“Consumers' Willingness to Pay for Animal Welfare Attributes in Dairy Products: Evidence From Experimental Auctions"

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Poster prepared for presentation at the Agricultural & Applied Economics Association 2010 AAEA, CAES, & WAEA Joint Annual Meeting, Denver, Colorado, July 25-27, 2010

Consumers' Willingness to Pay for Animal Welfare Attributes in Dairy Products: Evidence From Experimental Auctions

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Introduction

- Debates about animal welfare in agricultural production have been increasing (Norwood and Lusk, 2009). Animal rights groups advocate for improved animal care. Livestock industry tends to dismiss the arguments as emotional and lacking scientific basis. Numerous publications highlighting the debate between the two sides have surfaced including but not limited to the report by the Pew Commission on Industrial Farm Animal Production (2008) and consequent response from The American Veterinary Medical Association (2009).
- Rollin (2003) as well as FAO (2009) discusses several dimensions of animal welfare in dairy production. Examples are, early separation of calf and mother, heat stress (some farmers provide shade and cooling with sprinklers), ample space, waste removal, flooring that reduces slippage, comfortable bedding, grazing on pasture, etc.
- While political and legislative efforts are ongoing, it is important to understand and reflect the impact of ethical dimensions of production, like consistency of agricultural production practices with "animal welfare" considerations, on consumer demand (Frank, 2006)
- A handful of studies have addressed public perceptions (Lusk and Norwood, 2008) and willingness to pay for improved animal care in agricultural production using hypothetical choice experiments (Liljenstolpe, 2008; Carlsson et al. 2007) .
- To the best of our knowledge there have been no other known published studies which estimate consumer willingness to pay (WTP) for animal welfare attributes in agricultural production using non-hypothetical experimental methods, and there have been no studies on consumer WTP for animal welfare attributes in dairy industry.

Objectives

- Estimate consumers' WTP for dairy products produced using practices consistent with "humane animal care" principles.
- Evaluate difference between two uniform price auction mechanisms (2nd price Vickrey auction and random Nth price Vickrey auction) and Open Ended Choice Experiments (OECE) in a non-hypothetical setting
- Evaluate the effect of information treatment on consumer behavior
- Estimate demand schedule, rather than a conventional WTP for 1 unit of a good, using OECE as well as Uniform Price Auctions
- Evaluate the effect of posted prices on participant behavior under uniform price auctions.
- Examine the effects of having multiple "bidding" rounds on participant behavior

Experimental Design

- All participants (218) were paid $30 for participating
- Participants played for "Humane" Ice Cream, and "Humane" Cheese
- Conventional Ice Cream and Conventional Cheese were available for purchase after each experiment session at the going market prices ($0.25/scoop of ice cream, and $0.5 per cheese unit)
- Non-hypothetical experimental methods were used to elicit consumers' willingness to pay. Specifically, we used Uniform Price Vickrey Auctions (UPVA) and Open Ended Choice Experiments (OECE)
  - **UPVA**: In this mechanism, the participants submit bids for different quantities of the goods in five rounds. On the provided sheet they are asked to write their bids for each amount and submit at the end of each round. Total of five rounds were played in the real auction. Two mechanisms of UVPA that were used in this study are:
    - **2nd price Vickrey Auction** – Highest bidder is declared as the winner and pays the price equal to the second highest bid (List and Shogren, 1999; Knetsch and Tang, 2001; Corrigan and Rousu, 2006)
    - **Random Nth price Vickrey Auction** – Binding price is selected to be the randomly determined Nth highest bid. Top N-1 bidders pay the binding price (Rousu et al. 2004; Shogren et al. 2001)
  - **OECE**: In this mechanism, the participants are presented with several different price combinations and are asked to indicate how many units they would like to purchase at each of these prices. A binding price is selected randomly, and everyone is expected to purchase the amount they indicated for the binding price (Corrigan et al. 2009). One of the five rounds is selected as binding
- In each mechanism the binding product was randomly determined for each round.
- Each mechanism had informed and uninformed treatment groups

Empirical Methods

Following econometric techniques were used:

- UPVA: Tobit for 4th round data; and Random Effects Tobit for panel data
- OECE: Poisson, Negative Binomial, Zero Inflated Poisson, Zero Inflated Negative Binomial, for the 4th round data; and Random Effects Poisson and Random Effects Negative Binomial for the Panel data.

The preferred models for OECE were chosen by using Vuong test, for ZINB vs. NB, and ZIP vs. Poisson, an likelihood ratio test on Alpha=0 for over dispersion for Poisson vs. NB, and ZINB vs. ZIP. The tests results favored ZINB.

