

**QUANTITY DISCOUNTS AND WILLINGNESS TO PAY FOR ORGANIC PRODUCTS:
EVIDENCE FROM MULTI-UNIT AUCTIONS**

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ABSTRACT:

In this paper we used multi-unit Vickrey and uniform-price auctions to measure consumers' willingness to pay for organic potato chips.

Faical – maybe we should just focus this paper purely on the WTP estimates and the issue of the whether quantity discount strategies would be a warranted marketing strategy. So review the organic WTP studies and quantity discount literature – my guess is that no one has evaluated the issue of quantity discounts in organic food marketing. This will be the contribution of our study. No need to mention/focus on

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which auction mechanism is better. You can even just use the Vickrey multi-unit auction results and exclude the uniform price auction mechanism in this paper. If you can then estimate a market demand curve, then you can also perhaps add some welfare analysis section – which would be a good addition to this paper....

Also we found that consumer's willingness to pay is decreasing in the number of units and that the price of conventional food and positive attitudes toward organic food significantly affect consumers' valuation for organic chips.

WILLINGNESS TO PAY FOR ORGANIC PRODUCTS: EVIDENCE FROM MULTI-UNIT AND UNIFORM-PRICE AUCTIONS

1. INTRODUCTION

The estimation of consumers' willingness to pay (WTP) for various food products has generated an extensive literature. In general, three alternative methods have been used: hedonic prices, contingent valuation, and conjoint analysis or choice experiments. The first method values the attributes of a good in terms of consumers' revealed preferences, while the last two methods are generally based on stated preferences and involve asking subjects to hypothetically evaluate products or rate and choosing between competing alternatives. When using these methods researchers suppose that subjects report truthfully their WTP since they believe that their responses have not practical repercussions. However, this assumption has not received support in both theoretical and empirical literature. In fact, subjects have not any incentive to spend a cognitive effort to evaluate the product as they use to do in real market situations. Also, the assumption of truthfully behaving is neglected when the subject

believes that his/her value will be used to formulate business strategies or public policies and consequently s/he behaves strategically in an attempt to influence the price or the quality of the product. In both situations subject's values are biased and the implementation of alternative experimental methods, such as experimental auctions, that allows researcher to impose costs on subjects who deviate from their true valuations, is necessary.

Faical – instead of the paragraph above, start with a discussion of the market for organic foods, the increasing market for organics and potato chips market, and our objective of finding out consumers' valuation of organic potato chips. Then perhaps discuss why we are using multi-unit auctions – because we want to examine the issue of quantity discounts as a marketing strategy.

During the last decade, the use of experimental auctions has gained recognition among agricultural economists as a tool for valuation of private and public goods. The auctions are defined as a market institution for determining prices and assigning goods. Auctions have a set of rules that determine, according to the bids presented by the participating bidders, the winner of the auctioned good and the price to be paid (McAfee and McMillan, 1987). Experimental auctions try to simulate a real market situation in which the consumer makes the decision to buy, thus offering to participants real products and allowing for exchange of real money. In this way, the auction participant can incur real costs if he or she deviates from their equilibrium strategy. The experimental auctions: 1) permit the control of possible deviations from true values and strategic behavior of participants; 2) allow us to obtain the WTP of each individual, which then enables us to make parametric assumptions regarding the form of the

demand curves of the market; 3) allow us to model directly the determinants of the WTP, as the dependent variable is continuous or truncated; and 4) enable the participant to incorporate the 'feedback' from the experimental auction into his or her bids, just like in the real market (Lee and Hatcher, 2001; Lusk and Hudson, 2004).

Several studies have used experimental auctions to determine consumers' WTP for new food products. A major part of these works was focused on the valuation of food safety attributes (Fox et al., 2002; Dickinson and Bailey, 2002; Shaw et al., 2006) and the acceptability of new food products (Kassardjian et al., 2005; Rousu et al., 2005). Many other works were carried out to contrast methodological aspects of auctions such as the comparison between the WTP and the WTA (Knetch et al., 2001; Shogren et al., 2001), learning effect (List and Shogren, 1999), the endowment effect (Lusk et al., 2004; Corrigan and Rousu, 2006), the optimum mechanism of auctions (Rustrom, 1998; List and Lusing-Reiley, 2000), and the risk preferences (McCeland et al., 1993) etc.

