CONSUMERS WILLINGNESS TO PAY TO AVOID TRANSGENIC PRODUCTS

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ABSTRACT

The debate on transgenic, which is embebed in asymmetrical information, has as a focal point, the risks and uncertainties to them associated. Many are the concerns and questions about the risks for the human health and the environment.

Considering the interests of the productive sector in the transgenic technology, the matter sets itself in terms of how fast it wants to be settled taking into consideration the incapability of establishing certainties about the damages or benefits within the process. With the recent liberation by the Brazilian government for its production the sector starts showing segmentation. Therefore, this issue reflects in the market itself.

The question is: are the consumers willing to buy transgenic? As an attempt to answer this question, this paper used a Contingent Valuation procedure, with an exploratory character, estimating consumer willingness to pay (WTP) to avoid de consumption of transgenic. This variable (WTP) was measured as a monetary estimate benefits.

Key Words: Transgenic, Contingent Valuation, measure of Well-being.

INTRODUCTION

During the modernization of the agricultural sector in Brasil within the range of the "Green Revolution", a few decades ago, the growth in productivity and agricultural production has been persistent and substantial, representing the main force for the real growth of Goiás.

In the perspective of continuance and growth of the model in vogue, a group of grain producers and representatives of institutions from Goiás, went to the United States in 2003, to get acquainted with the big transgenic crop fields – its technology, maintenance, productivity, costs, etc. A series of advantages related to production efficiency and effectiveness presented themselves as social benefits: "democratization of food", competitive advantages in the international market and concern for the environment. Adding to the pre-disposition of planting transgenic is the liberation by the government.

Genetically modified goods have been discussed worldwide. In Brasil, especially in the late 90's, the discussions ended up drawing the attention of farmers, researchers, environmentalists and consumers.

According FAO, in ANAIS (1999), the genetically modified food may be the answer to solve world hunger. It is said that the traditional agricultural methods are still able to produce enough to feed the world, but this looses effect if we think of a time frame 30 years ahead. Even if there is an increase of the agricultural areas, it won't be enough due to population growth. On the other hand, while such technology extinguishes the need of pesticides, it allows a better

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quality of the products, being beneficiary to the health of the consumers and at the same time avoiding harm to the environment.

On the other side of this debate is hunger. This problem is not due to lack of food. There is enough food being produced worldwide to feed the current population. The problem is not production, but distribution of food. This may be worsened by the adoption of the new biotechnology due to its supply structure.

It is said that the rush of investing in the production of transgenics is intrinsically attached to powerful forces of the world's capitalism. According to SHAPIRO (1999), from Monsanto, "today the 3 biggest industries of the world – agriculture, food and health – still work in different sectors, but there is a set of changes that will lead them to integrate". It is known that the production of these industrial sectors tend to fight over the transformation that arises from the emergence of new technologies, especially bio-technology. The fusion processes and alliances between the world's biggest food companies, agricultural chemicals, seeds and pharmaceuticals show how these global industrial sectors depend more and more on the technology, which will lead to integration.

There are discussions about the process of production of food in global scale where new technologies play an important role. This leads to the questioning of the "food democratization". In relation to food quality and environmental protection, there are no conclusive researches. There are researches scattered around the world, that question the positive results of the technology.

The debate on transgenics is marked by asymmetrical information and has as focal point the risks and uncertainties associated to them. The issue here is not to go against biotechnology or the evolution of science; it is about the speed in which biotechnology wants to be implanted in face of the incapability of establishing certainties about damages and benefits associated to it.

Having in perspective the interest of the productive sector for the technology and considering that in a short timeframe there are not trustworthy indicatives about human health and environment, the issue places itself on the scope of the market. This leads to the following question: will consumers be willing to buy transgenic products?

This paper aims to obtain, in an exploration level, knowledge on transgenic technology, as a factor of food safety, having as starting point consumers preference. To be more accurate the goal is to generate information about the acceptance of Goiânia consumers to transgenic products. The research will consider the willingness to accept the exposure to the risks and uncertainties inherent in the process.

Contingent Valuation

Transgenic technology has been associated to risks and uncertainties therefore its implementation can generate negative externalities. According to SERÔA DA MOTTA (1990:113) "externalities occur when the consumption or the production of goods generate adverse effects (or benefits) to other consumers and, or firms, and these are not effectively compensated in the market via pricing system".

