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Willingness to pay for organic products: study for a municipality in the State of Santa Catarina

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Abstract
Understanding the behavior of consumers when offering organic products makes it possible to understand the challenges that may be faced by public policies, the marketing strategies of companies and the opportunities that the market offers for the growth of this production chain. The aim of this research was to investigate the determinants of consumers' willingness to pay a higher price for organic fruits and vegetables in the municipality of São Lourenço do Oeste in the State of Santa Catarina. The method applied is the contingent valuation using binary regression models: LPM, logit and probit. To obtain the variables for the research, questionnaires were applied to consumers. The results indicated that some factors increase the willingness to pay for organic products, such as age and education, while some variables contribute to reducing the willingness to pay for these products, such as lack of information about organic products and high prices or insufficient income. Multisectoral public actions can contribute to improving various aspects of the organic production chain, thus increasing production and consumption.
Keywords: Contingent valuation method. Alternative products. Probit. Logit.

Disposição a pagar por produtos orgânicos: estudo para um município catarinense

Resumo
Compreender o comportamento dos consumidores frente à oferta de produtos orgânicos possibilita conhecer os desafios que podem ser enfrentados por políticas públicas, as estratégias de comercialização pelas empresas e oportunidades que o mercado oferece para o crescimento dessa cadeia produtiva. O objetivo da pesquisa consistiu em investigar os determinantes da disposição dos consumidores a pagar um preço maior por frutas, verduras e legumes orgânicos no município de São Lourenço do Oeste – SC. O Método aplicado é o de valoração contingente utilizando os modelos de regressão binários: MPL, logit e probit. Para obter as variáveis para a pesquisa foram aplicados questionários aos consumidores. Os resultados indicaram que alguns fatores aumentam a disposição a pagar por produtos orgânicos, como a idade e a escolaridade, enquanto algumas variáveis contribuem para

reduzir a disposição a pagar por esses produtos, como a falta de informação sobre os orgânicos e os altos preços ou renda insuficiente. Ações públicas multisetoriais podem contribuir para melhorar diversos aspectos da cadeia produtiva dos orgânicos, aumentando assim sua produção e o consumo.
Palavras-chave: Método de valoração contingente. Produtos alternativos. Probit. Logit.

Dispuestos a pagar por productos orgánicos: estudio para un municipio del estado de Santa Catarina

Resumen
Entender el comportamiento de los consumidores al ofrecer productos orgánicos permite comprender los desafíos que pueden enfrentar las políticas públicas, las estrategias de marketing de las empresas y las oportunidades que ofrece el mercado para el crecimiento de esta cadena productiva. El objetivo de la investigación fue investigar los determinantes de la disposición de los consumidores a pagar un precio más alto por frutas y verduras orgánicas en el municipio de São Lourenço do Oeste en el estado de Santa Catarina. El método aplicado es el de valoración contingente utilizando los modelos de regresión binaria: MPL, logit y probit. Para obtener las variables para la investigación se aplicaron cuestionarios a los consumidores. Los resultados indicaron que algunos factores aumentan la disposición a pagar por productos orgánicos, como la edad y la educación, mientras que algunas variables contribuyen a reducir la disposición a pagar por estos productos, como la falta de información sobre los productos orgánicos y los altos precios o ingresos insuficientes. Las acciones públicas multisectoriales pueden contribuir a mejorar varios aspectos de la cadena productiva orgánica, aumentando así la producción y el consumo.
Palabras clave: Método de valoración contingente. Productos alternativos. Probit. Logit.

1 Introduction

The organic production system seeks to improve the quality of life of the producer and the consumer, based on environmental and social sustainability. Thus, it is important for this type of product that its production process is ecologically sustainable, economically viable and socially integrated with human and environmental well-being practices. The world market for organic products follows a growth trend mainly due to changes in habits and awareness of individuals regarding healthy and safe living and lower social and environmental impacts (TERRAZZAN; VALARINI, 2009).

Sales of organic products in the world grew by more than 500% in the period from 2000 to 2017, covering approximately 69.8 million hectares of arable land, 10% of which in Latin America alone (LIMA et al., 2020).

In Brazil, the agricultural area occupied by organic production exceeded 1.13 million hectares in 2017, representing 0.4% of the total arable area in Brazil, with more than 15 thousand producers (LIMA et al., 2020).