In these studies, participants were asked to report their WTP for a single unit of the auctioned product². However, the use of single-unit auctions to measure consumers' WTP for each unit purchased is appropriate only if we assume that the WTP for all units purchased is the same. Nonetheless, this assumption contradicts economic theory as it predicts a reduction in the WTP of a rational consumer for each additional purchased unit beyond the first one. In practice, a few food producers and retailers take into account this reduction of the WTP and adopt some marketing strategies, such as quantity discount (i.e., an incentive offered by a seller to a buyer for purchasing or ordering greater than usual or normal quantity of food products), to fit consumer preferences. To test this assumption, we use a relatively new method that preserves the advantages of experimental auctions and eliminates the bias of using single-unit auctions in a multi-unit setting. This method, called multi-unit auctions, is

² Also the participant can be asked to report his/her WTP for different products but at the end of the auction only one product is randomly drawn to be sold to the winner.

defined as an auction where multiple identical units are auctioned and participants are asked to report their WTP for each unit.

Among multi-unit auction formats, the most common mechanisms used in the empirical literature are the uniform-price and the multi-unit Vickrey auctions. The Vickrey auction is a generalization of the single-unit second price auction. In this mechanism, the winner will pay an amount corresponding to the sum of the bids (excluding his or her own bids) that are displaced by his or her successful bids. Since the clearing price is not based on the winner's bid but on the bids of the other participants, bidding truthfully is a dominant strategy in the Vickrey auction (Engelbrecht-Wiggans et al., 2006). In spite of its demand-revealing property, the Vickrey auction, however, is not popularly used in real auctions due to the complexity of its pricing rule. In contrast, the uniform-price auction mechanism has been used frequently in Treasury bill and Federal Communications Commission (FCC) auctions due to its straightforward implementation and, therefore, understandable pricing rule. All winners pay the same price which is equal to the highest rejected bid (Krishna, 2002). Ausubel and Cramton (2002) also mentioned other attractive properties of the uniform-price auction such as its fair outcome given that all winners pay the same price. It also greatly widens the market since its pricing rule favors small bidders increasing their probability to become winners. Nevertheless, recent theoretical work (Engelbrecht-Wiggans and Kahn (1998) and Ausubel and Cramton (2002)) has demonstrated that uniform price auction entails a potential problem commonly called "demand reduction". In fact, since one of the participant's bids can determine the clearing price (i.e., he or she has to pay for infra-marginal units), the bidder has an incentive to bid less than their values for all units except for the first one, which reduces the seller's revenue and induces economic inefficiencies (Kagel and Levin, 2001). Therefore, in addition to analyzing the factors affecting the consumers' WTP for multiple units of an organic product, another

contribution of our paper is to compare in an empirical setting consumers' bidding behavior in the multi-unit Vickrey and the uniform-price auctions.

The paper has been structured into four sections. In the next section we describe our experimental design. In the third section, results from both the survey and the experimental auction are presented. In section 4, we draw some concluding remarks

2. EXPERIMENTAL DESIGN

We designed an experiment to analyze the main determinants of consumers' WTP for organic products using multi-unit auctions and to evaluate the theoretical assumption of demand reduction, which is the reduction of the participant's WTP when s/he decides to purchase multiple units of the same product. The auctioned products were 40g packages of organic potatoes chips. The experiment took place in June 2008. 160 undergraduate students were recruited and were randomly assigned, equally, to four treatments. The use of a student sample was motivated by two reasons: 1) students are one of the most important potential consumer segments of potato chips packaged in small packets (40g) as they are basically sold in self-service machines that are generally located in universities (e.g., in our study 100% of participants declared to be at least occasional consumer of potato chips); and 2) studies by Dyer et al. (1989); Potters and van Winden (1996); Garratt et al. (2004); Lusk et al. (2005); and Depositario et al. (2009) showed no significant difference in subjects' behaviour between studies employing student samples and those using more representative samples. Table 1 shows the socio-demographic and economic characteristics of the 160 participants in the experiment. About 46.4% of the subjects are regular consumers of chips and 13.1% are occasional consumers of organic chips. 51.9% of the sample are at least occasional purchasers of organic products. Interestingly, only 5% of the participants knew perfectly the meaning of organic foods.

