing concern about sustainability, nutritional aspect and health-related issues, consumption patterns have been changing quickly (HOPPE et al, 2012). According to Hoppe et al (2012, p.176), “food consumer behavior is directly linked to culture, family, environment and also to economic reality”.

When it comes to understanding the culture, the study of values is essential (PATO-OLIVEIRA; TAMAYO, 2002). For Schwartz (1992, p. 4) values “(1) are concepts or beliefs; (2) pertain to desirable end states or behaviors; (3) transcend specific situations; (4) guide selection or evaluation of behavior and events; (5) are ordered by relative importance”.

Schwartz (1992) classified the values into ten types: power, achievement, hedonism, stimulation, conformity, self-direction, universalism, benevolence, tradition and security. Values are important to evaluate products and their attributes. For Lancaster (1966), a product consists of a set of several attributes (not the product itself) that produce utility to the consumer. The attributes towards pasture-raised beef are described below. The aim of this study is to show both alternatives frameworks.

Consumer willingness to pay is the maximum price he/she would pay for a particular product, which corresponds to the value he/she attributes to it (KALISH; NELSON, 1991). Understanding how consumers react to price changes or how much they would be willing to pay for a new product or service is considered a competitive differentiator, because besides the predictive character, WTP allows to identify the value assigned to the product or service. Gall-Ely (2009) states that if the price can be customized, knowing consumer WTP can enable optimization in volume and margin of sale.

According to Steward et al (2000), the literature on consumer WTP is scarce and most of the studies focus on examining whether there is an ordering effect when issues of multiple contingent valuations are requested in a single research instrument. The term appeared in the literature in the early twentieth, when the WTP began to be used to determine the prices of public goods and services (GALL-ELY, 2009). The WTP is the maximum price that a buyer is willing to pay for a particular quantity of a product (WERTENBROCH; SKIERA, 2002; KALISH; NELSON, 1991). For Kalish and Nelson (1991), this maximum price is equal to the value of the product to the consumer and is also considered consumer’s reservation price for the product. According to these authors, consumers compare their reservation with the prices of each product they purchase, opting for the one that offers distinct advantage.

Consumers purchase a product from a set of alternatives. The chosen product, in general, is the one in which their WTP exceeds the purchase price (WERTENBROCH; SKIERA, 2002). For Scholz et al (2015), the WTP is an essential contribution to support business models, forecasting, and optimization, due to the fact it helps decision makers to define efficient pricing strategies. Gall-Ely (2009) adds that when there is no information or data available, such as when a product is still under development or public goods, WTP is an interesting

alternative for price elasticity of demand. For Gao and Schroeder (2009) consumer willingness to pay (WTP) for certain food quality attributes is an important indicator of the consumer response, and its understanding and estimation is relevant to policy makers and producers. Comparisons between the various willingness to pay on choice experiments enable the investigation of consumer preferences (GAO; SCHROEDER, 2009).

According to Harper and Makatouni (2002), animal welfare is used as a suggestion for other attributes such as safety and health impact. The study of Gao (2007) showed that, as additional attributes are presented to consumers, the willingness to pay for the signal attribute changes. Thus the first hypotheses of the study are:

***H_{1a}*: Consumer willingness to pay for the attribute “Guaranteed Animal Welfare” is greater than the other attributes in the same steak.**

***H_{1b}*: Consumer willingness to pay for the signal attribute “Guaranteed Animal welfare” decreases when independent attributes are added.**

Studies have found as a result that tenderness is the most important attribute in beef choice (LUSK; FOX, 2000; GOSS; HOLCOMB; WARD, 2002; FELDKAMP; SCHROEDER; LUSK; ROOSEN; FOX, 2003; HUFFMAN et al., 1996). Based on these studies, the present study also aims to test the following hypothesis:

***H₂*: Consumer willingness to pay for the attribute “Guaranteed Tenderness”, present both in pasture and feedlot raised beef is greater than the signal attribute “Guaranteed Animal Welfare”.**

The literature review study provided the basis of this work. The following refers to the methodological procedures.

3. Methodology

Step 1: qualitative research with consumers

The first step was made with beef consumers in Brazil and in the US with the objective to investigate the values of these consumers regarding beef production. In order to do so, we performed the laddering technique that is used to understand how individuals translate attributes in significant associations, involving a series of “why is it important for you?” questions. The purpose of this technique is to determine sets of links between key elements between all the attributes (A), consequences (C) and values (V). (REYNOLDS; GUTMAN, 1988).

Reynolds and Gutman (1988) propose a sequence of steps for data analysis. First, it is necessary to do a survey on the consumer perception through the question “why is this important to you?” repetitively. Then, content analysis and standardization of the key elements should be conducted. After that, a table known as the implication matrix is created, which shows the number of connections between the key elements, accounting for direct and indirect relationships between them. Finally, means-ends chains are structured by means of a mapping, a diagram with the connections between the attributes, values and consequences. (PINTO, et al., 2012).

In the questionnaire conducted, the first part for was used for the respondent to name words that characterize beef production such as production, producer, consumer and marketing. After that, the respondent was supposed to order the importance assigned to each attribute and the most important of each question was directed to the laddering. For example, if in the first

part, when asked about words that characterize the production, the respondent replied that “cattle” was the principal, in the second part the respondent was asked “why is the word “cattle” the most important to you?” followed by the question “why is the answer above important to you?”.

In order to analyze the data, firstly the content of the interviews was examined with the construction of a table that divided the responses into attributes (A), three consequences (C) and values (V). The attributes and consequences were grouped according to the similarity. From this table, a hierarchical value map (HVM) was built through MECAnalyst software that was developed specifically for the use of laddering. The relations with low incidence were disregarded and the cutoff point 2 was established, which covers about 80% of the relations, being consistent with Reynolds and Gutman (1988), who recommended between 75% and 80%. Finally, the values were classified according to the ten types of motivational domains of Schwartz (1992): power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security.