According to Willer and Lernoud (2018), Brazil is the largest consumer market for organic products in Latin America, being the third with the largest production area. The Brazilian production of organic products is oriented towards meeting the growing internal demand and institutional purchases for school feeding programs and for government agencies' food services, strongly contributing to this market.

Organic agriculture is a viable option for inserting small farmers into the market, as it requires low dependence on high-value external inputs and greater ease of handling, in addition to enabling diversification. Diversification reduces smallholders' risks and ensures stable income throughout the year. Family farming accounted for 76% of establishments producing organic agriculture or livestock in Brazil in 2017 (IBGE, 2017). Organic agriculture is also consolidated as a rural development strategy by generating alternatives to the rural exodus, inserting women into the activity and empowering them, by generating income and reducing rural poverty and improving the quality of life of workers (CAUMO; STADUTO, 2014).

The production process of organic products may imply a higher final value than that of unsustainable products. This difference in values leads to the need to know what are the factors that make consumers choose to pay more to purchase these products. The willingness to pay a higher amount represents a buyer's decision making and is related to perceived value and satisfaction. Willingness to pay has been widely used to understand the behavior of purchasing sustainable products, being a metric which quantitatively expresses decision-making (RAASCH; DE SOUSA JÚNIOR; DA ROCHA, 2021).

In this sense, the guiding question of this research is: what determines that the consumer is willing to pay more for organic fruits and vegetables? Thus, the purpose is to investigate the determinants of consumers' willingness to pay a higher price for organic fruits and vegetables in the municipality of São Lourenço do Oeste in State of Santa Catarina, using the Contingent Valuation method, which is carried out by capturing information through surveys directly with consumers of these products.

Understanding market relations for organic products enables reflections on human and environmental well-being, which are important for the sustainability of the present and future generations. Understanding the behavior of consumers when offering alternative products, such as the organics, supports the understanding of the motivations for consuming these products, the challenges that may be faced by policies and the opportunities that the market offers for the growth of this production chain.

When companies do not know the real willingness to pay their customers, it is impossible to create adequate pricing strategies, running the risk of ignoring determining factors for customers. Knowing customers' willingness to pay is also essential for marketing strategies and the development of new products and services (RAASCH; DE SOUSA JÚNIOR; DA ROCHA, 2021).

Therefore, this work is divided into five sections, including this introduction as the first section. The second section proposes a brief discussion about the challenges and potentials of the Brazilian organic market. The methodology is exposed through the third section and the fourth section presents the results and discussions. Finally, in the fifth section are the final considerations of the study.

2 The organic market in Brazil: challenges and potentials

The organic market gained emphasis from the concern of families with the quality of food and the recognition that organic food contributes to people's health and quality of life. Thus, most individuals opt for consumption of organic products if they have sufficient financial conditions to afford that. The organic market is growing all over the world, especially in richer countries, considering that organic products are generally priced higher than conventional products (TERRAZZAN; VALARINI, 2009).

In Brazil, the discussion and implementation of proposals considered alternatives, opposed to the Green Revolution pattern, stood out from the 1970s onwards, however there were no public incentives for this. Even with theoretical and practical advances in the following two decades, sustainable methods of food production entered public policy agendas effectively after the 2000s (RESENDE; RESENDE JÚNIOR, 2011).

The debate on the topic related to organic production culminated in the first Normative Instruction regarding organic production, nº 07/1999 of the Ministry of Agriculture, Livestock and Supply (MAPA), which was revoked by Normative Instruction nº 64/2008 and, in its Article 10, goes on to define that, "For a product to receive the designation of organic, it must come from a production system where the principles and norms established in the regulation of organic production have been applied [...]". These principles and norms are also defined by the same Normative Instruction, which points out general requirements of organic production systems, such as seeking to preserve environmental resources, value cultural and regional aspects, legal work relations and improve the quality of life of all agents involved in the production chain (BRASIL, 2008).

