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There are huge gaps from the farm to the processing plants. No one knows where the cows are coming from . . . . Trace forward from the processing plant is supposed to be accurate, but no one knows for sure."—Caroline Smith DeWaal, Food Safety Director for the Center for Science in the Public Interest.

ABSTRACT

This article reports the results from a series of laboratory auction markets in which consumers bid on meat characteristics. The characteristics examined include meat traceability (i.e., the ability to trace the retail meat back to the farm or animal or origin), transparency (e.g., knowing that the meat was produced without growth hormones, or knowing the animal was humanely treated), and extra assurances (e.g., extra meat safety assurances). This laboratory study provides non-hypothetical bid data on U.S. consumer preferences for traceability, transparency, and assurances (TTA) in red meat at a time when the U.S. currently lags other countries in development of TTA meat systems. Our results suggest that U.S. consumers would be willing to pay for such TTA meat characteristics, and the magnitude of the consumer bids suggest a likely profitable market for development of U.S. TTA systems.

MEAT TRACEABILITY: ARE U.S. CONSUMERS WILLING TO PAY FOR IT?

Introduction

Recent research suggests the U.S. red meat system is falling behind many of its major competitors and trading partners in terms of traceability, transparency, and other quality assurances (TTA) (Liddell and Bailey (2001)). In fact, the U.S. pork system ranks last, according to Liddell and Bailey, when compared against the United Kingdom (UK), Denmark, Canada, Japan, and Australia/New Zealand for TTA. Traceability is sometimes called identity preservation and is defined in Liddell and Bailey as the ability to track the inputs used to make food products backward to their source at different levels of the marketing chain. Transparency refers to the public availability of information on all of the rules, procedures, and practices used to produce a food product at each level of the marketing chain (Baines and Davies (1998); Early (1998)).[1]

Quality assurance has three key elements including managing hygiene to ensure food safety, ensuring quality through grading and other measurements, and providing mechanisms for product recalls (Early (1998); Baines (2001)). For example, the processes for ensuring hygiene in the European Union (EU) red-meat system has focused on Hazard Analysis Critical Control Point (HACCP) systems[2] at each point in the pork value chain beginning at the farm level.

Ensuring quality in red-meat system includes measurements of the intrinsic quality of a carcass or product (tenderness, back fat, curing, etc.). Intrinsic quality measurements are common to most government grading systems including the United States, its trading partners, and competitors. However, the EU system also provides measures of the extrinsic qualities of

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[1] Transparency requires published procedures that are publicly available and can be influenced by input from stakeholder groups (Liddell and Bailey (2001)).

[2] Codex standards emphasize hygiene and fit well into the HACCP approach for ensuring food safety. ISO 9000 standards are private labeling schemes that certify practices and procedures for a wide range of products. Capmany et al. (2000) indicate that the United States is also lagging other countries in the adopting ISO 9000 standards.

red meat. Extrinsic qualities do not affect either food safety or the intrinsic qualities of the meat product but may still affect the value of the product. Extrinsic qualities could include assurances about animal welfare, environmental preservation, or other inputs or absence of inputs used to produce the meat product[3] (Liddell and Bailey (2001); Baines (2001)).

TTA evolved initially in response to the perceived regulatory failure of European Union (EU) governments to provide adequate information ton consumers during the EU *BSE* (*bovine spongiform encephalopathy*)[4] crisis (Baines and Davies (1998)). As a result, the EU has developed systems that enhance the credence nature of attributes such as animal welfare and even food safety issues such as *BSE* by filling the perceived information void inherent in standard government grading practices with TTA.

This article presents initial evidence on U.S. consumers willingness to pay (WTP) for TTA characteristics in beef and pork. We report the results from a series of controlled laboratory experiments in which consumers bid in a (theoretically) demand-revealing auction on meat sandwich upgrades. These WTP auctions, utilized first in Shogren et al. (1994b), generate non-hypothetical data on consumer valuation of TTA attributes in meat and are a first step towards identifying the potential U.S. market(s) for meat produced through a TTA system. We find that consumers are willing to pay significant amounts of money to upgrade a sandwich to an otherwise identical sandwich containing TTA attribute(s) meat. Furthermore, our results suggest that the market for TTA beef may be broader than the market for TTA pork, as auction market

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[3] An example would be the assuring the absence of genetically modified organisms (GMOs) in a product. TTA is different than typical quality assurances and standardization in its scope (tracing throughout the market chain) and its focus (certifies more than just food safety). For example, Codex standards emphasize hygiene. ISO 9000 standards are private labeling schemes that certify practices and procedures for a wide range of products. TTA could serve as a basis for ISO certification if private companies decided these types of certifications were desirable. Capmany et al. (2000) indicate that the United States is also lagging other countries in the adoption of ISO 9000 standards.

[4] Also known as "mad-cow" disease.

valuation of the latter is more sensitive to the specific demographic characteristics of the consumers. Part of the focus of our analysis is on what consumers are willing to pay for extrinsic quality assurances because extrinsic characteristics are beyond the typical assurances (food safety and intrinsic qualities) provided by public sector inspection and grading in the United States (Baines and Davies (2000)).

Background on TTA

TTA is obtained through a system of records and certifications that allow a product to be traced and certified back to different points in the food chain. Currently most U. S. red meat is traceable from retail back to the processor but not to the farm or animal level. Establishing TTA prior to processing would require a system that is currently not generally in place in the United States. While the U. S. has been slow to adopt TTA standards and certifications, some countries in the European Union (EU) and elsewhere have been developing TTA systems (Early (1998); Baines and Davies (2000); Liddell and Bailey; Abbatemarico).