The research sample included a total of 58 respondents (32 Brazilian consumers and 26 Americans). However, as the laddering does not accept incomplete answers, these were excluded, resulting in a total of 52 respondents (30 consumers from Brazil and 22 from the United States). The questionnaires with North American consumers were conducted in February 2013, in Columbus, Ohio, and the sample was composed of students and staff at Ohio State University. In July and August of the same year, the research was conducted with end users of Campinas and Piracicaba for being a region known due to high-level consumer demand. In Campinas the questionnaires occurred in the city’s downtown streets and a leisure park. In Piracicaba, the questionnaire was applied to college students and researchers’ acquaintances.

Step 2: quantitative research: experiment in Brazil

Social science researchers have used the experiment to identify, monitor and quantitatively measure many important variables that affect the motivation of an individual or group (HOLLOWAY; WHITE, 1963, p. 63). In this study the choice experiment (CE) was conducted in which pre-determined attributes are chosen so that it is believed that they will have a major impact in consumers’ decision of choice. The choice experiment simulates real-life purchasing situations and thus is expected to provide more reliable willingness-to-pay estimates than hypothetical valuation questions (TONSOR et al. 2005). Respondents must choose an alternative among the others in order to maximize their usefulness based on the Random Utility Theory (GAO; XIAOHUA; HOUSE, 2009). They have choice alternatives in which the products are defined by their attributes. Price is one of them and when individuals make their choice, “they implicitly make trade-offs between the levels of the attributes of the different alternatives presented in a choice set” (ALPIZAR; CARLSSON; MARTINSSON, 2001).

Through choice experiments, the willingness-to-pay for the choices made can be measured (MAHIEU et al, 2014). For Gao and Schroeder (2009) willingness to pay for certain food quality attributes is an important indicator of consumer response and its understanding and estimation is relevant to policy makers and producers. Comparisons between the various willingness-to-pay in choice experiments allow the investigation of consumer preferences (GAO; SCHROEDER, 2009).

Theoretical model and estimate

The theoretical model is based on consumer utility showing that when there is a change in the number of attributes in the utility function, consumer willingness to pay for a particular

attribute also changes. Thus the authors define a linear and random utility function as shown in the following equation:

$$(1) \quad U_{ij} = \alpha_i \cdot p_{ij} + \sum_{k=1}^T \beta_{ik} \cdot x_{ijk} + \varepsilon_{ij}$$

Where α_i is the marginal utility of price by person i , p_{ij} is the price of alternative j by the person i , β_{ik} is the marginal utility of k^{th} attribute, x_{ijk} is the k^{th} attribute of alternative j by the person i , ε_{ij} is the stochastic disturbance of alternative j by the person i and T is the number of attributes of alternative j (GAO; SCHROEDER, 2009).

Consumer willingness to pay (i) is the amount the individual will pay to stay in their level of usefulness when k^{th} attribute changes (GAO; SCHROEDER, 2009). For the authors, assuming that k^{th} in alternative j improves from level 0 (without the attribute k , superscript 0 of the attribute x) to level one (with attribute k , superscript 1 of the attribute x), the WTP of consumer i to accept the price he/she would like to pay for this change is represented by the following equation:

$$(2) \quad \alpha_i \cdot p_{ij} + \sum_{\substack{h=1 \\ h \neq k}}^T \beta_{ih} \cdot x^0_{ijk} = \alpha_i \cdot (p_{ij} + WTP^k) + \sum_{\substack{h=1 \\ h \neq k}}^T \beta_{ih} \cdot x_{ijk} + \beta_{ik} \cdot x^1_{ijk}$$

Solving the equation (2):

$$(3) \quad WTP^k = - \frac{\beta_{ik}}{\alpha_i} (x^1_{ijk} - x^0_{ijk})$$

Thus the linear function of the utility willingness to pay for k^{th} attribute is the negative ratio of the parameter of k with price (GAO; SCHROEDER, 2009): $WTP^k = - \frac{\beta_{ik}}{\alpha_i}$. Since the objective of the study is to test the effect of additional attributes on consumer willingness to pay for attribute k , it is assumed in the equation (1) that alternative j has additional $M - T$ attributes ($M > T$), which changes the linear and random utility function of consumer i to:

$$(4) \quad U_{ij}^* = \alpha_i^* \cdot p_{ij} + \sum_{k=1}^T \beta_{ik}^* \cdot x_{ijk} + \sum_{k=T+1}^M \beta_{ik}^* \cdot x_{ijk} + \varepsilon_{ij}$$

In addition, when adding attributes in the function, the marginal utility of the consumer changes from α_i to α_i^* and from β_{ik} to β_{ik}^* , changing WTP for the attribute k from $WTP^k = - \frac{\beta_{ik}}{\alpha_i}$ to $WTP^{k*} = - \frac{\beta_{ik}^*}{\alpha_i^*}$. Then this model was used to verify whether “ WTP^k is different from “ WTP^{k*} ”.

For the estimation, we used the Mixed Logit Model, also known as Random Parameters Logit Model (RPL) due to its flexibility benefits to simulate any random utility model, and also the fact that it does not have the limitations of other logit models, such as the homogeneous preference among individuals, the pattern of limited substitution between alternatives and non permission of the correlation on unobservable factors through choice options from each individual. In the RPL, “the mean of the random parameters is estimated, together with their variance, while in the standard logit, the variance is set equal to zero” (NAHUELHUAL; LOUREIRO; LOOMIS, 2004, p. 544). Thus the attributes with random coefficients will have a distribution around the mean.