Data Description

Variables		2nd Price Vickrey			Nth Price Vickrey			OECE		
		Participants: 79			Participants: 83			Participants: 56		
		Median	Mean	S. D.	Median	Mean	S. D.	Median	Mean	S. D.
Trust Scores		4	3.993671	0.893329	4	3.777108	0.914827	4	3.6375	1.045608
Age		23	27.8481	11.76271	23	29.95181	12.90481	23	27.30357	11.87039
Individual Income*		1	1.78481	1.823429	1	1.759036	1.91649	1.5	1.589286	1.592902
Family Income*		3	4.177215	4.075441	4	4.096386	3.617756	2.5	3.607143	3.148902
Category		**Percentage**								
Gender	Male	43.04%			36.14%			41.07%		
	Female	56.96%			63.86%			58.93%		
Formal Education	Up to high School	3.8%			1.2%			0%		
	Associate Degree/ College	72.15%			72.29%			69.64%		
	Post graduate	24.05%			26.51%			24.05%		
Awareness About animal welfare	No	8.86%			19.28%			41.07%		
	Yes	91.94%			80.72%			58.93%		
Belief on super quality of animal welfare products	Yes	43.04%			40.96%			42.86%		
	No	56.96%			59.04%			57.14%		

* Individual income was reported in intervals: (less than $499), ($500-$999), ($1,000 - $1,999), ($2,000-$2,9999), etc.
**Family income was reported in intervals: (I< $999), ($1,000-$1,999), ($2,000-$2,999), … (9,000-$9,999), ($10,000-$14,999), ($15,000-$19,999),… ($40,000-$49,000), (> $50,000)

Mean and Median WTP (4th Round)

		2nd Price Vickrey				Nth Price Vickrey				OECE	
		2 Price Posted		All Prices Posted		N Prices Posted		All Prices Posted		All Posted	
		Ice Cream	Cheese	Ice Cream	Cheese	Ice Cream	Cheese	Ice Cream	Cheese	Ice Cream	Cheese
Informed Group	Median	0.1	0.25			0.25	0.2			0.25	0.5
	Mean	0.252222	0.34037			0.311724	0.227586			0.484783	0.739583
	S. D.	0.264245	0.292042			0.290813	0.235988			0.438861	0.544135
Uninformed Group	Median	0.225	0.25	0.375	0.275	0.2	0.135	0.2	0.1	0.25	0.75
	Mean	0.323077	0.338846	0.377692	0.360385	0.202308	0.213462	0.3	0.185357	0.766	0.96875
	S. D.	0.416949	0.349277	0.180717	0.249487	0.153449	0.199999	0.278834	0.233928	0.663438	0.777791

Nonparametric Test – P values

		Vickrey		OECE	
	Groups	Ice Cream	Cheese	Ice Cream	Cheese
Wilcoxon Rank-Sum Test*	Male vs. Female	0.2958	0.5607	0.6174	0.0288
	Informed vs. Uninformed	0.1658	0.3727	0.0000	0.0000
	Random Nth Vickrey vs. 2nd price vickrey	0.8061	0.0000		
	All bids posted vs. N bids & 2 bids posted	0.0509	0.0000		