Red meat producers and processors in the United States should be concerned that the U. S. system is lagging other countries in terms of TTA for at least two reasons. First, consumers have become increasingly concerned about the processes (inputs and methods) used to produce food (e.g. Dorey; Nakamoto). Second, if competitors are able to differentiate their red meat products as being superior to U. S. red meat products in terms of TTA, the United States may lose market share in its red meat export markets. For example, food safety concerns in Japan, including the recent discovery of *BSE*, could potentially lead to heightened import restrictions and regulations (Nakamoto). Japan is the United State's principal export market for red meat and such concerns could eventually lead to a loss of U. S. market share if competitors such as Canada, Australia/New Zealand, and Denmark are successful in convincing Japanese buyers that

their products are "safer" than U. S. products because their system provides more TTA than the U. S. system.

While TTA has not been a central issue in red meat markets in the United States, it has in the EU and other countries during the past five years (e.g. Early (1998); Baines and Davies (1997, 1998, and 2000) Liddell and Bailey). As a result, the EU systems have evolved at a faster rate than the U. S. system. The consequences in the U. S. may not be felt immediately, but the potential of the U. S. losing market share in red meat markets in the future exists if competitors can successfully differentiate their products based on real or perceived food safety and quality assurance characteristics that can be certified and traced (Bailey and Hayes).

Dr. John Wiemers, the chairman of the U. S. Department of Agriculture's, Food Safety and Inspection Service Interagency Committee on Animal Identification, has stated that red-meat traceability systems will only be implemented in the United States if consumers are found to be willing to pay for the additional costs to produce traceable products. This suggests that evidence of consumer willingness to pay for TTA products is essential if TTA systems are to be developed in the United States.

Economic research on issues relating to TTA is quite limited since these systems have been evolving only within the past five years. The economic literature that exists dealing with TTA focuses primarily on the aftermath of the *BSE* crisis in the United Kingdom. For example, Palmer and Loader and Hobbs document the economic devastation to the British beef industry resulting from the *BSE* scare.

Hobbs used transaction costs economics to examine the perceived value of tracing beef cattle from the farm to the packer level (1996a) and between beef suppliers and retail outlets in the UK (1996b). Her findings indicate that traceability is the most important characteristic

desired by large beef processors when purchasing cattle from farmers (1996a). Hobbs (1996b) also found that the ease of traceability ranked ahead of prices paid to processors as an important characteristic to consider when supermarkets purchased meat.[5] Latouch, Rainelli, and Vermersch reported that consumers in the Rennes area of France were willing to pay for traceability. However, their study focused on only one issue, *BSE*, and did not deal with more general issues relating to TTA. Verbeke et al. examined the attitudes of Belgian meat consumers about pork and they argued that traceability systems would work best when coupled with efforts to improve intrinsic qualities such as leanness, taste, and tenderness and the extrinsic quality of healthiness. None of these studies provide information or data for U. S. consumers and all are quite narrowly focused, typically dealing with only one issue such as *BSE*.

An examination of differences in worldwide consumer attitudes about TTA and the market value they place on different TTA certifiable characteristics will eventually be essential to identifying the optimal approach to improving TTA in the U. S. red meat system since U. S. red meat is traded not only domestically but also internationally. However, in this study we focus on the United States to ascertain if domestic consumers are willing to pay for TTA and other meat characteristics that could be certifiable through TTA. If significant changes are made in the U. S. red meat system to address TTA concerns, large investments will be needed to do so. Recapturing these investments will require capturing a significant market share of the red meat market for products featuring TTA characteristics. This will probably require a significant penetration of domestic red meat markets as well as foreign ones. The controlled experiments we use in this study generate non-hypothetical bid data on consumer WTP for TTA, and this information is vital towards assessing whether the U.S. red meat system should consider implementing TTA. A large-scale field experiment would be an effective but prohibitively

[5] However, Hobbs (1996b) found supermarkets' most important consideration to be consistent quality of products.

costly way of conducting such research. As an alternative, the small-scale controlled laboratory experiments described in the next section offer a cost effective way to generate initial data on domestic consumer attitudes about WTP for TTA.

Experiments

Since data on TTA systems in the United States is not publicly available,[6] we use the laboratory market approach for eliciting individuals' WTP for food traceability and related characteristics. Our experiments follow the basic design utilized in Shogren et al (1994b) for eliciting bids to "upgrade" a meat sandwich. Subjects in the experiments are given a free lunch, which includes a meat sandwich, along with $15 cash at the beginning of the one-hour experiment. Subjects in the experiment are allowed to bid on what they would be willing to pay to exchange or upgrade their existing sandwich for a sandwich with the meat described as having one or more extra verifiable attributes. The upgrades we consider are based are 1) extra assurance or information relating to the processes used to produce meat including animal treatment (humane treatment procedures and lack of growth hormones used in production of the meat),[7] 2) extra assurance of food safety (extra tests for *e coli* or *salmonella* for beef or pork, respectively),[8] 3) the ability to trace the meat back to the farm of origin,[9] and 4) all three upgrades combined. The respective auction sandwiches are numbered as Sandwich 1, Sandwich 2, Sandwich 3, and Sandwich 4.

Subjects were recruited from four different demographic cohorts for the experiments. The subjects were informed at recruitment that either beef or pork would be consumed as part of

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[6] Some TTA products have been developed by private companies in the United States. For example, Farmland Industries has developed TTA products. The fact that a large firm like Farmland is developing TTA products provides additional evidence that TTA systems and products are becoming more important in the United States and should be studied.

[7] This relates to the transparency or knowledge of the processes used to produce red meat.

the free lunch. Each experimental group consisted of 13-14 individuals on average. Eight total experiments were conducted, four experiments using ham sandwiches and four using roast beef sandwiches. Experimental groups were recruited for the ham and beef experiments such that students were one experimental group, faculty were a group, professional staff (e.g., accountants, administrative personnel, etc) another group, and classified staff (e.g., maintenance workers, buildings and grounds keepers, etc.) as the fourth distinct demographic group. We chose to conduct experiments in groups of similar individuals for two reasons. First, it is often the case that individuals of similar socio-demographic populations shop in similar locations, and so this approach may help engage subjects in the auction process to the largest extent possible.[10] Secondly, *ex poste* controls for the experimental group can help uncover the potential importance of consumer demographics in estimating the market potential for traceable food products.