The bootstrapping procedure of Krinsky and Robb (1986) was used to generate 1,000 parameters that enabled to calculate 1,000 WTP for each attribute in all choice experiments, besides estimating its average and variance. Since the coefficients of the meat attributes have a normal distribution and the price is not a random parameter, the ratio between the coefficients of the attributes and price also has a normal distribution. Thus the means of WTP for each choice experiment were calculated by T-test (mean-comparison test). All statistical analyzes were performed using the Software STATA 13, except the descriptive ones, for which we used the SPSS 19.

Design of experiments and questionnaires

In the first step, one part of the questionnaires was conducted with 14 clients of “Beef Passion”, in the store in São Paulo. In the second step, the questionnaires were distributed in the form of a survey through Qualtrics that randomly alternated between the four questionnaires as each respondent accessed the link that was shared in the social media of “Blog da Carne”. In the third step, 54 students.

The sample was composed of 267 consumers. According to Ward, Lusk and Dutton (2008) samples may be small, medium and large, with approximately 250, 500 and 1000 respondents, respectively. The question “are you a vegetarian?” was used as a filter, and only those who answered “no” could continue answering the questionnaire.

For the experiments, two sets of attributes from a prime steak were used based on the study of Gao and Schroeder (2009). The first set is used to test the information effect of an additional attribute in the consumer willingness to pay when a signal attribute was introduced. In a choice experiment, the minimum number of attributes should be at least two and no more than five, since a larger number leads to information overload for respondents (GAO; XIAOHUA; HOUSE, 2009).

Five attributes directly related to pasture-raised meat were chosen according to the hypothesis of the study. The sixth attribute is the price. The first set consists of: price per 100-gram steak, guaranteed omega 3, guaranteed leanness and guaranteed Vitamin E. The second, which was used to test the additional effect on consumer willingness to pay if no signal attribute were presented included: guaranteed omega 3, guaranteed leanness and guaranteed tenderness.

After the theoretical review and with the methodological procedures already established and organized, the following brings the results.

4. Results

Laddering

The values of consumers regarding beef production were the object of investigation in this first step. The content analysis identified: 4 attributes, 6 consequences and 3 values for Brazilian consumers; and 4 attributes, 8 consequences and 5 values for US consumers. Figure 1 brings these elements organized according to the country.

Attributes	Consequences	Values
Brazil		
1. Production Aspects	5. Feeling	11. Achievement
2. Security	6. Quality	12. Universalism
3. Animal	7. Food	13. Security
4. Quality	8. Health	
	9. Accessibility	
	10. Production Aspects	
United States		
1. Necessity	5. Animal	13. Power
2. Production Aspects	6. Production Aspects	14. Self-direction
3. Negative	7. Origin	15. Universalism
4. Animal	8. Financial/economic Aspect	16. Security
	9. Choice	17. Achievement
	10. Feeling	
	11. Food	
	12. Necessity	

Figure 1. Attributes, consequences and values for production.

It is observed that for Brazilian consumers the most important values related to livestock production are: universalism and security. The first showed a greater number of incidences and shows that respondents see production in a way to provide food for the general

population. Moreover, the value security showed that they link the production to health and food safety.

In the case of US consumers, the main value was self-direction followed by safety. The first is connected to consumer choice. According to the respondents, despite production having negative aspects, it is up to consumers whether to consume, what they will consume, and also to seek information about the origin and production method. However, they considered meat as a necessity for people's feeding and that it should be safe.

Finally, both consumers from Brazil and the United States, behind the values that they have for beef production, consider aspects concerning livestock that relate to signal attributes and in the case of this study, animal welfare. In the case of Brazil, the concern for the value health and security were important in the analysis performed. These factors relate to the present study, in which we identified the preference for attributes such as animal welfare, omega 3, leanness and vitamin E. In addition to this qualitative approach analysis, another one was carried out with beef experts.

Choice experiments

In October 2015, the three steps of the experiment were performed. Firstly, the questionnaires were applied with 14 customers of "Beef Passion" store in São Paulo. A survey was shared on social media through "Blog da Carne" in which 210 questionnaires were answered, and 199 were applicable to the analysis due to the fact they were complete. Finally, 54 questionnaires were answered by students of the Management course at Luiz de Queiroz College of Agriculture, campus of Piracicaba, University of São Paulo.

Results of Econometric Models

A total of 267 questionnaires were completed (78 of A12, 62 of A23, 60 of B12 and 67 of B23). Eight logit models of random parameters were estimated for each of the eight choice experiments. The alternative price coefficient is a non-random parameter because if it were assumed that the price coefficients had normal distribution, it would imply that some people had positive price coefficients, which is not consistent with the price-demand relationship. Not allowing the price coefficient to vary randomly "also ensures that willingness-to-pay estimates for a particular steak are normally distributed" (TONSOR et al, 2005).

Coefficients of meat attributes used in the study were defined as random parameters with normal distribution in order to enable consumer's heterogeneous preferences for these attributes. The assumption that random parameters have normal distribution is the most widely used (NAHUELHUAL; LOUREIRO; LOOMIS, 2004). The normal distribution enables the coefficients to be positive or negative and thus the estimates of willingness-to-pay may be positive or negative (NAHUELHUAL; LOUREIRO; LOOMIS, 2004; TONSOR et al., 2005; LUSK; ROOSEN; FOX, 2003; TRAIN, 1988). Besides that, the proportion of the sample for each signal is determined by the mean and standard deviation estimated (TRAIN, 1988).

The coefficients were also classified as correlated "because in choice experiments, each respondent makes sequences of choice decisions with several (eight in our case) choice sets, individual preferences are perfectly correlated across the choice sets for a given respondent" (GAO, 2007, p. 55). Table 1 shows the coefficients of the attributes of the products to the four questionnaires A12, A23, B12 and B23.

Table 1:

Coefficients estimated for the questionnaires A12, A23, B12 and B23.