TABLE1. SAMPLE SOCIO-DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

Variables	Categories	Percentage Sample
Consumption frequency of conventional chips	Regular consumer	46.4
	Occasional consumer	53.8
	No consumer	0.0
Purchase frequency of organic foods	Regular consumer	5.0
	Occasional consumer	46.9
	No consumer	48.1
Consumption frequency of organic chips	Regular consumer	0.0
	Occasional consumer	13.1
	No consumer	86.9
Knowledge level of organic foods	High knowledge	5.0
	Low knowledge	94.4
Gender	Female	39.4
	Male	60.6
Family income	High income	6.0
	Medium income	37.0
	Low income	57.0
Health	Bad	0.0
	Regular	6.5
	Good	93.5
Sport	Doing sports	49.0
	Do not doing sports	51.0

As mentioned earlier, we utilized and compared two auction mechanisms: multi-unit Vickrey auction and uniform-price auction. In both mechanisms, we carried out ten sessions of two bidders and two units (2_2), ten sessions of two bidders and four units (2_4), two sessions of ten bidders and two units (10_2) and two sessions of ten bidders and four units (10_4)³. No subject participated in more than one session. Since we conducted the experiment through five rounds and needed to determine the winner(s) and the price to be paid after each round, we executed the experiment in a computer lab using the z-tree software (Fischbacher, 2007). Programming using the z-tree software allowed us to collect participants' bids and compute all needed information in a relatively short time. Table 1 shows the number of auctions ran during the

³ By varying in the number of bidders and the number of units among treatments we aim to test the sensitivity of the participant' bidding behavior to contrast the effect of varying the number of bidders and units in participants' bidding behavior in both the multi-unit Vickrey and the uniform-price auctions.

experiment. In total, we ran 48 auctions, consisting of 24 uniform-price auctions and 24 Vickrey auctions.

TABLE 2. EXPERIMENTAL TREATMENTS

Treatment	Bidders per auction	Units per auction	Vickrey auction sessions	Uniform price auction sessions	Total subjects
2_2	2	2	10	10	40
2_4	2	4	10	10	40
10_2	10	2	2	2	40
10_4	10	4	2	2	40

Before auctioning the product, participants filled in a questionnaire regarding various aspects related to organic products with the purpose of characterizing the sample and analyzing its main attitudes and purchase habits. This information was used to analyze the major factors that determine their willingness-to-pay for the multiple units of organic chips. The questionnaire was structured in four parts. The first part was intended to capture the purchasing and consumption habits related to potato chips. The second part included various questions intended to capture the participants' degree of knowledge of organic food (measured through 8 statements about the characteristics of the organic food). The third part attempted to obtain information regarding the attitudes that participants had towards organic products (e.g., if they considered organic foods healthy, of higher quality or just a fraud). The fourth part included questions about subjects' socio-demographic characteristics and lifestyles.

We conducted the experiment using a four-step procedure. In step 1, participants were invited to a specific computer lab at a specific day and hour. Each subject sat in a table separated from the rest to minimize any possible interactions and so that each participant would report his or her bid in an anonymous manner. After taking a seat, each participant received an envelope which contained 10 Euros as compensation for their participation, his or her identification number (to be held in secret during the process) and a questionnaire designed to collect information on participants' socio-demographic characteristics.

In step 2, once the questionnaire was completed, the actual experiment began. One of the main determinants of success in experimental auctions is a good understanding by the participants of the operating procedures used in the auction mechanism. To achieve this goal, we gave each participant a printed material that included an explanation of how the specific auction works and some examples to illustrate the auction. The instructions were identical across all treatments except for auction type and number of the bidders and units. After reading and discussing the instructions, participants were given the opportunity to ask questions to dissipate any doubts about the process. Finally, to permit a better understanding of the auction mechanism and a good familiarity with the software, we carried out a training session using an auction of two or four (depending on the treatment) identical packets of the product we used in the auctions (i.e., organic potato chips), informing participants that no actual economic exchange will take place at the end of the training session.

