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RESEARCH PAPER

An economic analysis of consumer preference towards organic produce

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ABSTRACT

Organic agriculture performs multiple functions. It is an important tool for achieving green productivity in agriculture and mitigates the negative impacts of conventional input-intensive agriculture by excluding the use of agrochemical inputs from the production system, minimizing environmental pollution, promoting reuse and recycling of organic farm waste and crop residues, improving biodiversity and enhancing soil productivity. Public interest in organically produced food is increasing throughout the world in response to concerns about conventional agricultural practices, food safety, human health, animal welfare and concern about the environment. This study was conducted to evaluate empirically the demographic characteristics which cause consumers to be more likely to purchase organic grown produce. This paper evaluated the consumer preference for organic produce that can help advising on policy issues related to implementing organic related programmes. Following the Lancaster consumer's demand theory, it was assumed that consumer's utility depends on product characteristics instead of the product itself. Consumer's choice for organic grown produce was analyzed within the random utility discrete choice model and a logit model was specified. The data were collected through a questionnaire conducted in the western region of Tamil Nadu in 2013. A hypothetical willingness-to-purchase as well as willing-to-pay models for organic grown produce were presented. Income and education were found to be the most significant determinants of willingness-to-purchase organic grown produce.

KEY WORDS : Organic produce, Environment, Logit, Consumer preference

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Continuous use of chemical inputs such as pesticides, herbicides and chemical fertilizers in Indian agriculture has resulted in damage to the environment, caused human ill-health, negatively impacted on agricultural production and reduced agricultural sustainability (Pimentel and Greiner, 1997). Fauna and flora have been adversely affected (Pimentel and Greiner, 1997). Numerous short and long-term human health effects have been recorded (Wilson, 1998). Human deaths are not uncommon (Wilson, 1998). Hence, there is an urgent need to find viable alternatives to chemicals so as to minimize the residues of these chemicals. The increase of the environmental consciousness has a thoughtful effect on consumer behaviour, with the green product market expanding at a remarkable rate (Bhaskaran *et al.*, 2006). The defining characteristic of organic agriculture is the absence of synthetic chemical pesticides. Organic agriculture performs multiple functions. It is an important tool for achieving green productivity in agriculture and mitigates the negative impacts of conventional input-intensive agriculture by excluding the use of agrochemical inputs from the production system, minimizing environmental pollution, promoting reuse and recycling of organic farm waste and crop residues, improving biodiversity, and enhancing soil productivity. Organic

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agriculture should sustain and enhance the health of soil, plant, animal, human and planet as one and indivisible. The market for organic foods is one of the fastest growing agricultural segments of the economy. Public perceptions regarding the environmental and health attributes of consuming fresh fruit and vegetables produced without the use of synthetic chemicals has fueled a growing demand for these types of products since the 1990s. Despite rapid growth in production and sales, consumer's demand for organic produce is still relatively small when compared to conventional produce. While similar studies have been undertaken in the past, the market for organic produce has quickly evolved in recent years. Increased awareness of organic produce necessitates that new research is carried out to document the current dynamics of the organic market. For reduced chemical produce to be marketed successfully, it is necessary to determine whether consumer concern for chemical residues has resulted in fundamental changes in consumer attitudes and behaviour. This study begins to address these issues by quantifying aggregate levels of prior knowledge of organic produce, willingness-to-purchase organic produce and willingness-to-pay for organic produce.

METHODOLOGY

To analyse demand of organic grown produce, the Lancaster consumer demand model (1966) was used instead of the traditional theory of consumer's demand. The reasons behind selecting this approach are related to the nature of organic produce. Organic produce have some specific characteristics that make the food product different from the conventional one. In particular, an organic food product possesses some credence characteristics that make these products totally different products compared to conventional ones. Then, those consumers who perceive and highly value the credence characteristics of organic products (*i.e.* healthy, protecting the environment, etc.) would be more willing to buy organic food products. In practice, consumers' decisions to choose organic food instead of conventional are made by comparing not only the observable characteristics of the organic food product (namely, search and experience attributes) but also the unobservable ones (credence attributes).

In this context, the Lancaster consumer demand model (1966), which assumes that a consumer's utility depends on product characteristics instead of the product itself, is more appropriate to analyse the demand for organic produce. In the Lancaster approach, the consumer chooses the product that possesses the combination of attributes that maximises his/her utility. Thus, consumers derive utility (U) from the attributes (Z), which are embodied in the purchased products:

$$U_{ij}=U_{ij}(Z_1,Z_2,.....,Z_m) \quad .....(1)$$

where,

$Z_i = a_{ij}q_j$ is the amount of ^{ith} attribute obtained by consuming the j^{th} product

a_{ij} – amount of i^{th} attribute per unit of j^{th} product

q_j – quantity of j^{th} good consumed.