Independent Variable of the Choice Experiment	A11	A12	A21	A22
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	Coefficient	Coefficient	Coefficient	Coefficient
Price	-0.169*	-0.778*	-0.097*	-0.122*
Guaranteed Animal Welfare	6.492*	1.733*	1.576*	2.494*
Guaranteed Omega 3	1.309*	0.811*	0.695*	0.982*
Guaranteed Leanness		0.976*	0.657*	1.069*
Guaranteed Vitamin E				0.673
Standard deviation of the distribution parameters				
Guaranteed Animal Welfare	5.572*	1.535*	1.239*	3.389*
Guaranteed Omega 3	1.778*	0.602	0.409	1.987*
Guaranteed Leanness		0.8255*	1.432*	1.116
Guaranteed Vitamin E				1.420*
Independent Variable of the Choice Experiment	B11	B12	B21	B22
	Coefficient	Coefficient	Coefficient	Coefficient
Price	-0.103*	-0.829*	-0.113*	-0.104*
Guaranteed Animal Welfare	2.538*	1.063*	0.900*	0.098
Guaranteed Omega 3	1.092*	1.928*	1.435*	1.300*
Guaranteed Leanness		1.127*	0.746*	-0.124
Guaranteed Vitamin E				3.171*
Standard deviation of the distribution parameters				
Guaranteed Omega 3	1.926*	0.747*	0.993*	3.591*
Guaranteed Leanness	1.906*	1.955*	2.090*	2.675*
Guaranteed Vitamin E		0.774	1.132*	0.801
Guaranteed Tenderness				3.492*
X²	A11	A12	A21	A22
	107.85	22.79	21.04	45.83
	B11	B12	B21	B22
	54.94	31.94	45.02	95.48

*Significance level of 5%.

Source: Author.

Aside from the guaranteed omega 3 and guaranteed vitamin E, both in the situation of choice A22, all coefficients were different from zero at a 5% significance level. The coefficient price was negative in all situations of choice and the coefficients of the other attributes were positive, which were consistent with the price-demand relationship. Standard deviation distributions of each attribute show that there are heterogeneous preferences for attributes of meat. However, the attribute “Guaranteed Omega 3” in the choice experiment A12 and A21, and the attribute “Guaranteed Leanness” in A22 were not statistically significant at a significance level of 5%.

For the four choice experiments of the questionnaires B12 and B23, all coefficients of the attributes except “Guaranteed Omega 3” and “Guaranteed Vitamin E”, both in B22, were different from zero at a significance level of 5%. The coefficients of price are negative in all the choices, and the other attributes were positive. Although the coefficient “Guaranteed Vitamin E” has presented a negative sign in B22 choice, it was not statistically significant.

In Table 2, the negative covariance between “Guaranteed Animal Welfare” and “Guaranteed Omega 3” (A12) presented in the matrix of random parameters to the questionnaires A12 and A23, indicates that the presence of “Guaranteed Animal Welfare” in steak would decrease consumer’s marginal utility for “Guaranteed Omega 3” and vice versa. The negative covariance also occurred with “Guaranteed Leanness” and “Guaranteed Omega 3” (A12); “Guaranteed Animal Welfare” and “Guaranteed Omega 3” (A21); “Guaranteed Leanness” and “Guaranteed Omega 3” (A21); “Guaranteed Leanness” and “Guaranteed Animal

Welfare” (A21); “Guaranteed Leanness” and “Guaranteed Omega 3” (A22); “Guaranteed Leanness” and “Guaranteed Animal Welfare” (A22). The positive covariance among other attributes indicates that the marginal utility of a steak attribute positively affects the other attributes.

Table 2:

Covariance matrix of random parameters to questionnaires A12 and A23.

A11	Guaranteed Animal Welfare	Guaranteed Omega 3		
Guaranteed Animal Welfare	31.046			
Guaranteed Omega 3	5.414	3.160		
A12	Guaranteed Animal Welfare	Guaranteed Omega 3	Guaranteed Leanness	
Guaranteed Animal Welfare	2.357			
Guaranteed Omega 3	-0.285	0.362		
Guaranteed Leanness	0.474	-0.094	0.682	
A21	Guaranteed Animal Welfare	Guaranteed Omega 3	Guaranteed Leanness	
Guaranteed Animal Welfare	1.535			
Guaranteed Omega 3	-0.104	0.167		
Guaranteed Leanness	-0.519	-0.430	2.051	
A22	Guaranteed Animal Welfare	Guaranteed Omega 3	Guaranteed Leanness	Guaranteed Vitamin E
Guaranteed Animal Welfare	11.487			
Guaranteed Omega 3	2.600	3.948		
Guaranteed Leanness	-0.219	-0.231	1.245	
Guaranteed Vitamin E	3.987	2.817	-0.172	2.015

Source: Author.

For the questionnaires B12 and B23 covariance matrix demonstrated that most of the random parameters had a positive relationship with each other (Table 3). The attributes “Guaranteed Omega 3” and “Guaranteed Vitamin E” in B12 and B21 choices, and “Guaranteed Vitamin E” and “Guaranteed Leanness” had negative covariance, which indicates a negative relationship between these attributes in the choices presented. Respondents showed heterogeneous preferences for all attributes of B11 and B21 choices. The attribute “Guaranteed Vitamin E” was not statistically significant in B12 and B22 choices.

Table 3:

Covariance matrix of random parameters to questionnaires B12 and B23.

B11	Guaranteed Omega 3	Guaranteed Leanness		
Guaranteed Omega 3	3.710			
Guaranteed Leanness	1.204	3.631409		
B12	Guaranteed Omega 3	Guaranteed Leanness	Guaranteed Vitamin E	
Guaranteed Omega 3	0.559			
Guaranteed Leanness	-0.357	3.823		
Guaranteed Vitamin E	0.358	0.876	0.600	
B21	Guaranteed Omega 3	Guaranteed Leanness	Guaranteed Vitamin E	
Guaranteed Omega 3	0.985			

Guaranteed Leanness	-0.586	4.367		
Guaranteed Vitamin E	0.758	1.181	1.281	
B22	Guaranteed Omega 3	Guaranteed Leanness	Guaranteed Vitamin E	Guaranteed Leanness
Guaranteed Omega 3	12.894			
Guaranteed Leanness	1.709	7.153		
Guaranteed Vitamin E	0.860	-0.195	0.641	
Guaranteed Tenderness	7.598	2.932	-0.573	12.194

Source: Author.