Once the experimental subjects arrived, they were seated with the free lunch in front of them, given the $15 cash up front, and told to await instruction before unwrapping the lunch sandwich. Subjects had hardcopy instructions of the experiment, the instructions were also explained orally, and all clarification questions were answered prior to commencement of the experiment. The auction format was such that subjects would place a bid to upgrade their existing sandwich to one of the four auction sandwiches, and the auction rules were those of a (theoretically demand-revealing) second-price sealed-bid auction.[11] There were no differences in appearance of any of the sandwiches, which were visually inspected by each subject prior to bidding. The instructions clearly explained the different verifiable meat attributes in each

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[8] This relates to the assurance part of TTA since actual tests and guarantees are made.
[9] This is the traceability portion of TTA.
[10] Subject engagement in the auction was one reason behind the use of the random n^{th}-price auction in Shogren et al. (2001).
[11] Shogren et al (1994a) examine second-price, random n^{th} price, and combinatorial auction rules and find that average bids in such food auction experiments are insensitive to the auction format.

auction sandwich (see the Appendix for the text of the instructions).[12] Unlike the auctions in Shogren et al (1994b), subject bids are not truncated at zero, although we expect that individuals would place positive value on the attributes we study in this article.[13]

Bids from each subject were taken in turn for each auction sandwich, and this constituted one round of the auction. Ten total rounds were conducted to allow for bid stabilization (see Hayes et al (1995), and Shogren et al (1994b)), and market price information (i.e., the second highest bid) for each sandwich was presented prior to eliciting the next round's bid for that sandwich. Subjects were aware that a random draw at the end of the 10th round would determine which of the four simultaneous auctions would be binding—no subject would end up consuming more than one sandwich in the experiment.[14] A second random draw determined which of the 10 rounds would be binding. Subjects were therefore fully aware prior to starting the first auction round that there was a uniform chance that any round for any auction sandwich might be the binding auction, and the subjects reported no confusion over the understanding of these procedures. After this second random draw, the appropriate auction was consummated by the winning subject paying the second highest bid amount to exchange his/her original sandwich for the auction sandwich. Note that only one auction winner per experimental group consumes an auction sandwich. All subjects were then allowed/required to consume their sandwiches prior to leaving the experiment with their experiment cash.

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[12] The experiments involved no deceit as the auction sandwiches were truly and verifiably different in the meat they contained. Imported ham from Denmark was used for the traceable (and related characteristics) ham, and one of the Utah State University farms was used to trace the roast beef (as well as to conduct extra safety tests and verify humane animal treatment).

[13] While it is highly unlikely that negative bid possibilities would significantly affect the average willingness-to-pay data for items generally viewed as upgrades from a baseline product, this is not to say that negative bids might be much more likely for other food attributes that are not necessarily considered "goods" (e.g., radiated meat). In our experiments, only a small minority of the subjects every submitted negative bids, and these subjects often did this only in the early auction rounds—these rounds are not included in the Table 1 analysis of the data.

Results

The main results of average bid behavior for beef and pork are highlighted in Figures 1 and 2, respectively. While the magnitudes of the average bids are important, our main discussion will involve comparisons of bids for different attributes of the same type of meat and for the same attribute for different types of meat. As do Hayes et al (1995), we consider the magnitudes of the average bids more as an upper bound on bids due to the nature of the one-day experiment. Nonetheless, it is apparent that the average subject is willing to pay nontrivial amounts of money to upgrade the meat in a sandwich valued at approximately $3.00. Average willingness to pay (averaged across all subjects and all rounds) to upgrade the roast beef sandwich is $0.23 to add basic traceability, $0.50 to add assurances on animal treatment, $0.63 to add extra assurances of food safety, and $1.06 to upgrade the sandwich to one in which the roast beef contains all three upgrades. For pork, the same respective upgrades were valued on average at $0.50, $0.53, $0.59, and $1.14.

From Figure 1 we see that, while traceability for beef products itself may be valued, consumers place an even larger value on specific attributes that might be verifiable within a traceable meat system. Bids for beef traceability are statistically significantly lower than bids for animal treatment assurances and bids for increased food safety ($p<.01$ for the two-tailed nonparametric Mann-Whitney U-test of means using average bids in each round as the observation of interest).[15] Similarly, among the specific attributes of food safety and animal treatment, bids for food safety are higher than those for animal treatment ($p<.05$). Subjects are

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[14] While some may find elicitation of bids on four products at once cumbersome and/or confusing for the subjects, Melton et al. elicit simultaneous bids on eight different pork chops after noting that consumers regularly evaluate from six to eight packages of a particular cut of meat on display at once.

[15] The Mann-Whitney nonparametric test of means places no distribution assumptions on the subject bids, although it does assume that average subject bids are independent across rounds for each sandwich auction. The basic results are, however, consistent with the parametric regression results shown in Table 1 in which we use each subject's average bid *across* the final five auction rounds as the dependent variable.

also willing to pay significantly more for beef that combines all three of these meat attributes in a single product ($p<.01$ for each comparison), although the average bid for the "everything" sandwich is less than the sum of the bids for individual meat attributes. That is, subjects display a decreasing marginal willingness-to-pay for additional attributes. Similar results are to be found by analyzing market price data, which is descriptive of the subjects' highest willingness-to-pay for comparative valuations of the food attributes.

Figure 2 shows the comparable aggregate bidding data for the ham sandwich upgrade. The bid data for each auction sandwich are not as neatly ordered for ham as they are for beef, but subjects are still willing to pay significantly more for food safety than for animal treatment assurances ($p<.10$ for the two-tailed test) or basic traceability ($p<.05$). We find no significant difference, however, in the average willingness-to-pay for animal treatment assurances and basic traceability for ham ($p>.10$). As before, subjects are willing to pay significantly more for all attributes together in the sandwich meat ($p<.01$ for each comparison), but the average bid for the "everything" sandwich upgrade is less than the sum of the individual meat attributes. Interestingly, similar analysis of the market price data for the ham experiments show that the market price for the animal treatment upgrade is significantly higher than the market price for basic traceability ($p<.01$). These results are due to some outlier subjects' high willingness to pay for basic traceability in ham, which generates high market prices but is tempered more in the overall average bid data.