The consumer's choice of buying organic produce versus conventional ones is then analysed within the random utility discrete choice model (McFadden and Train, 2000). The utility function is assumed to be known by the individual but some of its components are unobserved by the researchers. This unobserved part of the utility is treated as a random variable. Then, the utility for the organic produce is modelled as the sum of the observed attributes and not the observable random component (ε_{io}):

$$U_{ip} = {}_{ip}Z_i + £_{ip} \quad .....(2)$$

In the same way, the conventional food choice utility is defined as:

$$U_{ic} = {}_{ic}Z_i + £_{ic} \quad .....(3)$$

where, β_{iP} and β_{ic} are vectors of parameters to be estimated.The organic produce will be chosen if $U_{ip} > U_{ic}$. The probability that the consumer chooses the organic produce is given by:

$$P(y_p) = P(U_{ip} > U_{ic}) = P(£_{ic} - £_{ip} < {}_{ip}Z_i - {}_{ic}Z_i) \quad .....(4)$$

where, y_p is a binary choice variable for the organic food product, U_{ip} and U_{ic} are the conditional indirect utility functions and p and c subscripts represent organic and conventional foods, respectively.

The logit model was selected as the regression method in this analysis because its asymptotic characteristic constrains the predicted probabilities to a range of zero to one. The logit technique is a better procedure for capturing the magnitude of the independent variable effects for qualitative variables than are probit models (Amemiya, 1983).

The logit model is commonly used in settings where the dependent variable is binary. Because the data source provided individual rather than aggregate observations, the common estimation method of choice was the maximum likelihood method. Among the beneficial characteristics of MLE are that the parameter estimates are consistent and asymptotically efficient.

The empirical models assume that the probability of willingness-to-purchase organic or conventional produce, P_i, is dependent on a vector of independent variables (X_{ij}) associated with consumer i and variable j, and a vector of unknown parameters β. The likelihood of observing the dependent variable was tested as a function of variables which included socio-demographic and consumption characteristics:

$$P_i = F(Z_i) = F(\sim + X_j) = 1/[1 + \exp(-Z_i)$$

F (Z_i) = represents the value of the standard normal density function associated with each possible value of the underlying index Z_i. P_i is the probability observing a specific outcome of the dependent variable given the independent variables X_is. Z_i is the underlying index number or βX_i. βX_i is a linear combination of independent variables, so that

$$Z_i = \log [P_i/(1-P_i)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots\ldots\ldots\ldots + \beta_n X_n + \varepsilon$$

where, i is 1,2,……. n are observations, Z_i is the unobserved index level or the log odds of choice for the ith observation, β is the parameters to be estimated, ε is the error (or) disturbance term.

The dependent variable Z_i in the above equation is the logarithm of the probability that a particular choice will be made. The parameter estimates do not directly represent the effect of the independent variables. The independent variables used in this study were all binary qualitative discrete variables, therefore, $\partial P_i / \partial X_{ij}$ does not exist. The changes in probability that $Y_i = 1$ (P_i) brought about by a change in the independent variable, X_{ij} is given by:

$$(\partial P_i / \partial X_{ij}) = P_i (Y_i.X_{ij}=1) - P_i (Y_i.X_{ij}=0)$$

Three logit models were developed to predict the likelihood of a number of dependent variables which included prior knowledge of organic, purchasing organic produce and paying a premium for organic produce. The models were initially tested under specification:

$$Y = \beta_0 + \beta_1 \text{Male} + \beta_2 \text{Age} + \beta_3 \text{Income\_low} + \beta_4 \text{Edu\_Graduate} + \beta_5 \text{Shop-Many} + \beta_6 \text{Risk} + \beta_7 \text{Urban} + \beta_8 \text{Visit} + \beta_9 \text{Try-New} + \beta_{10} \text{Garden} + \beta_{11} \text{Hsize} + \beta_{12} \text{Married} + \beta_{13} \text{Media}$$

Male	=1 if the individual is male and 0 otherwise
Age	=1 if respondent age was below 35 and 0 otherwise
Income_	=1 if the household income was Rs 3 lakh or less and 0 otherwise
Edu_ Graduate	=1 if respondent's education was graduate and 0 otherwise
Shop-many	=1 if the individual regularly shops at many food stores to purchase advertised specials and 0 otherwise
Risk	=1 if the participant believed that the use of synthetic chemical posed a very serious health risk and 0 otherwise
Urban	=1 if the individual resides in an urban neighbourhood and 0 otherwise
Visit	=1 if the individual indicated they had visited a farmers' market within the past five years and 0 otherwise
Try-new	=1 if participant classified him/herself as among the very first to try newly introduced food products and 0 otherwise
Garden	=1 if fruits and vegetables were grown for consumption at the household
Hsize	=1 if 4 or more individuals presently reside in the household and 0 otherwise
Married	=1 if the participant was married and 0 otherwise
Media	=1 if the participant regularly made use of media reports on food safety and 0 otherwise.