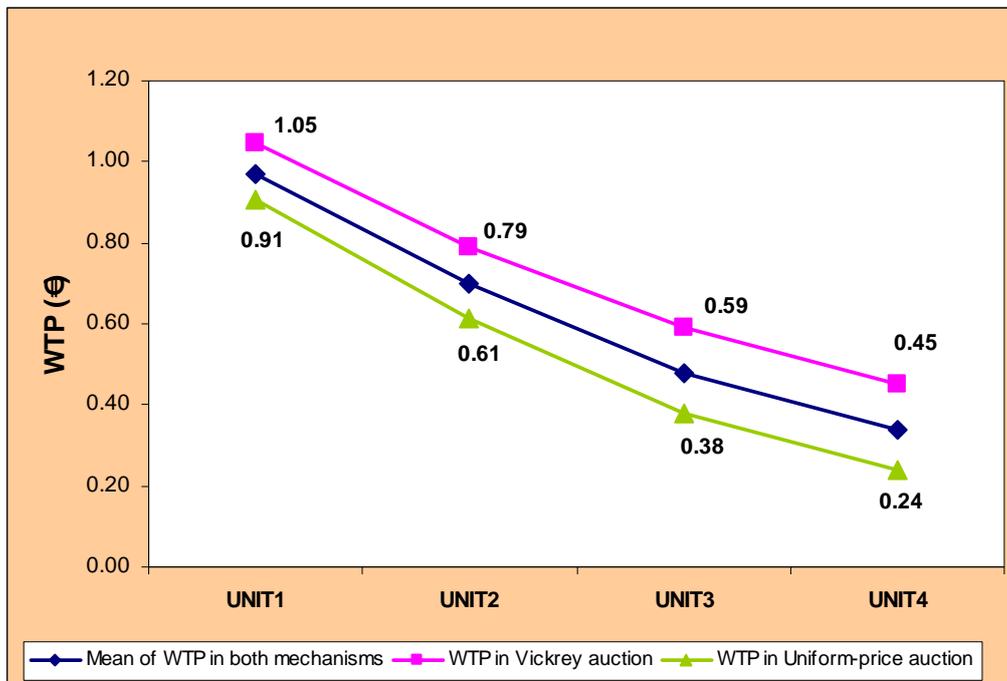
In step 3, and once the participants became familiar with the procedure, the subjects were requested to come close to a table where a few packets of organic potato chips were placed along. Each participant was allowed to visually and manually inspect the auctioned product. Once all participants had finished inspecting the product, the auction began. Each participant had to submit, via the computer, how much he or she was willing-to-pay for each auctioned unit. Once all participants finished to report their bid, the software displayed whether the participant was the winner or not and the price that he/she had to pay for each unit won. The same process was repeated for four additional rounds.

In step 4, the auctioneer closed the auction (after the fifth round) and one binding round was chosen randomly to determine the winner(s). The winner(s) of the binding round was (were) appointed as the winner(s) of the auction. Once the results were announced, the experiment ended by handing the product to the winner(s) who had to pay the corresponding market-clearing price.

3. RESULTS

As mentioned in the introduction, we wish to evaluate the theoretical assumption of a reduction in consumers' WTP in a multiple-unit purchase setting and, therefore, the necessity of adopting the strategy of price discrimination (a lower price for each additional purchased unit) as a marketing tool to better fit consumers' preferences. As predicted by the theory, Figure 1 shows that the mean of participants' WTP for organic potato chips is decreasing as the number of units being auctioned increases in both mechanisms. In fact, the mean WTP taking into account both mechanisms is 0.97€ for the first unit, 0.70€, for the second unit, 0.48€, for the third unit and 0.34€, for the fourth unit. Moreover, differences between average bids of two concrete units (1 vs. 2, 2 vs. 3 and 3 vs. 4) are statistically significant at the 5% level. These results show the importance of encouraging the adoption and the generalization of the strategy of quantity discount by food retailers to better fit consumer's preferences.

FIGURE1. WTP FOR ORGANIC CHIPS



In this study, we are also interested in analyzing the factors affecting consumers' WTP for multiple units of organic potato chips using multi-unit auctions.

We estimated five random effects Tobit models to take into account the panel nature of our data. The dependent variables are: (1) the average WTP for all auctioned units; (2) the WTP for the first auctioned unit [BID1]; (3) the WTP for the second auctioned unit [BID2]; (4) the WTP for the third auctioned unit [BID3]; and (5) the WTP for the fourth auctioned unit [BID4]. Regarding the explanatory variables, Annex1 shows the list of variables used in this study as well as a short description on how they were measured. In order to keep the estimated model as simple and manageable as possible, information on participants' attitudes toward organic food (that were measured through a 9-item Likert scale) has been reduced through a factor analysis (see Annex 2) resulting in 4 factors: 1) positive attitude toward organic foods (GOOD); 2) negative attitudes toward organic foods (WORSE); 3) no differences between conventional and organic foods (NODIFFER); and 4) unavailability of organic foods in shops and supermarkets (UNAVAIL).