The organic products market in Brazil presents weaknesses that are discussed and studied in order to promote improvements in the production and commercialization chain. Terrazzan and Valarini (2009), Neto *et al.* (2010), Barbosa and Souza (2012) and Padua -Gomes, Gomes and Padovan (2016) discuss and mark several factors as challenges for organic production, highlighting: the lack of public technical assistance; difficulty in accessing credit; the costs of converting conventional to organic production; costs with permanent certification; lack of research and investment in technologies for organic production; scarcity of information for consumers; absence of data referring to the market; use of the same conventional channel for marketing organic products; demand higher than supply; constancy in the supply of products; corporations and conventional companies occupying the space of organic production; difficult access for buyers due to higher added value; difficulty in increasing production per area; bureaucracy costs; and the lack of government incentives as a whole.

On the other hand, the potential of the Brazilian organic market is clear, Khatounian (2001), Fonseca and Medaets (2005), Schultz (2007), Barbosa and Souza (2012) and Ferreira *et al.* (2016) point out as potential factors: the elimination in the cost of chemical inputs; increased demand for quality food; concern with environmental and social aspects in the food production chain; the smaller need for territorial space to produce greater added value; less dependence on external inputs; advantages of diversifying production that provide more stability in the face of

market instabilities; in a macronational environment, it contributes to job creation and income generation for marginalized farmers; the international trend of conscious consumption and environmental sustainability, in addition to food and social security; and the possibility of increasing animal production with organic and agroecological practices, which is still little explored in Brazil.

In this sense, Aquino, Gazolla and Schneider (2017) argue that public policies aimed at agroecological farming in Brazil, such as credit and rural extension policies, are outdated in relation to other countries. The National Program for Strengthening Family Agriculture – PRONAF, for example, created in the mid-1990s, began to provide specific credit lines for agroecology from 2005/2006 and still has values considered low. In addition, in 2013 the first National Plan for Agroecology and Organic Production – PLANAPO (2013-2015) was launched, with the aim of expanding and strengthening organic and agroecological production, giving priority to family farmers. The Plan was reassessed and relaunched for the period 2016-2019. From 2019 to the present (2021), a new plan has not yet been launched. The authors indicate that resources are insufficient, as well as the application of government programs and policies. The government could implement its practices with sustainable development policies, which include organic production, within comprehensive planning.

3 Methodology

Contingent valuation method

The valuation of environmental assets aims to indicate the price of an environmental resource, so that it is possible to use these values in the determination of policies that include the conservation of the environment in parallel with its use for economic needs (LIMA; SILVA, 2004). Similar to this definition, Silva (2003) describes the importance of environmental valuation, which consists of creating a reference value for the rational use of environmental resources. Valuation is essential for providing information to both the public and private sectors regarding the value that people place on certain assets and how this could affect the well-being of the population.

The contingent valuation method, as indicated by Lima and Silva (2004), is carried out by capturing information through surveys directly with individuals affected by the environmental resource under study. Through the method, it is possible to capture people's willingness to pay (WTP) for a good, considering that there are different preferences for these goods and it depends on many factors.

The contingent valuation method helps to arrange the preservation of environmental resources with economic growth in a sustainable way. Environmental sustainability is on government agendas, however, it is often considered an obstacle to economic growth. In this sense, estimating the WTP value for environmental products or harmless products for the environment is a way to stimulate the economy without compromising long-term environmental well-being (SERRA *et al.*, 2004).

There are numerous ways to estimate the WTP of consumers products. In the case of this research, the aim is to evaluate the WTP for organic products. Organic products already have a market, however, depending on the factors, the value attributed to these products is different, varying from individual to individual.