Besides the analysis of the coefficients, the estimate of willingness-to-pay for each attribute in each choice experiment was carried out.

Willingness-to-pay and the influence of signal attribute

With estimates of consumer willingness to pay for each attribute, the impact of inserting additional attributes for each choice experiment can be measured. Consumer willingness to pay for a meat attribute is the ratio of the coefficient of the attribute and price: $WTP_k = \frac{\beta_k}{\alpha}$, where β_k is the coefficient of the k^{th} attribute of an alternative and α is the price coefficient. A bootstrap procedure was used to generate 1000 coefficient values for each attribute of meat, enabling that 1000 WTP were simulated for each attribute of each steak and on each choice experiment.

Tables 4 and 5 present the average WTP simulated for each attribute of each choice of the questionnaires A12 and A23; B12 and B23, respectively. The total WTP is the amount (in Brazilian Reais) that a consumer would be willing to pay for a steak that had all the attributes present in every choice. All WTP estimates were different from zero at a 5% significance level for the questionnaires A12 and A23 (Table 5). The results showed that the WTP was higher for the attribute “Guaranteed Animal Welfare, followed by “Guaranteed Leanness”, “Guaranteed Omega 3”, and finally “Guaranteed Vitamin E”.

Tables 4 and 5 also bring the ratio of consumer willingness to pay for each attribute of a choice, calculated by the formula: $WTPp = \frac{WTP^k}{WTP^{Total}}$. The higher the ratio is, the greater the importance of that attribute. For example, in a steak in which only the attributes “Guaranteed Animal Welfare” and “Guaranteed Omega 3” are presented (A11), the first accounted for 87.1% of the total willingness-to-pay for this steak. The “Guaranteed Animal Welfare” was the most important attribute in all choices, which confirms the hypothesis H_1a of the study.

With WTP proportions it is possible to make comparisons within and between. At first, it is estimated that when adding the attribute (A12), the importance of WTP for “Guaranteed Animal Welfare” decreases between A11 and A12 (“Guaranteed Leanness” as an additional attribute), as in A21 and A22 (“Guaranteed Vitamin E” as a signal attribute). The willingness-to-pay for “Guaranteed Omega 3” gains importance between A11-A12 (Within) and A12-A21 (between), but loses between A12-A22 (within) and A21-A22 (between).

Table 4:
Estimates for the WTP of the questionnaires A12 and A23.

	A11	A12	A21	A22	A11	A12	A21	A22
Guaranteed Animal Welfare	3906*	26.61*	15.93*	17.52*	87.4%	54.0%	53.7%	45.0%
Guaranteed Omega 3	5.63*	10.98*	6.52*	7.57*	12.6%	22.3%	22.0%	19.4%
Guaranteed Leanness		11.70*	7.23*	9.67*		23.7%	24.4%	24.8%

Guaranteed Vitamin E				4.18*				10.7%
Total WTP	44.69	49.29	29.68	38.95	100%	100%	100%	100%

* Significance level of 5%.

Source: Author.

In Table 5, all estimates of the choices B11, B12 and B21 are different from zero at a 5% significance level. It is observed that without the signal attribute “Guaranteed Animal Welfare”, “Guaranteed Omega 3” gains greater importance to the detriment of “Guaranteed Leanness” in the choice experiment B11. However, the analyzes within (B11-B12) and between (B11-B21) and B11 show that, as the attribute “Guaranteed Vitamin E” is added, “Guaranteed Leanness” starts to have greater importance in consumer willingness to pay.

Table 5:
Estimates for the WTP of the questionnaires B12 and B23.

	B11	B12	B21	B22	B11	B12	B21	B22
Guaranteed Omega 3	22.21*	14.80*	8.77*	-25.25	67.6%	29.0%	32.8%	-135.8%
Guaranteed Leanness	10.66*	23.44*	12.93*	9.72*	32.4%	45.9%	48.3%	52.3%
Guaranteed Vitamin E		12.79*	5.04*	-0.12		25.1%	18.9%	-0.7%
Guaranteed Tenderness				34.24*				
Total WTP	32.87	51.02	26.75	18.59	100,0%	100,0%	100,0%	100,0%

* Significance level of 5%.

Source: Author.

In the experiment B22, while adding the attribute “Guaranteed Tenderness”, the WTP and hence its proportions have been negative for the attributes “Guaranteed Omega 3” and “Guaranteed Leanness”, having no statistical significance. Consumers, however, were willing to pay R\$ 34.24 more, at a significance level of 5 %, for a bovine meat with “Guaranteed Tenderness”.

When comparing the results between the questionnaires A12 and A23 (Table 4) with the questionnaires B12 and B23 (Table 5), it is observed that the signal attribute “Guaranteed Animal Welfare” was the one with the highest proportion (importance) between the choice experiments. “Guaranteed Tenderness” presented a share of 184.2% in the B22 choice experiment, but the two attributes were not statistically significant, which makes this percentage little concise due to two factors: First, when considering the findings of Lusk and Fox (2000), Goss, Holcomb and Ward (2002), Feldkamp, Schroeder and Lusk (2003), Huffman et al (1996) that tenderness is the most important attribute in choice, the willingness-to-pay for other attributes may have suffered some sort of “rejection”. Second, the “tyranny of choice” described by Sobal and Bisogni (2009) as the excess, confusion of information, that may be an explanation for this result, as they are different attributes and one of them (tenderness) has a preference that was statistically high.