The difficulties in obtaining the value of external costs constitute for the neoclassic economists a problem of empirical measurement of the values of the variables theoretically defined. The neoclassic theory solves the measurement issue through the concept of Willingness to pay (WTP) – which reflects the individual preferences in terms of value or utility. These are then expressed in monetary values and this is the unit used to express the preferences that are not priceable like health values, life values and values of environmental goods and services. (PEARCE e TURNER, 1991).

To obtain the External Cost Function, in monetary values, the neoclassical school seeks the development of new methodologies, amongst which the Contingent Valuation plays an important role.

Since we are dealing with public goods, or when there are externalities and, or informational asymmetries interfering in the determination of the consumers surplus, we can establish a hypothetical market to deduce equivalent variations or individual compensations.

This is the basis of the Contingent Valuation Method, which obtains from sampling data revealed preferences for goods or environmental services in the context of hypothetical markets, using questions about the consumers willingness to pay or willingness to accept.

The Hypothetical Market

To structure the hypothetical market an association was established between the soy bean oil and the production of the bean, that may be transgenic or not. It was assumed that soy bean oil, is of common use in the goianian cuisine and as so, it is part of the diet of most families. In a healthy diet, adults consume about one liter of oil a month.

Due to the exploratory aspect, it was determined that the population of the research would be constituted by the community of the Federal University of Goiás. The research was conducted in all units of the Campi and the interviews were answered by professors, students and employees.

The Contingent Valuation study was conducted in December of 2003 by the post graduate students from the Masters in Agribusiness course.

DIFFERENCE UTILITY FUNCTION

HANEMANN (1984), in his analytical model "Difference Utilities Function", considers that consumers responses to referendum type of question, result of a process of utility maximization; starting at an initial level, from which each individual considers to answer YES and compares it to the answer NO, choosing the option that better assures the highest level of utility.

Presented the following question: "Are you willing to pay an additional amount of R$ p for every liter of soy bean oil to avoid the consumption of a transgenic product?". It is assumed that the individuals take into consideration the utility of the oil consumption and their monetary income, and asserting that this type of question leads to an exceeding compensation measure, the utility function established is:

$$u(j,y;s) \quad (3)$$

where:

j = binary variable; j = 1 represents "utility function without the uncertainties associated to transgenics", and j = 0 represents the utility function with "uncertainties";

y = income;

s = vector that represents other attributes that the individuals have that may interfere in the preference. So:

$$u1=u(1,y;s), \quad (4)$$

means that the individual prefers to consume non-transgenic soybean oil.

$$u0=u(0,y;s), \quad (5)$$

means that the individual doesn't prefer to consume non-transgenic soy oil .

u1 e u0 are random variables with a certain probability distribution with means v (0, y; s) and v (1, y; s). Therefore, the utilities are :

$$u(j, y; s) = v(j, y; s) + ej \quad ; \qquad j = 0, 1 \tag{6}$$

where: e0 e e1 are identical random variables independently distributed, with zero mean and finite variance.

The consumers response is positive if:

$$v(1, y-p; s) - v(0, y; s) \square e0 - e1 \tag{7}$$

where: p is the additional amount the individual would pay per liter, to purchase non-transgenic soy oil. (Without the uncertainties related to health and the environment).

If the individual is sure of the choice that maximizes utility, for the econometrist one's response is a random variable with probability distribution defined as:

$$P1 = \Pr\{\text{the individual pays}\} \tag{8}$$

$$P1 = \Pr\{v(1, y-p; s) + e1 \quad \square \quad v(0, y; s) + e0\} \tag{9}$$

$$P1 = \Pr\{\square v \ \square \ \square\} \tag{10}$$

where:

$$\square v = v(1, y-p; s) - v(0, y; s) \tag{11}$$

$$\square = e0 - e1 \tag{12}$$

Consequently:

$$P0 = \Pr\{\text{the individual doesn't pay}\} \tag{13}$$

$$P0 = 1 - P1 \tag{14}$$

Being $\square = e0 - e1$ the accumulated density function of $\square$ is $F\square(.)$, so that the probability of willingness to pay R$ p can be:

$$P1 = F\square(\square v) \tag{15}$$

Using the Logit model, $F\square(.)$ is the accumulated distribution of the standard logistic function and $\square v$ is the Difference Utilities Function, as presented in the equation (11). The statistical model of the binary responses can be interpreted as the result of a choice that maximizes utility. So, the relevant functional form to be specified is $\square v$. HANEMANN (1984) proposes that the utility function be specified first obtaining the functional form of $\square v$ by manipulation.