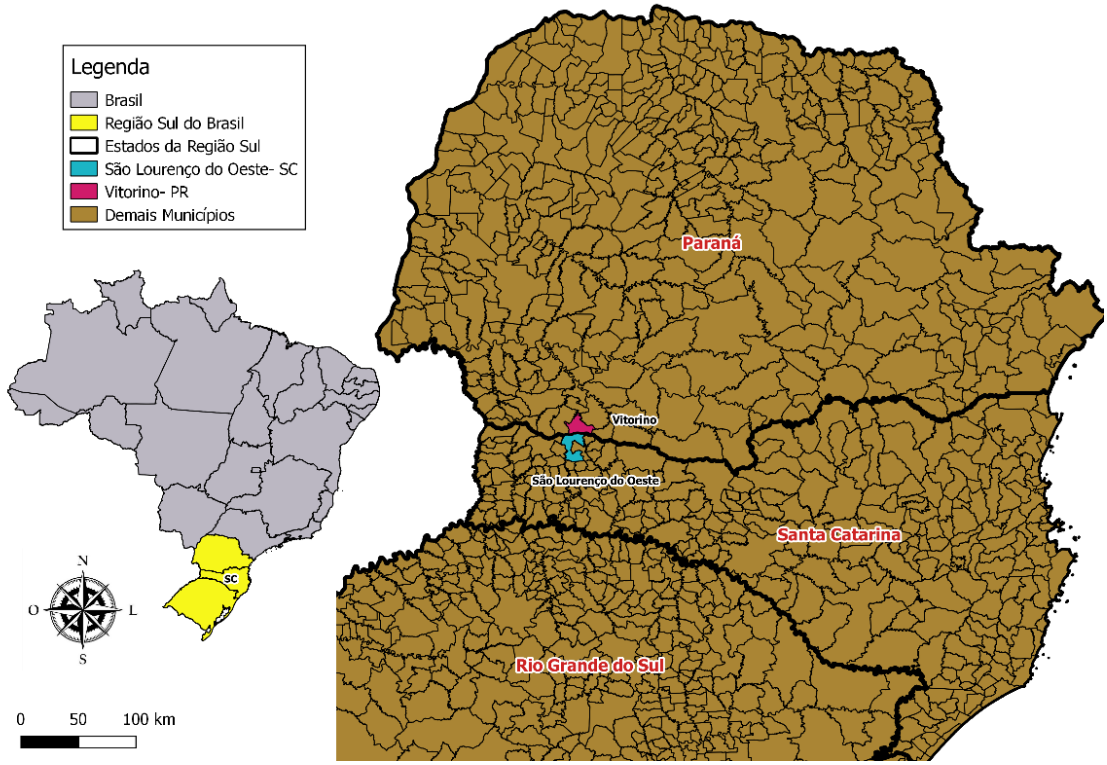
Geographic clipping and variables

In this study, questionnaires were applied as one of the procedures of the contingent valuation method to reach the objective of investigating the determinants of the willingness to pay for organic fruits and vegetables in São Lourenço do Oeste, municipality in the State of Santa Catarina.

São Lourenço do Oeste is a municipality with an estimated population for 2020 of 24,291 people. The municipality is located in the South of Brazil, in the state of Santa Catarina, in the western mesoregion and in the border of the state of Paraná to the North, specifically with the municipality of Vitorino, whose estimated population for 2020 is 6,859 people (IBGE, 2020).

So, figure 1 shows the location of the municipality of São Lourenço do Oeste.

Figure 1 – Location of the municipality of São Lourenço do Oeste.



Source: survey results (2021).

The applied questionnaire underwent a pre-test with 3 researchers and it was available online for responses from April 15 to May 15, 2021. The questionnaire was disseminated through social networks, through *WhatsApp*, *Facebook* and *Instagram*. The questionnaires were not applied in person due to health restrictions resulting of the Pandemic of Covid -19.

As the questionnaire was applied online, it was necessary to take some filters. Only responses with valid information for age were kept. Also,only respondents from the city of São Lourenço do Oeste belonging to the state of Santa Catarina and respondents from the Araucária Park neighborhood of the city of Vitorino, belonging to the state of Paraná, were also kept a large number of respondents from that location. This neighborhood borders the urban perimeter of São Lourenço do Oeste, it is closer to the urban center of Santa Catarina than that of Paraná and many residents of this neighborhood are former residents of the urban perimeter of Santa Catarina and, therefore, it is assumed that they can continue to consume products in São Lourenço do Oeste.

Other filters applied to avoid biasing the analysis were: if the respondent reported being responsible for purchasing food, mainly fruits and vegetables in his/her home; if fruits and vegetables are consumed in his/her home; and if the respondent knows the definition of organic products. These filters were applied with the premise that, if the respondent is not responsible for the purchases, he/she is not aware of the prices or even the existence or not of difference of prices between organic and non-organic. Furthermore, if fruits and vegetables are not consumed at home, automatically that person would not be willing to pay more for organic fruits and vegetables. The option to remove people who do not know the definition of organic was also considered important to capture the reality of the willingness to pay for organic products. The final sample consisted of 204 respondents, 19 of whom were from Vitorino. Thus, the sample was characterized by accessibility or convenience, as pointed out by Gil (2008).

Through the applied questionnaire, it was possible to construct the variables presented in Table 1.