Finally, comparisons within-subjects were made between the choice experiments A11-A12, B11-B12, A21-A22, B21-B22; and comparisons between-subjects between experiments the A11-A21, B11-B21, A12-A22 and B12-B22. For both types of comparisons we used the T-test, which carried out the difference between the mean WTP between choice experiments. For example, the value 12.45 in Table 6 was calculated from the difference between the means 39.06 (A11) and 23.61 (A12), as shown in Table 4, using the T-test with a significance level of 5 %.

In Table 6, the positive values mean that there was a decrease in WTP between the experiments in question while the negative ones increased. The results showed that the willingness-to-pay for the attribute “Guaranteed Animal Welfare” decreases by adding “Guaranteed Omega 3” between the choice experiments A11-A12, A11-A21, A12-A22, but showed a slight increase of the experiment A21, with the introduction of “Guaranteed

Vitamin E” on the experiment A22. In general, as attributes are added, the WTP for “Guaranteed Animal Welfare” decreases and for “Guaranteed Omega 3” increases. Thus by adding independent attributes, the signal attribute, which serves as a proxy for other quality attributes loses WTP, confirming the H_1b of the study.

Table 6:
Comparisons within and between-subjects.

Type of comparison	Within-Subject		Between Subject		Within-Subject		Between Subject	
	A11- A12	A21- A22	A11- A21	A12- A22	B11- B12	B21- B22	B11- B21	B12- B22
Choice Experiment								
Guaranteed Animal Welfare	12.45	-1.59	23.13	9.09				
Guaranteed Omega 3	-5.35	-1.05	-0.89	3.41	7.41	34.02	13.44	40.05
Guaranteed Leanness		-2.44		6.09	-12.78	3.21	-2.27	13.72
Guaranteed Vitamin E						5.16		12.92

Source: Author.

In Table 6, the positive values means that there was a decrease in WTP between experiments in question, while the negative ones increased. The results showed that the willingness-to-pay for the attribute “Guaranteed Animal Welfare” decreases by adding the “Guaranteed Omega 3” between the choice experiments A11-A12, A11-A21, A12-A22, but showed a slight increase of the experiment A21, with the introduction of “Guaranteed Vitamin E” in the experiment A22. In general, as attributes are added, the WTP for “Guaranteed Animal Welfare” decreases and “Guaranteed Omega 3” increases. Thus by adding independent attributes, the signal attribute, which serves as a proxy for other quality attributes, loses WTP, confirming the H_1b of the study.

When comparing the choice experiments of the questionnaires B12 and B23, the willingness-to-pay for the attribute “Guaranteed Omega 3” also decreases with additional attributes. This finding is in line with the study of Gao (2007), who found as a result that, as additional information is passed to consumers, the willingness-to-pay for additional attributes decreases. Finally, a T-test comparing the means between the WTP of the attribute “Guaranteed Animal Welfare” of the experiment A22 and “Guaranteed Tenderness” of B22 was carried out (Table 7). These experiments were chosen for having the same amount and the same attributes. Both for “Guaranteed Animal Welfare” and “Guaranteed Tenderness” presented the WTP a significance level of 5%.

Table 7:
Comparison between the WTP for animal welfare and tenderness.

	WTP	Deviation
“Guaranteed Animal Welfare” (A22)	17.52	4.83
“Guaranteed Tenderness” (B22)	34.24	8.53
Difference - T-test (5% of significance)	-16.72	

Source: Author.

As a result, the willingness to pay for the attribute “Guaranteed Softness” was statistically higher than “Guaranteed Animal Welfare”, with a difference of 16.72, which confirms the H_2 of the study. With the end of the results, the next section brings the final considerations of this study.

5. Final Considerations

The purpose of this study was to identify the marginal impact of introducing a signal attribute of beef produced on pasture in consumer willingness to pay (WTP) for other independent attributes. In this way, two specific goals were set: i) investigate the values of consumers towards livestock production; and ii) determine whether, with additional information, consumer willingness to pay for the signal attribute changes. According to the specific objectives, the study was divided into three steps.

The first objective was achieved in the first step, in which we conducted 52 interviews, 30 with consumers in Brazil and 22 in the United States. The results showed that both consumers from Brazil and the United States (behind the values that they have for beef production) consider aspects of livestock. For Brazilians, the value security was the most important, being a result of concerns with health issues and food safety. For US consumers, the production is connected to consumer choice and the value of self-direction was considered a necessity, but it must be carried out safely.

The second objective was achieved in step 2 of the study, in which 267 beef consumers participated in choice experiments distributed in the form of physical questionnaire and survey. The results show that the willingness-to-pay for the attribute “Guaranteed Animal Welfare” was the most important in all the four choice experiments of the questionnaires A12 and A23, which confirmed the H1a.

By adding independent attributes, the willingness-to-pay for the signal attribute decreased, confirming the H1b. This result met the study of Gao (2007), who found that, as additional information is passed to consumers, the willingness-to-pay for additional attributes decreases. Finally, the comparison between the WTP of the attribute “Guaranteed Animal welfare”, of the choice experiment A22, and “Guaranteed Tenderness”, of the experiment B22 showed that consumer willingness to pay was higher for tenderness than for animal welfare. Just as in the studies of Lusk and Fox (2000), Goss, Holcomb and Ward (2002) and Feldkamp, Lusk and Schroeder (2003), Hoffman (2000), and in the responses of the two experts, tenderness proved to be an important attribute in purchasing decisions.

As well as the results of Umberguer et al (2003), Conner et al (2008) and Harper and Henson (2001) carried out abroad, this study showed that consumers are willing to pay more for attributes of pasture-raised meat, especially animal welfare. These findings offer an alternative beef differentiation, enabling it to be sold with higher added value by integrating these products.