In comparing average willingness to pay for a meat attribute in beef and pork, there is no significant difference in subjects' average bids for animal treatment in beef versus pork ($p>.10$ for the two-tailed Mann-Whitney test) and food safety in beef versus pork ($p>.10$). However, subjects are willing to pay significantly more for basic traceability in pork than in beef ($p<.01$),

which contributes to a higher average bid for a ham sandwich with all three attributes than a roast beef sandwich with all three attributes ($p<.10$). Figures 3 and 4 show the average bid frequencies for beef and ham, respectively. While the average subject is willing to pay significant amounts of money for meat with these attributes, Figures 3 and 4 highlight that a significant number of subjects—anywhere from 15% (food safety) to 55% (basic traceability) in beef and from 21% (food safety) to 40% (basic traceability) in pork—place a zero value on some of the individual food attributes. As such, the conditional mean willingness-to-pay for these quality attributes in meat is even higher for the relevant segment of the market that positively values these attributes. The parametric regression results reported next will help highlight whether the positive willingness-to-pay of certain consumers is general across the demographic groups we used as experiment subjects or specific to one or more demographic group.

Table 1 reports the results of a basic treatment effects regression on average bids for ham and beef attributes. The dependent variable in each case is the average bid from the final 5 rounds of each auction so that our analysis focuses on behavior after subject bids stabilize in the auctions. The regression results include group-specific controls, and each group represents a different demographic market type. The results demonstrate that specific demographic characteristics affect the bids for both beef and ham. Students and faculty made significantly lower bids for ham than professional staff while classified employees bid higher for ham than professional staff. For beef, each of the other three demographic groups placed higher average bids than the classified employees group (Table 1). These results, which are attributed to differences in meat preferences, could be a function of educational differences. Education (students and faculty) probably affects the level of awareness of issues related to TTA such as *BSE*, a potential problem with beef, resulting in a these two groups placing a premium on

enhanced beef characteristics relative to enhanced pork characteristics. It is also possible that students and faculty having lower average bids for ham but higher average bids for beef could be expressing a different characteristic(s) not directly controlled in the specific-cohort design of the experiments.[16] Also, the range of demographic group effects on average bid prices is narrower for beef than for pork in Table 1, implying that a specific demographic groups is a more important determinant of bidding differences for TTA pork than beef. In either case, this suggests that significant demographic effects exist, which implies that marketing strategies for TTA characteristics should perhaps not be uniform across meat types.

Subjects in the ham sandwich experiment would pay the same additional amount for the three sandwiches with individual characteristics (Sandwich 1, 2, or 3) but would pay significantly more for a sandwich with the combined characteristics (Sandwich 4) than they would for a sandwich with only traceability (see Table 1 and Figure 2). Conversely, subjects in the roast beef sandwich experiment would pay more for animal welfare (Sandwich 1), food safety (Sandwich 2), and the combined characteristics (Sandwich 4) than for traceability alone (Sandwich 3) (Table 1 and Figure 1). This suggests perhaps a higher degree of concern about the procedures used to produce and process beef than ham. One could surmise this result from more highly publicized food scares in recent years being related to beef than to pork.

Discussion

Our results suggest that many consumers would be willing to pay for TTA characteristics in red meat products. Average bids for each individual TTA characteristic as well as the

[16] While the average bids of students, faculty, and professional staff were statistically above those of classified employees for beef, the premium above classified employees is statistically equal for the three groups (i.e., a test of the restriction for the parameter estimates for students=faculty=professional staff could not be rejected (p>10%)).

combined characteristics were found to be significant and positive. The potential market segments for TTA red meat products appear to be large, which suggests that a significant marketing opportunity might be exploited if red meat producers developed TTA products. These results imply that U. S. consumers would be willing to pay for TTA characteristics in red meat products meeting the criterion suggested by Wiemers for considering the implementation of these systems.

The implementation of some sort of TTA system for red meat in the United States seems inevitable as our trading partners and competitors move rapidly to develop such systems. While possible TTA systems in the U.S. are being examined, and in some cases implemented, the USDA and producer groups in the U.S. have sought evidence that TTA systems would produce a net benefit to the industry.

Consumers in non-hypothetical auction experiments seem to value specific TTA attributes or combinations of attributes more than just traceability or identity preservation in beef and pork. This implies that a system of meat traceability alone may not be valued enough to justify its creation. Systems that provide traceability can, however, provide additional information on TTA characteristic(s) that consumers do value. The characteristic most valued by consumers in our experiments was food safety, and so safety guarantees are likely an important component of any profitable TTA system.

We also find some distinct results for beef and pork. Specifically, consumers seems more willing to pay *additional* money for knowledge about animal treatment and additional food safety assurances in beef than in pork—this is in addition to what consumers are willing to pay for meat traceability information alone. Therefore, markets for specific and distinct TTA guarantees may be worth exploring in beef. Consumers are still willing to pay for TTA

characteristics in pork, but we find less evidence for a difference in WTP for food safety and animal treatment guarantees versus traceability than in beef. There is also evidence that a consumer's demographics are less a determinant of WTP for TTA beef than TTA pork. This has important implications for any marketing strategy for TTA meat products since TTA pork may have to be targeted to more specific consumer demographic groups than TTA beef, which may be a broader potential market.

Our results need to be confirmed by field trials and also do not answer the question of how TTA systems would affect the cost structure for producing and processing red meat. Nonetheless, our findings offer enough evidence to justify continued examination and determination of the most effective ways for implementing TTA in the U.S. red meat system.