Chart 1 – Variables constructed from the questionnaires

Variables	Name	How was it calculated
Variable dependent		
Y	Willingness to pay (WTP)	1 if the respondent stated that he would be willing to pay a higher price to consume organic fruits and vegetables. 0 otherwise
Variables independent		
X1	Age	Age informed for the respondent
X2	Gender	1 for male, 0 for others
X3	Color	1 for whites, 0 for others
X4	Marital status	1 for married, 0 for others
X5	Income	Respondent's monthly income, ranging from 1 – less than 1 minimum wage to 7 – more than 10 minimum wages
X6	Education	Respondent's education, ranging from 1 - incomplete elementary school to 7 postgraduate
X7	People in the residence	Number of people living in the house including the respondent
X8	Risk group	1 if the respondent lives with a child, elderly person, pregnant woman, person with cancer, person with a chronic illness or person with a disability. 0 otherwise
X9	Relative with cancer	1 if the respondent has or had a family member with cancer, 0 otherwise
X10	Works in the health field	1 if the respondent works in activities related to nursing, medicine, laboratories, pharmacy, physical activity, among others, 0 otherwise
X11	Test / government	1 if the respondent stated that it would be up to the government to test and certify organic foods, 0 otherwise
X12	Reads labels	1 if the respondent claimed to have the habit of reading the labels of the products he buys to analyze the validity, composition, origin, whether it is organic, among other attributes, 0 otherwise
X13	Risk perception	1 if the respondent stated that he considers about the purchase of fruits and vegetables if the products are free of pesticides, 0 otherwise
X14	Attitude	1 if the respondent stated either that all pesticides should be definitively prohibited or that unsafe ones should be definitively prohibited and the rest should be more restricted, 0 otherwise
X15	Never bought organic	1 if the respondent stated that he/she never bought organic fruits and vegetables and did not think about buying them or never bought them but is thinking about buying them, 0 otherwise
X16	Purchase organic then	1 if the respondent stated that he consumes organic fruits and vegetables every week, twice a month or several times a week, 0 otherwise
X17	Difficult to find	1 if the respondent reported that it is difficult to find organic products in the city where he/she lives, 0 otherwise
X18	Concern about health	1 if the reason that would lead the respondent to consume organic products is because they are healthier, 0 otherwise
X19	Concern about the environment	1 if the reason that would lead the respondent to consume organic products is because they help preserve the environment, 0 otherwise
X20	Incentive to the producers	1 if the reason that would lead the respondent to consume organic products is due to the incentive they would give to producers, 0 otherwise
X21	Economic reasons	1 if the reason that would lead the respondent not to consume organic products is due to the price being high or not having enough income, 0 otherwise
X22	Lack of certification	1 if the reason that would lead the respondent not to consume organic products is due to lack of certification, 0 otherwise
X23	Unknown brands	1 if the reason that would lead the respondent not to consume organic products is because the brands are not known, 0 otherwise
X24	Problem in the packaging	1 if the reason that would lead the respondent not to consume organic products is due to packaging problems, 0 otherwise
X25	Do not have habit	1 if the reason that would lead the respondent not to consume organic products is due to not having this habit, 0 otherwise
X26	Not knowing the Benefits	1 if the reason that would lead the respondent not to consume organic products is due to not knowing their benefits, 0 otherwise

Source: survey results (2021).

The choice of questions to form the questionnaire was based on several previous studies on the subject. Arguing about the socioeconomic profile (age, sex, income, marital status, among others) is very common and essential for this type of analysis, because with these questions it is possible to find patterns of consumers. In addition, knowledge about consumer behavior is a tool for companies and government that allows developing mechanisms to encourage or discourage behavior within society. In other words, with this knowledge it is possible to develop marketing strategies and identify market opportunities (DUARTE, 2016).

The question related to the person responsible for household purchases was based on Corrêa (2016), which also included questions related to the socioeconomic profile. The question about the definition of organic products to measure knowledge about organics was based on Raposo (2018).

Silva (2015), Barros (2018) and Raposo (2018) also presented questions related to the socioeconomic profile. Based on these authors, questions related to the frequency of consumption of organic fruits and vegetables were also included.