This study was limited regarding the steps taken. At first, though more than half of the sample was randomly selected (downtown and in a park of Campinas), the other part was through convenience. With consumers in the United States, the limitation was due to the fact that the sample is partly composed of undergraduate students. In Step 3, since part of respondents answered by survey and although they are mainly distributed through a specialized meat blog, the sample ends up being a bit comprehensive. The questionnaires with college students also have a limitation. Although they can have greater access to information, they often have lower income. The sample as a whole could also have been more comprehensive.

For future studies, a suggestion is to apply other methods such as conjoint analysis and contingent valuation. Finally, it is proposed that similar studies replicate the model with a larger and more concentrated sample.

References

- ALPIZAR, F. CARLSSON, F.; MARTINSSON, P. Using choice experiments for non-market valuation. **Working Paper in Economics**, n. 52, Department of Economics, Goteborg University, 2001.
- BECKER, T. Consumer Perception of fresh meat quality: a framework for analysis. **British Food Journal**, v. 102, n. 3, p. 158-176, 2000.

- BRESSAN, M.C. et al. Genotype × environment interactions for fatty acid profiles in *Bos indicus* and *Bos taurus* finished on pasture or grain. **Journal of Animal Science**, n.89, p.221-232, 2011.
- CONNER, David S. et al. Demand for pasture-raised livestock products: Results from Michigan retail surveys. **Journal of Agribusiness**, v. 26, n. 1, p. 1-20, 2008.
- ENSER, M. et al. Fatty acid content and composition of UK beef and lamb muscle in relation to production system and implications for human nutrition. **Meat Science**, v.49, n.3, p.329-341, 1998.
- EVANS, J. R. **Determining Consumer Perceptions of and Willingness to Pay for Appalachian Grass-Fed Beef: An Experimental Economics Approach**. Thesis (Ph.D). Davis College of Agriculture, Forestry, and Consumer Sciences at West Virginia University. Morgantown, 2007.
- EVANS, J. R.; D'SOUZA, G. E.; COLLINGS, A.; BROWN, C.; SPEROW, M. Determining Consumer Perceptions of and Willingness to Pay for Appalachian Grass-Fed Beef: An Experimental Economics Approach. **Agricultural and Resource Economics Review**, v. 40, n. 2, p. 233-250, 2011.
- FELDKAMP, T.; SCHROEDER, T.; LUSK, J. Consumer valuation of steaks with different quality attributes. In: CATTLEMAN'S DAY, Kansas State University University Agricultural Experiment, 2003. **Proceedings...** Kansas, 2003
- FRENCH, P. et al. Meat quality of steers finished on autumn grass, grass silage or concentrate-based diets. **Meat Science**, v. 56, p; 173-180, 2000.
- FURST, T. et al. Food choice: a conceptual model of the process. **Appetite**, v. 26, p. 247-266, 1996.
- GALL-ELY, M. L. Definition, Measurement and Determinants of the Consumer's Willingness to Pay: a Critical Synthesis and Directions for Further Research. **Recherche et Applications em Marketing**, SAGE publications, v. 24, n.2, p.91-113, 2009.
- GAO, Z.; **Effects of additional quality attributes on consumer willingness-to-pay for food labels**. Thesis (Phd). Kansas State University. Manhattan, 2007.
- GAO, Z.; SCHROEDER, T. C. Effects of label information on consumer willingness-to-pay for food attributes. **American Journal Agricultural Economics**, v. 91, n. 3, p. 795-809, 2009.
- GAO, Z.; XIAOHUA, Y; HOUSE, L. O. Using Choice Experiments to Estimate Consumer Valuation: the Role of Experimental Design and Attribute Information Load. In: Agricultural & Applied Economics Association Annual Meeting. Milwaukee, 2009. **Proceedings...** Milwaukee, 2009.
- GARCIA, P.T. et al. Beef lipids in relation to animal breed and nutrition in Argentina. **Meat Science**, v. 79, p. 500–508, 2008.
- GIL, J.M. et al. Market segmentation and willingness to pay for organic products in Spain. **International Food and Agribusiness Management Review** vol. 3, n. 2, p.207-226, 2000.
- GOSS, J.; HOLCOMB, R.; WARD, C. Factors influencing consumer decisions related to natural beef in the Southern Plains. **Journal of Food Distribution Research**, v. 33, n. 1, p. 73-84, 2002.
- HARPER, G. C.; MAKATOUNI, A.. Consumer perception of organic food production and farm animal welfare. **British Food Journal**, v. 104, n. 3/4/5, p. 287-299, 2002.
- HARPER, G.; HENSON, S. Consumer concerns about animal welfare and the impact on food choice. **EU FAIR CT98-3678, Centre for Food Economics Research, The University of Reading**, 2001.
- HEITSCHMIDT, R. K.; VERMEIRE, L. T.; GRINGS, E. E. Is rangeland agriculture sustainable? **Journal of Animal Science**, v. 82, p. 132-146, 2004.