To calculate a measurement, based in the utility, of monetary value of the benefits attributed to the availability of the good, an amount R$ p is estimated to satisfy the following:

$$v(1, y-p^*; s) - v(0, y; s) = \square \tag{16}$$

R$ p is the value that would make an individual indifferent between choosing transgenic soy oil (and the uncertainties relative to health and the environment) and the total income y; or non transgenic soy oil (without the uncertainties relative to health and the environment) and lower income (y - p*), where p* is the amount to be payed to obtain the benefit. If $\square$ has a standard logistic distribution, the mean and median are equal to zero. So the value $\square = 0$ is associated to the indifference point, being $F\square(0) = 0{,}5$. For $\square v = \square = 0$ the individual would be indifferent about consuming or not the good, and the mean value of p is considered as that which the individual would be willing to pay for it (AGUIRRE & FARIA, 1996). This leads us to:

$$\Pr\{\square v = \square = 0\} = F\square(\square v = 0) = 0{,}5 \tag{17}$$

Therefore, in the logit model, p* satisfies the condition:

$$\square v(p^*) = 0 \tag{18}$$

ESTIMATE OF THE WILLINGNESS TO PAY

Considering the following utility function suggested by HANEMANN (1984):

$$v(j, y; s) = aj(s) + b\,y \qquad j = 0, 1\ ; \quad b > 0 \qquad (19)$$

The function is linear in y, so the marginal utility of the income is constant, what implies that the probabilities associated to the discrete variable of choice are independent of the individual's income, therefore only the substitution effects occur whereas the income effects do not occur. (HANEMANN, 1989).

If we apply the definition of the difference utilities function in (19) as shown in (11), we have:

$$\Delta v = a1(s) + b(y - p) - a0(s) - by \qquad (20)$$

$$\Delta v = [\,a1(s) - a0(s)\,] - b\,p \qquad (21)$$

$$\Delta v = (\,a1 - a0\,) - b\,p \qquad (22)$$

$$\Delta v = a - b\,p \qquad (23)$$

Substituting (23) in (15) the statistic model of choice is:

$$P1 = F\Delta(a - b\,p) \qquad (24)$$

where:

$$a = a1 - a0 \qquad (25)$$

The parameters a1 and a0 can't be identified from the data, only their difference is identifiable (HANEMANN, 1984).

Following the procedure, the function determined in (24) is estimated by the logit model whose functional form used is linear and the equation is adjusted by the method of maximum likelihood, defined as:

$$\Delta v = \Delta + \Delta 1\ PRICE + \Delta 2\ FAMINC + \Delta 3\ BIAS + \Delta 4\ WOR \qquad (26)$$

$$\hat{\Delta} v = 1{,}737337 - 1{,}291506\ PRICE + 0{,}248886\ FAINC - 1{,}596710\ BIAS + 0{,}518489\ WOR \qquad (27)$$

where:

Δv = dependent binary variable with 0 value for answer NO and 1 for answer YES;

PRICE = monetary values for willingness to additional pay for liter of soy oil: R$0,50; R$1,00; R$1,50; R$2,00.

FAINC = ranges of family income:

1	1 minimum wage	4	11 a 15 minimum wages
2	2 a 5 minimun wage	5	16 a 20 minimum wage
3	6 a 10 minimun wage	6	More than 20 minimum wage

WOR = dummy with values 0 e 1, respectively represents the individuals which are not worried about transgenic and those which are worried.

BIAS = variable that indicates bias in the answers of contingent valuation, being 0 for not biased answer and 1 for biased answer. The bias identified by this variable is known as "free-ride".