TABLE3. RESULTS FROM RANDOM EFFECTS TOBIT MODEL FOR PANEL DATA

VARIABLES	MODEL1 BIDS MEAN	MODEL2 BID1	MODEL3 BID2	MODEL4 BID3	MODEL5 BID4
CONSTANT	.502***	.528***	.299	.852***	.513
AUCTION	-.249***	-.197***	-.259***	-.422***	-.462***
ROUND1	-.053**	-.030	-.034	-.003	-.132***
ROUND2	-.058***	-.013	-.081**	-.063	-.082*
ROUND3	-.053**	-.013	-.073**	-.060	-.135***
ROUND4	-.048**	-.029	-.057*	-.050	-.078*
REGCONS	-.033	-.020	-.009	-.007	-.045
PRICE	.618***	.731***	.596***	-.013	-.045
REGPUROF	-.005	-.025	.000	.264	.277
NOCONSOF	.069	.092	.111	-.098	-.154
HKNOWLEGE	.025	-.135	.025	.109	.137
HIGHINC	-.009	.023	-.011	-.056	.001
GOODHEAL	-.014	-.069	.021	-.124	.147
DOSPORT	.068	.032	.106	.123	.156
GOOD	.066**	.071**	.089**	-.057	-.046
WORSE	.022	.038	.021	.082	.071

NODIFFER	.024	.015	.045	-.031	-.031
UNAVAIL	-.023	.001	-.015	.099	.082
Log likelihood	-10.63	-112.25	-274.18	-144.52	-122.96
Wald chi2	118.95	97.65	65.72	25.72	33.81
Prob > chi2	.00	.00	.00	.10	.01

*** (**) (*) Statistically significant at 1% (5%) (10%) level

Results from the five random effects Tobit models are shown in Table 3. In general, we note that the results from the first, the second and the third model are similar. However, the statistical significance of the variables decreased in models 4 and 5 due the small number of positive value in the bid for the third and fourth units (i.e., 21% of the third-unit bids and 36% of the fourth-unit bids are zero bids). As predicted by Englebrecht-Wiggans and Kahn (1998), we found that consumers' willingness to pay for organic potato chips decreases significantly when we move from the multi-unit Vickrey auction to the uniform-price auction. This finding implies that the frequent use of the uniform-price auction in Treasury bill and FCC auctions may have to be reconsidered due to the dramatic damage that can engender the problem of demand reduction on the sellers outcomes. On the other hand, the use of the multi-unit Vickrey auction to measure consumers' WTP seems to be effective as it has shown insensitivity to the demand reduction issue.

In accordance with other studies, such as Drichoutis et al (2008), we have found that the reference price exercises a significant effect on consumer's WTP. In fact, our results showed that the higher is the price of conventional potato chips (i.e., average price of 40g of conventional potato chips in supermarkets), the higher is the participant's WTP for organic chips. This result is of great interest for food retailers who sell their own brand of organic food. In fact, some big retailers sell their brand of conventional food at a lower price in comparison with other brands of the same product but sell their brand of organic food at a price equal to the price of the other brands sold

in the market. Therefore, since the consumer is sensitive to the reference price, s/he expects that the price of retailers' brand of organic product is lower than private brands of the same product. But if retailers offer similar prices, consumers might think that the retailers' organic product is too expensive and may turn his/her interest to the branded products generally considered to of higher quality.

We also found that the more positive is the consumer's attitude toward organic food, the greater is his/her WTP for organic chips. This finding showed the necessity of multiplying and expanding promotion companies to sensitize a larger number of consumers of organic foods' benefits.