ANALYSIS AND DISCUSSION

The data for this analysis were collected from a consumer survey. The survey was administered at three grocery retailers in Coimbatore and Erode districts of Tamil Nadu. Respondents were approached at random while entering the retail shops. In total 120 completed responses were obtained from grocery shoppers.

In addition to attitudes and preferences, the questionnaire included items relating to demographic information such as age, gender, income, education and household size. Questions related to consumer risk perceptions and the premium price that consumers would be willing to pay for organic produce was also a primary focus of the survey. In addition to data on direct consumer response to organic, questions were also included to ascertain perceptions of chemical use and chemical concern levels.

Table 1 provides a descriptive tabulation of the explanatory variables used in this analysis. Approximately 53 per cent of respondents were female and also 62 per cent of respondents were graduates. About 60 per cent of respondents were 35 years of age or below and approximately 40 per cent of respondents had annual household incomes of less than three lakhs rupees. About 95 per cent of the respondents were from urban area.

About 85 per cent of respondents believing that the residues from chemicals pose a very serious hazard and they were well known that use of synthetic chemical has a negative effect on environment.

Empirical results:

Model one – Prior knowledge of organic produce:

Model one examined the factors which contributed to having prior knowledge of organic produce. The dependent variable, HEARD-OF-ORGANIC, was coded according to whether or not the respondents indicated they had heard or read about organic before taking the survey. For those who had heard of organic (6%), the dependent variable was coded as 1 and for those who had not (94%), the dependent variable equaled 0. The results for model one are given in Table 2.

The variables Edu_Graduate, urban, try-new and risk were only significant at the 0.10 level. It indicates that the graduated consumers, the consumers who were from urban areas and the consumers who know the risk of use of chemical

Table 1: Descriptive tabulation of explanatory variables

Variables		Freq	Mean
	Male	56	
	Female	64	
Age	Less than 35 years	72	0.621
Annual income	< 3 lakh	48	1.214
Education	Graduate	74	0.412
Regional location			
Rural		28	
Urban		92	
Have you visited a farmer's market in the past five years?			
Yes		58	
No		62	
Do you regularly shop at more than one food store?			
Yes		74	
No		46	
Do you believe residues from chemicals pose a very serious hazard?			
Yes		114	
No		6	
Do you think the use of synthetic chemical has a negative effect on environment?			
Yes		114	
No		6	
Do you grow fruits or vegetables at home?			
Yes		58	
No		62	
Are you among the first to try newly introduced food products?			
Yes		58	
No		62	
Do you usually make use of food advertisements?			
Yes		78	
No		42	
Do you usually make use of media reports on food safety?			
Yes		50	
No		70	

Table 2: Prior knowledge of organic

Variable	Estimate	Standard error	Exp.(β)
Intercept	-0.9680	0.8038	
Male	-0.4312	-0.3452	0.650
Age **	0.6712	0.2756	1.957
Income_low**	-0.5178	0.2187	0.596
Educ_Graduate***	0.6958	0.2214	2.005
Shop-many ***	0.9845	0.3138	2.676
Urban**	0.8742	0.3945	2.397
Visit**	0.8945	0.4056	2.446
Risk**	0.9987	0.4125	2.715
Garden*	0.7126	0.4025	2.039
Hsize*	0.7069	0.4102	2.028
Married**	0.8367	0.4092	2.309
Media***	1.3775	0.4735	3.965
Try-New***	2.4312	0.8412	11.373

McFadden's R^2: 0.15, *,** and *** indicate significance of values at P=0.01, 0.05 and 0.1, respectively

were more likely to have prior knowledge of organic produce.

Model two - Willingness to purchase organic :

Model two is a willingness-to-purchase model for organic produce. The dependent variable (BUY-ORGANIC) was based on a survey question which asked respondents if they would be willing to purchase organic. For those who indicated they would buy organic (102 respondents), the dependent variable was coded as one and for those who reported they would not purchase organic (18 respondents), the dependent variable was coded as zero. The regression results for model two is given in Table 3.