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Table 1. Regression Results for Ham and Roast Beef Depicting Differences in Bids Different Panels and Sandwich Types.[a]

Item/Independent Variable	Ham (bid)	Beef (bid)
Observations	212	220
Adjusted R^2	0.4603	0.2392
Intercept	0.943	-0.017
	(0.140)**	(0.097)
Demographic Type:[b]		
Students	-1.084	0.296
	(0.154)**	(0.105)**
Faculty	-1.074	0.230
	(0.148)**	(0.103)*
Professional Staff	0.485	0.345
	(0.150)**	(0.103)**
Meat Characteristic(s):[c]		
Sandwich 1 (Animal Treatment)	0.038	0.265
	((0.152)	(0.104)*
Sandwich 2 (Food Safety)	0.127	0.375
	(0.152)	(0.104)**
Sandwich 4 (Combined Characteristics)	0.676	0.802
	(0.152)**	(0.104)**

[a] Standard errors are in parentheses.
[b] Base is professional staff.
[c] Base is Sandwich 3 (traceability).
* Significantly different than zero at the 5% level.
** Significantly different than zero at the 1% level.

FIGURE 1

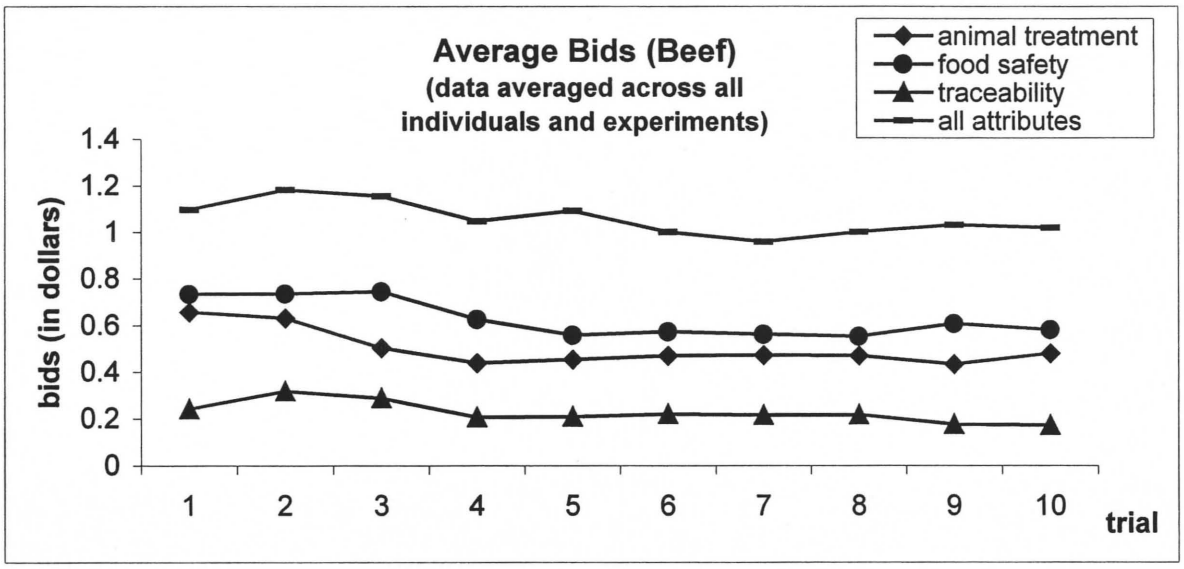


FIGURE 2

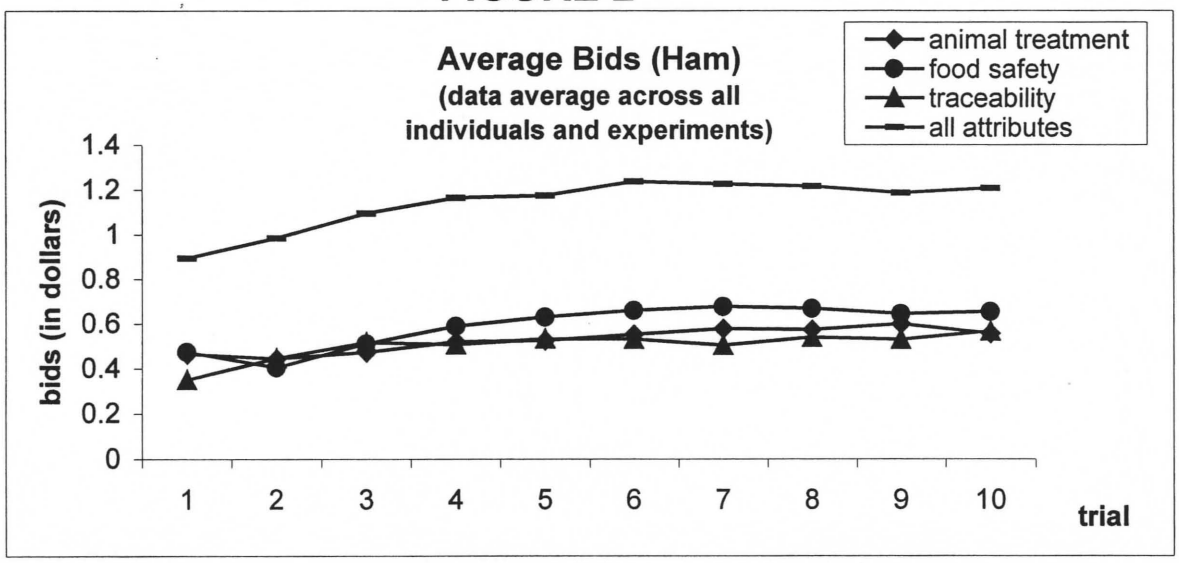


FIGURE 3

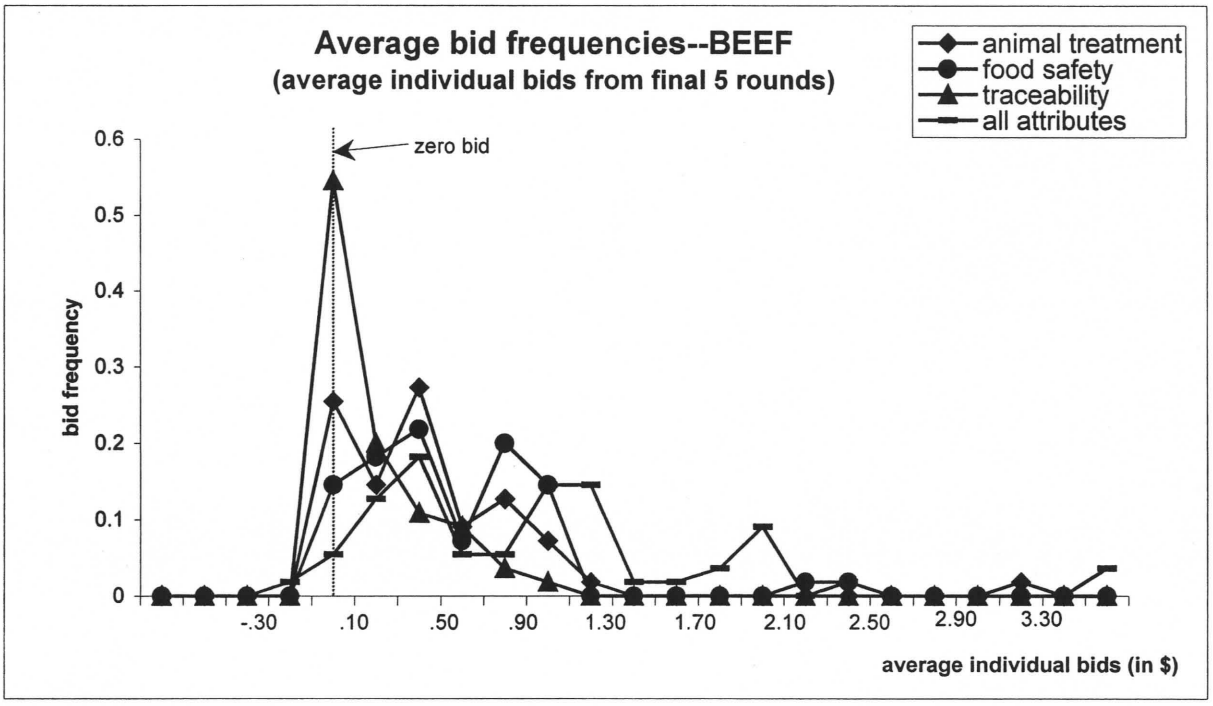
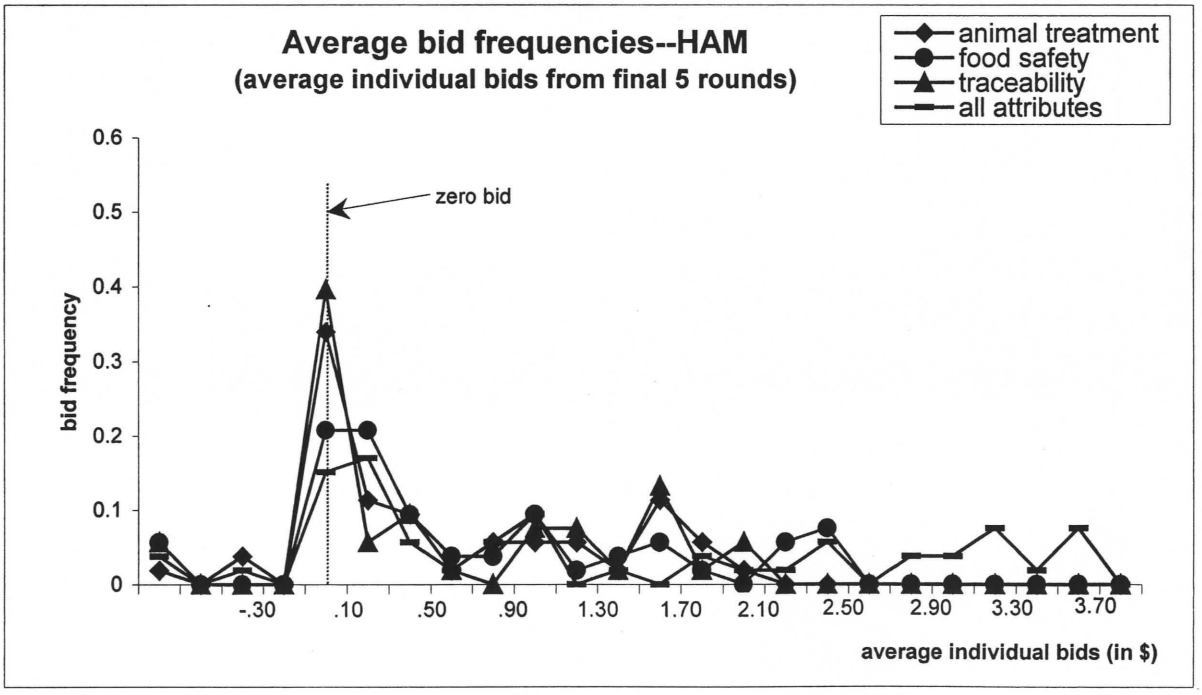


FIGURE 4



APPENDIX: Subject Instructions
(Given verbally to entire experimental group, as well as being provided in written form)
Distinctions in beef and pork instructions are noted for brevity

INSTRUCTIONS

Today you are participating in a decision-making experiment. Please read and follow the instructions carefully, and do not hesitate in asking any questions that you might have about the procedures in today's experiment.

You will be asked to decide how much you would be willing to pay for meat with certain characteristics. These characteristics include (1) whether or not **information is available on the processes and procedures** used to produce the animal that provided the meat (e.g., humane treatment of animals guaranteed, no growth hormones used, etc), (2) whether or not the meat can be **traced back to the original farm** the animal came from, and (3) whether or not the meat has **a higher than average level of consumption safety**. We can truthfully verify all of the characteristics of the meat products that will be described to you today, and no deceit is being used in claiming that the products possess the specified characteristics.