4. CONCLUSION

In this study, we used multi-unit auctions to measure consumers' willingness to pay for organic potato chips. In contrast to single-unit auctions, the multi-unit auctions allowed us to construct the real demand curve of the auctioned product. We used the multi-unit Vickrey auction and the uniform-price auction mechanisms in our experiments. The former is a compatible incentive mechanism but difficult to implement due to its rule complexity. The second mechanism is easy to use but incentives participants to reduce strategically her/his demand for units beyond the first one. To avoid the problem of demand reduction and to take advantage of multi-unit auction's benefits, we recommend the use of the multi-unit Vickrey auction. Nonetheless, Porter and Vargov (2006) showed in an induced value setting that the Vickrey auction is sensitive to participant's overbidding behavior and, therefore, we need carrying out more researches not only to contrast the overbidding in multi-unit Vickrey auction but also to study the effect of other key aspects in experimental auction such the endowment effect and the bid affiliation on subject bidding behavior. Also our results showed that the price of conventional product and consumer's positive

attitude toward organic food are key factors of willingness to pay for organic chips and, therefore, has to be seriously taken into account when laboring marketing strategies for trading organic food.

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ANNEX 1: THE INDEPENDENT VARIABLES USED IN THE ESTIMATION

Independent Variables	Name	Description
Auction	AUCTION	Dummy variable that takes the value 1 in case of the uniform-price auction ; and 0 otherwise
Round 1	ROUND1	Dummy variable that takes the value 1 if the round is the first one; and 0 otherwise
Round 2	ROUND2	Dummy variable that takes the value 1 if the round is the second one; and 0 otherwise
Round 3	ROUND3	Dummy variable that takes the value 1 if the round is the third one; and 0 otherwise
Round 4	ROUND4	Dummy variable that takes the value 1 if the round is the fourth one; and 0 otherwise
Round 5	ROUND5	Dummy variable that takes the value 1 if the round is the fifth one; and 0 otherwise
Consume frequency of chips	REGCONS	Dummy variable that takes the value 1 if the participant is a regular consumer of chips; and 0 otherwise
Price of conventional chip	PRICE	Continuous variable: the price that participant use to pay for a packet of 40g of conventional chips
Purchase frequency of Organic Foods (OF)	REGPUROF	Dummy variable that takes the value 1 if the participant is a regular purchaser of OF; and 0 otherwise
Consume frequency of organic chips	NOCONSOF	Dummy variable that takes the value 1 if the participant is a no consumer of organic chips; and 0 otherwise
Knowledge level of OF	HIGHKNOW	Dummy variable that takes the value 1 if the participant answers correctly to more than 8 out of 8 statements about MG; and 0 otherwise
Income	HIGHINC	Dummy variable that takes the value 1 if the participant's income is more than 2500€/month; and 0 otherwise
Health	GOODHEAL	Dummy variable that takes the value 1 if the participant have a good health; and 0 otherwise
Sport exercises	DOSPORT	Dummy variable that takes the value 1 if the participant does sport exercises regularly; and 0 otherwise
Positive attitudes toward OF	GOOD	Continuous variable. First factor from a factor analysis carried out on a 9-item Likert scale to measure participants' attitudes to organic food.
Negative attitudes toward OF	WORSE	Continuous variable. Second factor from a factor analysis carried out on a 9-item Likert scale to measure participants' attitudes to organic food
No difference between OF and conventional foods	NODIFFER	Continuous variable. Third factor from a factor analysis carried out on a 9-item Likert scale to measure participants' attitudes to organic food
Unavailability of OF	UNAVAIL	Continuous variable. Fourth factor from a factor analysis carried out on a 9-item Likert scale to measure participants' attitudes to organic food

ANNEX 2: RESULTS FROM THE FACTOR ANALYSIS

Variables	Factor 1	Factor 2	Factor 3	Factor 4	Commonalties
Organic foods (OF) are healthy	.835	-.149	.050	-.111	.735
OF have high quality	.813	.137	-.134	-.084	.706
OF are more respectful to the environment	.464	.294	-.480	.249	.594
OF have a bad external aspect	-.030	.656	.233	.362	.616
OF are expensive	.004	.801	-.133	-.205	.701
OF respond to a fashion	-.552	.462	.170	.170	.549
No difference between OF and conventional foods	-.012	-.124	.711	.327	.628
OF are fraud	-.109	.276	.795	-.100	.731
OF are unavailable	-.104	-.024	.042	.880	.788
<i>Eigen value</i>	2.313	1.458	1.226	1.052	
<i>Variance (%)</i>	21.15	16.71	16.57	12.76	
<i>Cumulative variance (%)</i>	21.15	37.86	54.43	67.19	
<i>Kaiser-Meyer-Oklin</i>	.636				
<i>Bartlett's test (significance)</i>	.000				