Also based on Silva (2015), a question was included regarding the ease of finding organic products. This variable was included to verify another important determinant, above all within the organic market, which refers to its supply in the market, which influences the price, as products that are scarcer or more difficult to produce have a higher price premium.

The influence of price on the willingness to pay for organic products was included through the economic motives variable, where the respondent informed the reasons that could discourage the consumption of organic products. As Mendes (2006) points out, price is an important variable in the purchase decision, and it is expected that the sign of this variable is negative, that is, the higher the price of organic products, the less willing to consume are the respondents.

The risk group variable was constructed based on Mendes (2006) in order to verify the altruistic character of the consumer, who would not only be interested in maximizing his utility based only on the goods/services he consumes, but also on the effects that these goods/services may have on the welfare of others. People with these characteristics would be more vulnerable to the effects of pesticide problems in food. The attitude and risk perception variable was also based on Mendes (2006).

The risk group variable is related to whether the respondent lives with a person with cancer. Due to the importance of the discussion in the literature of pesticides as cancer-causing agents, it was decided to ask whether the respondent had or has a family member with cancer, who may not live with the respondent. Thus, people with this background would be more likely to have a higher DAP due to this prior knowledge and sensitivity to this risk.

According to Raposo (2018), the main motivations for the consumption of organic foods are the concern about health and the care about the environment. Thus, the respondents were asked if they work in the health area, because working in this area, it is assumed that they are more likely to know the benefits of healthy foods. Then, in this sense, based on Silva (2015), Brandão (2016) and Barros (2018), consuming for the concern about health, the environment and to encourage producers, were included.

In the organic market there are some problems, among them is the asymmetry of information, because the organic quality is not observable, not even after consumption. On this wise, often only the producer or the marketer has this information, leaving the consumer hostage to what is advertised, where another problem can arise, the opportunism. To face these problems, the issue of organic certification arises, in which the objective is to achieve the consumer confidence and certify the compliance of organic products with the required standards. Certification is controlled by external agents and they need to be duly authorized to audit. For producers, certification can represent earning opportunities. However, this requires higher production costs (SOUZA; BATISTA; CÉSAR, 2019).

The questionnaire included a question whether the lack of certification could be an impediment to not consuming organic products, based on Raposo (2018). In the same sense, the test/government variable was included to capture concerns about food safety for consumers and the confidence given to the government to play the role of certifier, as Mendes (2006) used.

According to Corrêa (2016), regarding certification, food labels and the credibility of the information contained in them are important. As the certification information is usually on the labels, it was asked if the respondents have the habit of reading them.

Seeking to investigate other impediments to the consumption of organic products, basic questions related to marketing were included, such as brands and packaging that can support the decisions of producers and traders and questions related to the habits and knowledge of these products that can support public policy actions. These questions were also added based on Cunha (2006), Corrêa (2016), Brandão (2016) and Barros (2018).

Binary regression models

The dependent variable of the research will be binary (if the consumer is willing or not to pay a higher price for organic fruits and vegetables) and for this qualitative regression format, Gujarati and Porter (2011) inform that there are challenges in its estimation and interpretation. For this reason, it is necessary to specify and know the regression models with qualitative dependent variables. In this case, the objective is to find the probability of a certain variable occurring, that is, the probability of respondents paying a higher price for organic fruits and vegetables. For the data obtained by the applied questionnaire, three regression models with binary dependent variables will be tested: the Linear Probability Model (LPM); the logit model; and the probit model. They will be specified based on the works of Gujarati and Porter (2011) and Hill, Griffiths and Judge (2003).

LPM is similar to linear regression, however, the dependent variable is binary, so the dependent variable expresses a conditional probability of the event occurring given the independent variables. Therefore, the sum of the probabilities of occurring (P_i or not ($1 - P_i$) the event is equal to 1. The conditional probability can be expressed by the mathematical expectation $E(Y_i|X_i) = \beta_1 + \beta_2 X_i$, and considering the probability of the event occurring (1) or not (0), the expectation can be expressed in terms of $E(Y_i) = 0(1 - P_i) + 1(P_i) = P_i$. This corresponds to saying that: $E(Y_i|X_i) = \beta_1 + \beta_2 X_i = P_i$.

Besides that, the probability of P_i must respect the restriction $0 \leq E(Y_i|X_i) \leq 1$, i.e., the conditional probability must be between 0 and 1.