You will begin this experiment with $15 of starting income and a simple lunch, which includes a drink, a snack, and a sandwich made with meat. There are also 4 "distinct" sandwiches on the auction tables of this experiment. Your instructions contain a description of the distinguishing characteristics of the meat in each of these sandwiches. We will refer to these sandwiches as sandwich #1, #2, #3, and #4, and they are numbered this way on the auction tables. You currently *own* the lunch (including the sandwich) and the $15 of starting income given to you. You will soon have the opportunity to bid on exchanging your current meat sandwich with any one of the 4 distinct sandwiches. At the end of this experiment you will either eat your current meat sandwich, or you will eat one of the distinct sandwiches. You will not own or eat more than one sandwich at the end of the experiment. Your take-home income will be the $15 minus the value of anything purchased in the experiment, and you **must eat your experiment lunch before you can leave today with your take-home income.**

When deciding upon your willingness to pay for certain distinct food characteristics, you will be asked to record your monetary bid on a "bid sheet". Your instruction packet includes bid sheets (that can be torn out) for each distinct sandwich. You are not allowed to communicate *in any way or* to share your bids with other participants in this experiment. Bids are private information, and you should not attempt to discover the bids of any of the other participants in the experiment.

Sandwich bidding

Bidding in this experiment involves determining how much you would be willing to pay to trade your current sandwich with each distinct sandwich. Ultimately, a sandwich will be auctioned off to the highest bidder, but the high bidder will only have to pay the amount of *the second highest* bid to exchange his/her current sandwich for the distinct sandwich. As such the second highest bid would be considered the "market price" for the distinct sandwich. You will have to make these bid decisions for each of sandwiches #1, #2, #3, and #4, and bidding will occur in 10 separate trials. Bids can be in increments as small as one cent. At the end of each bidding trial, the reigning market price (i.e., the second highest bid) of each sandwich will be announced, and the next trial of bidding will commence. **Only one** of the trials of bidding will be binding, and the binding trial will be determined by a random draw (each trial has an equal change of being the binding trial). Also, **only one** of the sandwiches will actually be auctioned off to the highest bidder at the end of the experiment. The actual sandwich to be

auctioned off will be *randomly* determined at the end of the bidding *after* the binding trial has been chosen (and there is an equal chance that any one of the sandwiches will be the one actually auctioned off).

When you write your bid for a given sandwich on the bid sheet, your bid should be the **highest** amount that you would be willing to pay to exchange your current sandwich with the distinct sandwich. Please do **not** state the *total* amount that you would pay for each distinct sandwich, but rather the amount that you would be willing to pay to exchange your current sandwich for the distinct sandwich. For example, if you are, at most, willing to pay $Y for your current sandwich (had it not been given to you) and, at most, $X for the distinct sandwich #1, then the difference $X-$Y indicates your maximum willingness to pay to exchange your current sandwich with sandwich #1. Your bid for sandwich #1 should then be the amount $X-$Y. If you prefer a given distinct sandwich over your current sandwich, than your bid for that distinct sandwich should be a positive amount. However, if you would actually prefer your current sandwich, then $X-$Y would be negative. Negative bids are allowed, but keep in mind that you would only bid a negative amount if your maximum willingness to pay for your current sandwich (were it not given to you) were actually *higher* than your maximum willingness to pay for the distinct sandwich. If you are indifferent between your current sandwich and a particular distinct sandwich, then your bid for that distinct sandwich should be $0.00. Remember, only one of the bidding trials will be binding and only one of the distinct sandwiches will actually be auctioned off, and your bids do not effect which trial is chosen as the binding trial or which sandwich is auctioned off (it is just randomly chosen). *You should therefore treat each trial of bidding as the potentially binding trial and each distinct sandwich as if it were the one actually being auctioned off in terms of deciding your bid for each sandwich.*

In each bidding trial, once all participants have placed their bids for each sandwich (#1, #2, #3, and #4), the reigning market price for each sandwich will be announced before beginning the next bidding trial. Once the last bidding trial is completed, we will randomly choose one of trials as binding, and then we will randomly choose one of the sandwiches to auction based on the bids from that binding trial. For the chosen auction sandwich, we will review each of the participant bids, and the winner bidder and market price (the second highest bid) will be announced. Remember, the individual who bid the *highest* amount for the auction sandwich will receive that sandwich, but he/she will pay *the second highest* bid. For example, if the highest bid for the auction sandwich was $H, and the second highest bid was $T, then the individual who bid $H must exchange his/her current sandwich for the auction sandwich, but he/she would pay $T for the exchange. That individual would then take home $15-$T dollars at the end of the experiment (after eating the auction sandwich lunch). All other individuals would take home $15 at the end of the experiment (after eating the original sandwich lunch).

Please continue on the next page for a description of the verifiable information that we have on each of the auction sandwiches

The following brief descriptions of Sandwiches #1, #2, #3, and #4 highlight the ***verifiable*** characteristics of the meat in that sandwich. **Such characteristics have not been certified and cannot be verified for the meat in your current sandwich.**

After reading the description of each of these sandwiches, please place your bid for trial #1 for that sandwich on the bid sheet for trial #1. Please make sure the your bid for sandwich #1 is placed on the bid sheet for sandwich #1, your bid for sandwich #2 is placed on the bid sheet for sandwich #2, etc. When completed, you can tear off each bid sheet, fold it in half, and place it in the bid box next to that sandwich on the auction table. Once everyone had done this, we will document the bids, announce the reigning market price for each sandwich, and continue on to the next trial of bidding. Once the final trial is completed, we will randomly select one of the trials to be binding, and then we will randomly select a sandwich to be auctioned off using the bids from that trial. Again, **please ask before you place your bid** if you have any questions.