The estimates of the coefficient are as follows:

BOX 1: ***ESTIMATED PARAMETERS OF THE LOGIT MODEL FOR THE WILLINGNESS TO PAY AVOIDING THE CONSUMPTION OF TRANSGENIC PRODUCTS. GOIÂNIA, 2003.***

Dependent Variable: DAP
Method: ML - Binary Logit

Sample: 1 422
Included observations: 422
Convergence achieved after 3 iterations
Covariance matrix computed using second derivatives

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	1.737337	0.490291	-3.543483	0.0004
PRICE	-1.291506	0.285977	-4.516125	0.0000
FAINC	0.248886	0.115790	2.149464	0.0316
BIAS	-1.596710	0.233983	-6.824051	0.0000
WOR	0.518489	0.254003	2.041273	0.0412

Mean dependent var	0.481043	S.D. dependent var	0.500234
S.E. of regression	0.435269	Akaike info criterion	1.146721
Sum squared resid	79.00442	Schwarz criterion	1.194648
Log likelihood	-236.9581	Hannan-Quinn criter.	1.165660
Restr. log likelihood	-292.2047	Avg. log likelihood	-0.561512
LR statistic (4 df)	110.4932	McFadden R-squared	0.189068
Probability(LR stat)	0.000000		
Obs with Dep=0	219	Total obs	422
Obs with Dep=1	203		

Font: Reseach Data

The variable PRICE has a negative and significant coefficient. The variable FAINC presents a positive and significant correlation coefficient to the answer YES, showing that ceteris paribus, and raises in income increase the probability of positive answers.

The variable WOR also shows a significant positive coefficient indicating that when the individuals are worried about the transgenic origin of the products that they buy, higher is the probability of a YES answer. The BIAS variable also has a significant and negative coefficient, showing that the presence of biases interferes negatively in the contingent valuation.

The econometric results obtained so far, from the estimate of the difference utilities function, represent only the probabilities associated to a positive answer (YES) for the contingent valuation. To obtain the monetary measurement of well-being, we have to make the function Δv estimated equal to zero and solve it for the price.

Considering the function defined in (20) to (23):

$\Delta v = a - bp$

Considering $\Delta v = 0$:

$a - b\,p = 0$ 28)

Solving for p, we have:

$$p^* = \frac{a}{b} \qquad (29)$$

As defined in (16) to (18), starting from (29) we get the mean and median values of p written as p*, calculated using the coefficient of the statistic discrete model of choice. The value of the individual damage or benefit is given by:

$$\text{Individual Damage} = \frac{\alpha^*}{\beta^*} \qquad (30)$$

Where □* is the estimate of the coefficient that represent a, and □* the estimates of b in (29). So:

$$\alpha^* = \hat{\alpha} + \hat{\beta}_2(\overline{RENFA}) + \hat{\beta}_3(VIES) - \hat{\beta}_4(\overline{PREOC}) \qquad (31)$$

$$\beta^* = \hat{\beta}_1 PREÇO \qquad (32)$$

Substituting the variables FAINC, BIAS and WOR, shown in (31) by its respective medium values and using the estimated value of the parameters and also the estimated coefficient of the price variable in (32) :

$\alpha^* = 1{,}8105256$ (33)

$\beta^* = 1{,}291506$ (34)

Individual Benefit = 1,40187 = R$ 1,40 (35)

The estimated value (R$1,40), represents the individual monthly benefit obtained by the consumption of non-transgenic products.

CONCLUSION

This study aimed to obtain a monetary estimate of the damages (benefits) associated by the consumers of soy oil in relation to the implementation of the transgenic technology. The main reason for such valuation was to provide an investigation of the economical rationality in investing in the production of transgenic goods. This reference value can be used in cost-benefit analysis of policies or specific projects.

The basic idea of the concept of benefits or damages derived from consumption of transgenic, associated to human health and protection of the environment, are the individual preferences identified by the willingness to pay of the individuals. The measurement of these benefits (or damages) correspond to the level of well-being.

To estimate such, we used the Contingent Valuation Method. While applying the methodology, a monetary estimate of R$1,40 was found, this is interpreted as the individual monthly benefit to be obtained by the avoidance of transgenic soy oil. The evaluation of the validity and the extension of the results achieved had as a starting point the design of the research that generated the data used in the estimates.

The matter of valuation, although provided a wide range of information, limited itself to the problem of the consumption of soy oil of different origins and therefore the notion of damage does not apply to the transgenic technology in general, only to the product mentioned.

It may be concluded that the monetary value obtained indicates that products of transgenic origin generate losses in well-being for the population in the study. The productive sector should be aware of this fact, not losing site of this, when programming investiments. Finally, we should acknowledge the exploratory limits of this research and suggest new studies.

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