Economic Evaluation of Consumer Preferences using Experimental Methods: Ground Beef vs. Ground Bison

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Introduction

Bison's primary competitor in the commercial market for red meat is beef (Steiner et. al. 2010). The market for bison meat is a niche market and very little research on bison demand has been done. Thus, very little is known about consumer preferences for bison meat.

Consumer taste preferences with regards to ground bison relative to ground beef are identified. The role of meat attributes (flavor, tenderness, and juiciness) on consumer sensory panel rankings of the three ground meat products (10-point hedonic scale) was conducted. Analysis of how sensory panel meat attribute rankings affect bidding behavior in a Vickery auction mechanism was ascertained. The number of bison sensory panel studies with a non-bison treatment are limited (McClenahan et.al. 2001).

Objective

The objective of the study is to determine consumer monetary evaluation of ground beef and ground bison Meat-Eating-Quality (MEQ) attributes by a trained consumer panel that participated in a Vickery 2nd price auction.

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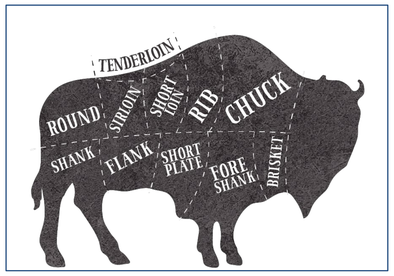

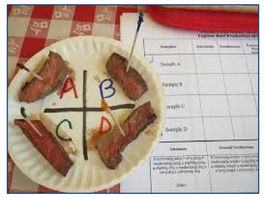

Methods

A combined consumer panel was assembled to conduct a willingness to pay and a sensory panel study (compliant with AMSA 1995 guidelines). The goal of panel study is to identify consumer taste preferences for ground bison vs. ground beef. Sensory panel data are combined with consumer willingness to pay data with regards to ground bison relative to ground beef. Specifically, we were interested in determining the role of meat attributes of flavor, tenderness, and juiciness on consumer sensory panel rankings of the three ground meat products. The sensory panel rankings are used as explanatory variables in a hedonic three stage least squares price regression.

The endogenous variables are PBF80 (price of 80% ground beef), PBF93 (price of 93% ground beef), and PBison (price of 93% ground bison). Exogenous sensory panel variables are based on a hedonic scale (extreme dislike =1; extreme like=10) used to rank flavor, tenderness, and juiciness of the meat sample evaluated during the sensory panel experiment. Selection of 3SLS is based on cross model residual correlations (Table 1).

Table 1: Cross Model Correlation

	BEEF80	BEEF93	BISON
BEEF80	1.00	0.63	-0.37
BEEF93	0.63	1.00	-0.65
BISON	-0.37	-0.65	1.00

Vickery auction price data was collected after the sensory panel experiment ended and the subjects filled out a survey. After the survey was completed, a second price Vickery auction mechanism was used to conduct an experimental auction. A total of 83 subjects participated in both the sensory panel and Vickery auction. A total of 9 panels were conducted. The auction experiment conducted five rounds of bidding after two training rounds. One training round and two rounds of the sensory panel were conducted. Data set was aggregated by price rounds. This resulted in a total of 415 observations.

Two additional exogenous variables were included, a) BNI (subject given bison nutrition information=1, zero otherwise), and b) Correct (correctly identified meat sample during sensory panel=1, zero otherwise).

Table 2: Nutritional Information on Selected Ground Meat Products

Nutrient (units)	80% Lean Ground Beef per 100 grams	93% lean Ground Beef per 100 grams	93% lean Ground Bison per 100 grams
Water (g)	61.94	71.77	71.59
Energy (Kcal)	254	152	146
Protein (g)	17.17	20.85	20.23
Total lipid fat (g)	20	7	7.21
Calcium, Ca (mg)	18	10	11
Iron, Fe (mg)	1.94	2.33	2.78
Fatty acids, total saturated (g)	7.591	2.932	2.917
Fatty acids, total monounsaturated (g)	8.854	2.92	2.753
Fatty acids, total polyunsaturated (g)	0.521	0.292	0.336
Cholesterol (mg)	71	63	55

Results & Discussion

Table 3: Price of 80% Ground 3SLS Equation Estimates

Variable	DF	Estimate	Error	t Value	Pr > |t|
Intercept	1	4.29	0.53	8.07	<.0001
PBISION	1	0.55	0.09	6.42	<.0001
PBF93	1	-0.76	0.11	-6.83	<.0001
B80correct	1	-0.45	0.14	-3.21	0.00
B80texture	1	0.09	0.05	1.95	0.05
B80Juice	1	-0.14	0.04	-3.12	0.00
B80Flavor	1	0.12	0.05	2.15	0.03

Table 4: Price of 93% Ground 3SLS Equation Estimates

Variable	DF	Estimate	Error	t Value	Pr > |t|
Intercept	1	3.06	0.55	5.52	<.0001
PBISION	1	0.71	0.06	11.69	<.0001
PBF80	1	-0.58	0.10	-6.01	<.0001
B93correct	1	-0.07	0.11	-0.64	0.52
B93texture	1	-0.25	0.04	-5.75	<.0001
B93Juice	1	0.24	0.04	5.70	<.0001
B93Flavor	1	0.08	0.04	2.15	0.03

Table 5: Price of Ground Bison 3SLS Equation Estimates

Variable	DF	Estimate	Error	t Value	Pr > |t|
Intercept	1	-3.23	0.52	-6.28	<.0001
PBF93	1	0.82	0.08	9.65	<.0001
PBF80	1	0.54	0.10	5.53	<.0001
BNI	1	0.34	0.12	2.96	0.00
Biscorrect	1	0.31	0.12	2.52	0.01
Bistexture	1	0.02	0.06	0.29	0.77
BisJuice	1	0.06	0.05	1.25	0.21
BisFlavor	1	0.15	0.05	2.94	0.00

Discussion:

- Data suggest that an increase in the bid price for bison will increase the bid price for PBF80 and PBF93. The inverse is also true, that an increase in the bid price of PBF80 or PBF93 will increase the bid price for bison.
- Bid prices for all three meat products, on average, increased as bidding rounds progressed. This suggests auction participants viewed the product they perceived as bison acted as an anchor in their bidding strategy.
- Data suggest that the bid price for PBF80 and PBF93 are inversely related. This suggests subjects are adjusting relative bids.
- Data suggests that providing subjects with nutritional information increases their bid price for bison.
- Correctly identifying the meat product sample in the sensory panel experiment, increases the bid price for bison, reduces the bid price for BF80, and has not effect on BF93 bid price.
- The ground beef products were significant at the 0.05. Texture had a negative price effect for BF93, and Juiciness had a negative price effect for BF80.
- For bison, only flavor was significant and has a positive effect on a subjects bidding price for bison.

Conclusion

The experimental methods in the study are novel because they combine a willingness-to-pay experiment with a trained sensory meat panel experiment in order to investigate multi-species meat attributes and estimate the monetary value of meat sensory attributes.

Another unique feature of the study is the inclusion of: a) a variable that captures the effect of providing nutritional information to a subset of the subject group, and b) a variable that captures a subject's cogitative error committed during the sensory panel (misidentified meat sample) and its effect on the subjects bidding behavior.

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