Table 3 : Willingness – to – purchase organic produce

Variables	Estimate	Standard error	Exp(β)
Intercept	-0.2182	0.6483	
Male**	0.5314	0.3188	1.701
Age**	1.0077	0.4702	2.739
Income_low*	-0.7069	0.4102	0.493
Educ_Graduate***	0.6958	0.2214	2.005
Shop-many ***	0.9845	0.3138	2.676
Urban**	0.8742	0.3945	2.397
Visit**	0.8945	0.4056	2.446
Risk**	0.9987	0.4125	2.715
Garden*	0.7126	0.4025	2.039
Hsize	0.1005	0.4181	1.106
Married *	0.7126	0.3912	2.039
Media**	0.7069	0.4102	2.028
Try-New**	0.8367	0.4092	2.309

McFadden's R^2: 0.31 ,*, ** and *** indicate significance of values at P=0.1 and 0.05 and 0.01, respectively

The variables age, income, male, urban and risk were all significant at the 0.05 level and the variable Edu_Graduate was significant at the 0.01 level. The other variables Shop many, Hsize, Try-New and Visit were all significant at the 0.10 level.

As expected, the estimated co-efficient for the variable Income_low was negative. It indicates that the consumers with less income were less likely to purchase organic produce. In the same way the consumers who were graduates were more likely to purchase organic produce. The consumers who were from urban area, the consumers who were grown the fruits and vegetables in their own garden, the consumers who knew the risk of the use of the chemicals, the consumers who regularly made use of media reports on food safety were all more likely to purchase organic produce.

Model three - Willing to pay >10% for organic:

Model three is a willingness-to-pay model for organic produce. The dependent variables were generated from

survey questions in which the respondents chose the additional amount they would be willing to pay to purchase organic produce from a list of pre-defined premiums. The questions provided six responses to choose from which ranged from no premium to an over 20 per cent premium. In the model the dependent variable was coded as one for those willing to pay at least a 10 per cent premium and 0 otherwise. The regression results for model three are presented in Table 4.

Table 4: Willingness – to – pay >10% for organic produce

Variables	Estimate	Standard error	Exp.(β)
Intercept	0.6982	0.7633	
Male	0.5312	0.3452	1.701
Age**	0.6984	0.3125	2.011
Income_low**	-0.5248	0.2235	0.592
Educ_Graduate***	0.6458	0.2145	1.908
Shop-many ***	0.8256	0.3138	2.283
Urban***	0.9458	0.3458	2.575
Visit**	0.8747	0.4056	2.398
Risk**	0.9743	0.4523	2.649
Garden***	0.8156	0.2956	2.261
Hsize**	-0.6478	0.2515	0.523
Married***	1.7586	0.4102	5.804
Media***	1.5678	0.4092	4.796
Try-New***	1.4756	0.4985	4.374

McFadden's R^2: 0.22, *, ** and *** indicate significance of values at P=0.1, 0.05 and 0.01, respectively

The variables male, age and Edu_Graduate were significant at 0.01 level and the variables income_low, urban, risk, Hsize were significant at 0.05 level. The variables Shop-many, Visit, Married. Media and Try – New were significant at 0.10 level.

The consumers who were under 35 years of age and the consumers who were graduates were more likely to pay premium for organic produce. The low income people and the consumers who had more than four members were less likely to pay premium for organic produce. The consumers from urban area and the consumers who knew the risk of the use of the chemical were more likely to pay premium for organic produce. The consumers who regularly shop at many food stores to purchase advertised specials, the consumers who had visited a farmers' market within the past five years, the consumers who regularly made use of media reports on food safety and the consumer who classified him/herself as among the very first to try newly introduced food products was more likely to pay the premium.

Conclusion:

Organic produce is an imminently successful production method that isinevitably plays a major role in the agriculture. The results of this study suggest that the majority of consumers appear willing to purchase organic produce; specifically, higher earning households and younger individuals are the most likely to purchase organic produce. As well as consumers were also found to be willing to pay a premium to obtain organic produce specifically higher earning households and younger individuals are the most likely to pay a 10 per cent premium for organic produce.

This analysis documents significant effects between many socio-emographic variables and willingness-to-pay for organic grown produce. The goal of this research was to provide marketing agents with a better understanding of consumer purchase behaviour, preferences and beliefs that are relevant to organic farming. These findings may be especially encouraging to those developing marketing strategies for green input produce such as organic produce. This study is also useful to producers. They can understand that cultivation of organic produce would provide a better premium for them.

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