Sandwich #1

Certified information is available on certain *enhanced* processes and procedures used to produce the animal that provided the meat in this sandwich, and this is over and above what one would know from typical USDA plant inspections (e.g., this meat product has assurances of extra measures taken to ensure humane animal treatment and absence of growth hormones)

Sandwich #2

Pork: It has been certified that salmonella was not present in the animal (at the farm) that provided the meat in this sandwich.

Beef: It has been certified that *e coli* was not present in the animal (at the farm) that provided the meat in this sandwich.

Sandwich #3

Pork: The meat in this sandwich can be traced back to the farm on which the animal was produced (i.e., we can identify the exact farm that produced the animal).

Beef: The meat in this sandwich can be traced back to the exact animal on the specific farm on which the animal was produced (i.e., we know exactly what animal this meat product came from).

Sandwich #4

(appropriate pork and beef distinctions made)

The meat in this sandwich can be traced back to the farm on which the animal was produced (i.e., we can identify the exact farm that produced the animal). **In addition**: (1) Certified information is available on certain *enhanced* processes and procedures used to produce the animal that provided the meat in this sandwich (e.g., this meat product has assurances of extra measures taken to ensure humane animal treatment and absence or growth hormones); and (2) it has been certified that salmonella was not present in the animal that provided the meat in this sandwich.

ALL STATEMENTS IN THE ABOVE DESCRIPTIONS ARE 100% TRUTHFUL

Meat traceability: Are U.S. consumers willing to pay for it?

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"There are huge gaps from the farm to the processing plants. No one knows where the cows are coming from. . . Trace forward from the processing plant is supposed to be accurate, but no one knows for sure." – Caroline Smith DeWaal, Food Safety Director for the Center for Science in the Public Interest

ABSTRACT

This article reports the results from a series of laboratory auction markets in which consumers bid on meat characteristics. The characteristics examined include meat traceability (i.e., the ability to trace the retail meat back to the farm or animal or origin), transparency (e.g., knowing that the meat was produced without growth hormones, or knowing the animal was humanely treated), and extra assurances (e.g., extra meat safety assurances). This laboratory study provides non-hypothetical bid data on U. S. consumer preferences for traceability, transparency, and assurances (TTA) in red meat at a time when the U.S. currently lags other countries in development of TTA meat systems. Our results suggest that U.S. consumers would be willing to pay for such TTA meat characteristics, and the magnitude of the consumer bids suggest a likely profitable market for development of U.S. TTA systems.

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Introduction

Recent research suggests the U.S. red meat system is falling behind many of its major competitors and trading partners in terms of traceability, transparency, and other quality assurances (TTA) (Liddell and Bailey (2001)). In fact, the U.S. pork system ranks last, according to Liddell and Bailey, when compared against the United Kingdom (UK), Denmark, Canada, Japan, and Australia/New Zealand for TTA. Traceability is sometimes called identity preservation and is defined in Liddell and Bailey as the ability to track the inputs used to make food products backward to their source at different levels of the marketing chain. Transparency refers to the public availability of information on all of the rules, procedures, and practices used to produce a food product at each level of the marketing chain (Baines and Davies (1998); Early (1998)).[1]

Quality assurance has three key elements including managing hygiene to ensure food safety, ensuring quality through grading and other measurements, and providing mechanisms for product recalls (Early (1998); Baines (2001)). For example, the processes for ensuring hygiene in the European Union (EU) red-meat system has focused on Hazard Analysis Critical Control Point (HACCP) systems[2] at each point in the pork value chain beginning at the farm level.

Ensuring quality in red-meat system includes measurements of the intrinsic quality of a carcass or product (tenderness, back fat, curing, etc.). Intrinsic quality measurements are common to most government grading systems including the United States, its trading partners, and competitors. However, the EU system also provides measures of the extrinsic qualities of red meat. Extrinsic qualities do not affect either food safety or the intrinsic qualities of the meat

[1] Transparency requires published procedures that are publicly available and can be influenced by input from stakeholder groups (Liddell and Bailey (2001)).

product but may still affect the value of the product. Extrinsic qualities could include assurances about animal welfare, environmental preservation, or other inputs or absence of inputs used to produce the meat product[3] (Liddell and Bailey (2001); Baines (2001)).

TTA evolved initially in response to the perceived regulatory failure of European Union (EU) governments to provide adequate information to consumers during the EU *BSE* (*bovine spongiform encephalopathy*)[4] crisis (Baines and Davies (1998)). As a result the EU has developed systems that enhance the credence nature of attributes such as animal welfare and even food safety issues such as *BSE* by filling the perceived information void inherent in standard government grading practices with TTA.

This article presents initial evidence on U.S. consumers willingness to pay (WTP) for TTA characteristics in beef and pork. We report the results from a series of controlled laboratory experiments in which consumers bid in a (theoretically) demand-revealing auction on meat sandwich upgrades. These WTP auctions, utilized first in Shogren et al (1994b), generate non-hypothetical data on consumer valuation of TTA attributes in meat and are a first step towards identifying the potential U.S. market(s) for meat produced through a TTA system. We find that consumers are willing to pay significant amounts of money to upgrade a sandwich to an otherwise identical sandwich containing TTA attribute(s) meat. Furthermore, our results suggest that the market for TTA beef may be broader than the market for TTA pork, as auction market

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[2] Codex standards emphasize hygiene and fit well into the HACCP approach for ensuring food safety. ISO 9000 standards are private labeling schemes that certify practices and procedures for a wide range of products. Capmany et al. (2000) indicate that the United States is also lagging other countries in the adopting ISO 9000 standards.

[3] An example would be the assuring the absence of genetically modified organisms (GMOs) in a product. TTA is different than typical quality assurances and standardization in its scope (tracing throughout the market chain) and it focus (certifies more than just food safety). For example, Codex standards emphasize hygiene. ISO 9000 standard are private labeling schemes that certify practices and procedures for a wide range of products. TTA could serve as a basis for ISO certification if private companies decided these types of certifications were desirable. Capmany et a. (2000) indicate that the United States is also lagging other countries in the adoption of ISO 9000 standards.

[4] Also known as "mad-cow" disease.