Regression Analysis

	OECE				Vickrey			
	Zero Inflated Negative Binomial Regression Round 4 (N=504)		Random Effects Negative Binomial (N=2520)		Tobit Round 4 (N=810)		Random Effects Tobit (N=4050)	
VARIABLES	**Ice Cream**	**Cheese**	**Ice Cream**	**Cheese**	**Ice Cream**	**Cheese**	**Ice Cream**	**Cheese**
Trust Scores (From 1 to 5)	-0.00357	0.230**	0.0739**	0.188***	0.116***	0.0621*	0.110***	0.0271
	(0.0629)	(0.0952)	(0.0303)	(0.0366)	(0.0317)	(0.0320)	(0.0304)	(0.0291)
Gender (Male=1; Female=0)	-0.155	-0.0529	-0.200***	0.0916	0.00835	0.00131	0.0173	0.0236
	(0.139)	(0.181)	(0.0628)	(0.0770)	(0.0565)	(0.0568)	(0.0542)	(0.0516)
Age	0.0129*	0.0135	-0.00355	-0.000240	-0.00543*	-0.00611*	-0.00444	-0.00464
	(0.00724)	(0.0115)	(0.00396)	(0.00430)	(0.00320)	(0.00319)	(0.00306)	(0.00290)
Education Level (From 1 to 9)	-0.0610	0.198***	0.00858	0.121***	0.0136	0.00951	0.0232	0.0183
	(0.0484)	(0.0598)	(0.0221)	(0.0249)	(0.0235)	(0.0236)	(0.0225)	(0.0215)
Personal Income (Dollars)	0.0775	-0.354***	-0.0332	-0.111***	0.0903***	0.0549**	0.107***	0.0556***
	(0.0654)	(0.100)	(0.0264)	(0.0317)	(0.0223)	(0.0222)	(0.0213)	(0.0202)
Family Income (Dollars)	-0.000732	0.0662**	-0.00663	0.00880	-0.0115	-0.0217***	-0.0106	-0.0236***
	(0.0210)	(0.0273)	(0.0102)	(0.0122)	(0.00720)	(0.00723)	(0.00691)	(0.00659)
Consumption Frequency (1 to 4)	0.226***	0.165	0.184***	0.190***	0.135***	0.226***	0.128***	0.227***
	(0.0800)	(0.116)	(0.0377)	(0.0346)	(0.0311)	(0.0288)	(0.0297)	(0.0258)
Familiarity with Agricultural Production (yes=1, no=0)	0.180**	-0.188	0.0741*	-0.124***	-0.121***	-0.0101	-0.0966***	-0.0635*
	(0.0907)	(0.125)	(0.0406)	(0.0469)	(0.0379)	(0.0393)	(0.0364)	(0.0356)
Quality superiority (yes=1; no=0)	-0.276***	-0.366***	-0.243***	-0.294***	-0.0918***	-0.0717***	-0.0971***	-0.0911***
	(0.0457)	(0.0652)	(0.0209)	(0.0262)	(0.0205)	(0.0206)	(0.0197)	(0.0188)
Time since Last Meal (minutes)	0.0353**	0.0259	0.0354***	-0.00308	-0.0173*	-0.0330***	-0.0233**	-0.0245***
	(0.0174)	(0.0233)	(0.00778)	(0.00992)	(0.00987)	(0.00999)	(0.00945)	(0.00900)
Awareness on Animal Welfare (Aware=1, no =0)	-0.0238	-0.103	0.0199	-0.0264	0.225***	-0.0335	0.203***	0.0699*
	(0.0883)	(0.117)	(0.0391)	(0.0423)	(0.0393)	(0.0400)	(0.0377)	(0.0363)
Animal welfare information treatment (yes=1, no=0)	-0.351***	-0.779***	-0.374***	-0.470***	-0.0549	-0.0611	-0.0562	-0.0659
	(0.128)	(0.186)	(0.0600)	(0.0720)	(0.0640)	(0.0641)	(0.0614)	(0.0584)
Price of Ice Cream ($ /unit)	-0.239	2.717***	-0.346	1.863***				
	(0.723)	(1.024)	(0.337)	(0.443)				
Price of HCH($ /unit)	-1.126**	-3.284***	-1.029***	-2.894***				
	(0.520)	(0.753)	(0.240)	(0.310)				
All posted or not (all=0; two & N posted=1)					0.127	0.224**	0.104	0.170***
					(0.0869)	(0.0880)	(0.0830)	(0.0167)
Random Vickrey Auction or not (Random N=1; Two Prices=0)					-0.0802	-0.555***	-0.0250	0.164**
					(0.0783)	(0.0805)	(0.0747)	(0.0793)
Quantity							0.136***	-0.412***
							(0.0174)	(0.0723)
Round			0.0512***	0.0735***			0.00145	0.00484
			(0.0178)	(0.0217)			(0.00440)	(0.00542)
Constant	0.777	0.402	2.008***	0.558*	-0.233	0.327	-0.731***	-0.305
	(0.517)	(0.690)	(0.296)	(0.292)	(0.245)	(0.259)	(0.241)	(0.242)

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Conclusions

- Bidding behaviors under Random Nth price auctions and 2nd price Vickrey auctions seem to differ statistically significantly for cheese but not for ice cream. This result is confirmed in nonparametric test (Wilcoxon Rank-Sum test) and in Tobit regression.
- Nonparametric tests as well as Tobit regressions suggest that information treatment had a significant effect in OECE, but not in Vickrey auctions.
- In Vickrey auctions posting all bids vs. posting only top N or top 2 bids had a significant effect on cheese bids but not on ice cream bids.
- Bidding across rounds differed significantly in OECE mechanism but not in Vickey auctions
- There was no significant difference in male vs. female bids.

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Acknowledgment:
Funding was provided by Federal State Marketing Improvement Program (USDA)
Contract number 12-25-G-0886

The Authors thank Jill McClusky and other participants of the workshop in Moscoew ID, Fall, 2009

USDA