- HOFFMAN, R. Country-of-origin – a consumer perspective of fresh meat. **British Food Journal**, v. 102, n. 3, p. 211-229, 2000.
- HOLLOWAY, R. J.; WHITE, T. Advancing the Experimental Method in Marketing. **Journal of Marketing Research**, v. 63, p. 130-144, 1963.
- HOPPE, A. et al. Comportamento do consumidor de Produtos Orgânicos: uma aplicação da teoria do comportamento planejado. **BASE – Revista de Administração da Unisinos**, v. 9, n. 2, p. 174-188, 2012.
- HUBER, J.; MCCAN, J. The impact of inferential benefits on product evaluations. **Journal of Marketing Research**, v. 19, p. 324-333, 1982.
- HUFFMAN, K. L. et al. Effect of beef tenderness on consumer satisfaction with steaks consumed in the home and restaurant. **Journal of Animal Science**, v. 74, n. 1, p. 91-97, 1996.
- KALISH, S.; NELSON, P. A comparison of ranking, rating and reservation price measurement in conjoint analysis. **Marketing Letters**, v. 2, n. 4, p. 327-335, 1991.
- KRINSKY, I.; ROBB, A. L. On approximating the statistical properties of elasticities. **The Review of Economics and Statistics**, p. 715-719, 1986.
- LANCASTER, K. J. A new approach to consumer theory. **The Journal of Political Economy**, v. 74, n. 2, p. 132-157, abr./1966.
- LIN, B. **An Analysis of consumer preferences for grass-fed versus grain-fed beef**. Thesis (Master). Graduate Faculty of Louisiana State University and Agricultural and Mechanical College. Baton Rouge, 2013.
- LOUREIRO, M. L.; HINE, S. Discovering niche markets: A comparison of consumer willingness to pay for local (Colorado grown), organic, and GMO Free products. **Journal of Agricultural and Applied Economics**, v.34, n.3, p.477-487, 2002
- LUSK, J. L.; ROOSEN, J.; FOX, J. A. Demand for beef from cattle administered growth hormones or fed genetically modified corn: a comparison of consumers in France, Germany, the United Kingdom, and the United States. **American Journal of Agricultural Economics**, v. 85, n. 1, p. 16-29, 2003.
- LUSK, J.; FOX, J. Consumer valuation of ribeye steak attributes. In: AMERICAN AGRICULTURAL ECONOMICS ASSOCIATION ANUAL MEETING, Tampa, FL, August, 2000. **Proceedings...** Tampa, 2000.
- MAHIEU, P.-A.; ANDERSSON, H.; BEAUMAIS, O. CRASTES, V; WOLFF, F.-C. Is choice experiment becoming more popular than contingent valuation? A systematic review in agriculture, environment and health. **FAERE Working Paper**, 2014.
- NAHUELHUAL, L.; LOUREIRO, M. L.; LOOMIS, J. Using random parameters to account for heterogeneous preferences in contingent valuation of public open space. **Journal of Agricultural and Resource Economics**, p. 537-552, 2004.
- PATO-OLIVEIRA, TAMAYO, A. Os valores como preditores de atitudes e comportamentos: contribuições para um debate. **Linhas Críticas**, v. 8, n.14, p. 103-117, 2002.
- PERDUE, B. C.; SUMMERS, J. O. Checking the success of manipulations in marketing experiments. **Journal of Marketing Research**, p. 317-326, 1986.
- PINTO, L. A. et al. Valores em serviços de policiamento comunitário: o Programa de Ronda do Quarteirão sob a ótica da teoria da cadeia de meios e fins. **Revista de Administração Pública**, v. 46, n. 1, p. 333-357, jan/fev. 2012.
- PIROG, R. **Consumer perception of pasture-raised beef and dairy products: an internet study**. Iowa State University, ISU Business Analysis, 2004.
- PURCHAS, R. et al. The effect of production system and age on concentrations of fatty acids in intramuscular fat of the longissimus and triceps brachii muscles of Angus-cross heifers. **Meat Science**, v. 70, p. 597-603, 2005.
- REYNOLDS, T. J.; GUTMAN, J. Laddering theory, method, analysis, and interpretation. **Journal of Advertising Research**, New York, v. 28, p. 11-31, fev/mar. 1988.

- RULE, D. et al. Comparison of muscle fatty acid profiles and cholesterol concentrations on bison, beef cattle, elk, and chicken. **Journal of Animal Science**, v. 80, n. 5, p. 1202-1211, 2002.
- SCHOLLAN, N. et al. Innovations in beef production systems that enhance the nutritional and health value of beef lipids and the relationship with meat quality. **Meat Science**, v. 74, p. 17-33, 2006.
- SCHOLZ, M. et al. Measuring consumers' willingness to pay with utility-based recommendation systems. **Decision Support Systems**, 72, pp.60–71, 2015.
- SCHWARTZ, S. H. Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. **Advances in Experimental Social Psychology**, v. 25, n.1 p. 1-65, 1992.
- SOBAL, J.; BISOGNI, C. Constructing food choice decisions. **Annals of Behavioral Medicine**, v. 38, p. 37-46, 2009.
- STEENKAMP, J.-B. E. M. Conceptual model of the quality perception process. **Journal of Business Research**, v. 21, p. 309–333, 1990.
- STEWART, J. M., et al. Do ordering effects matter in willingness-to-pay studies of health care? **Journal of Health Economics** v.21, n.4, p. 585-599, 2002.
- TONSOR, Glynn T. et al. European preferences for beef steak attributes. **Journal of Agricultural and Resource Economics**, p. 367-380, 2005.
- TRAIN, K. E. Recreation Demand Models with Taste Differences over People. **Land Economics**, v. 74, n. 2, p. 230-239, 1998.
- UMBERGER, W. J. et al. Country-of-Origin Labeling of Beef Products: U.S. Consumers' Perceptions. **Journal of Food Distribution Research**, v. 34, n. 3, 2003.
- VARELA, A. et al. Effect of pasture finishing on the meat characteristics and intramuscular fatty acid profile of steers of the Rubia Gallega breed. **Meat Science**, v. 67, p. 516-522, 2004.
- VAZ, F. N. et al. Qualidade da carcaça e da carne de novilhos abatidos com pesos similares, terminados em diferentes sistemas de alimentação. **Ciência Animal Brasileira**, v. 8, n. 1, p. 31-40, 2007.
- WANDEL, X.; BUGGE, X. 1996. "Environmental concern in consumer evaluation of food quality." **Food Quality and Preference**, v.8, n.1, p.19–26, 1996.
- WARREN, Helen E. et al. Effects of breed and a concentrate or grass silage diet on beef quality in cattle of 3 ages. II: Meat stability and flavour. **Meat Science**, v. 78, n. 3, p. 270-278, 2008.
- WERTENBROCH, K.; SKIERA, B. **Journal of Marketing Research**, v. 39, p. 228-241, 2002.