LPM estimations are that there is no normality of the error term, in addition to the error term being heteroskedastic. For the first problem it can be assumed that they are normally distributed for large samples, although this problem does not affect the point estimates by Ordinary Least Squares (OLS) which remain unbiased even for small samples. For the second problem, the fact that the errors are heteroskedastic makes the OLS estimators inefficient. However, this can be worked around using Weighted Least Squares (WLS). Gujarati and Porter (2011) also indicate that the coefficient of determination R^2 is also not suitable for models with a qualitative dependent variable due to the fact that the dichotomous values (0.1) do not fit well to a scatter plot and are always found within the logical range 0-1.

Another problem with this estimation is that it admits the possibility of the estimated dependent variable being outside the range between 0 and 1, not respecting the restriction $0 \leq E(Y_i|X_i) \leq 1$. This is because as the probability is linear, the increases in the independent variable have a constant effect on the probability of the dependent variable. One way to resolve this impasse is to consider the estimated dependent variable as 0 when it is negative, and consider it as 1 when it is above this value. Another way is to use estimation techniques that guarantee that the estimated conditional probabilities are between 0 and 1 and this can be done through the logit and probit models.

Although this last problem is solvable, it is noted that it is not very attractive due to its logic of increasing the probability of the independent variable linearly with increases in the independent variable, that is, in reality, one would not expect that the marginal effect of the independent variable would be constant all the time, but that it approaches 0 at ever-smaller rates as the independent variable decreases, and that it approaches 1 at ever-smaller rates as the independent variable gets larger, with a curve shaped like a " S" and nonlinear (GUJARATI; PORTER, 2011).

Unlike LPM equation, the probability equation for the logit function is expressed by:

$$P_i = \frac{1}{1+ e^{-(\beta_1 + \beta_2 X_1)}} \quad (1)$$

Equation (1) can also be written through Equation (2) which represents the logistic distribution function, which varies z_i from -∞ to +∞ and P_i varies from 0 to 1. In which the value of e = 2.71828.

$$P_i = \frac{1}{1+ e^{-Z_i}} = \frac{e^z}{1+ e^z} \quad (2)$$

In which $z_i = \beta_1 + \beta_2 X_1$.

In this way, P_i it is nonlinear in β, and this means that OLS cannot be used to estimate the parameters. However, Equation (1) can be linearized, so that if the probability of the event occurring is given by Equation (2), then $(1 - P_i)$ represents the probability of the event not occurring, according to Equation (3).

$$1 - P_i = \frac{1}{1+ e^{-Z_i}} \quad (3)$$

Or, rewriting:

$$\frac{P_i}{1-P_i} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{Z_i} \quad (4)$$

In this way, $\frac{P_i}{1-P_i}$ is the odds ratio that the event will occur minus the ratio of the probability that the event will occur versus the probability that the event will not occur. If we use the natural logarithm of Equation (4), we obtain the logarithm of the odds ratio, which is linear in *X* and linear in the parameters, circumventing the problem of lack of linearity in *β*. In Equation (5), L is called the logit.

$$L_i = ln\left(\frac{P_i}{1-P_i}\right) = Z_i = \beta_1 + \beta_2 X_i \quad (5)$$

logit model, when P varies from 0 to 1, the logit L varies from -∞ to +∞. The probabilities will lie between 0 and 1, but the logits are not limited. Furthermore, although L is linear in X, the probabilities will not be, as in the LPM and which would not seem to correspond to reality.

If L was positive, it demonstrates that, when the value of the independent variable increases, the chances of the dependent variable being equal to 1 increase, i.e., it indicates an increase in the chances of the event occurring. If L is negative, the chances of the dependent variable being equal to 1 decrease as the value of the independent variable increases, so the odds ratio decreases.

The probit model, as demonstrated by Gujarati and Porter (2011), can be expressed by an unobservable utility index I_i that will be determined by the independent variables, so that the higher the value of the index, the greater the probability of the event to happen. Equation (6) demonstrates the I_i index:

$$I_i = \beta_1 + \beta_2 X_i \quad (6)$$

There is a critical level (I_i^*) at which, if you I_i exceed I_i^*, there is the occurrence of the event, otherwise, there is no occurrence. Assuming that the index is normally distributed with the same mean and variance, it is possible to estimate the parameters from Equation (7):

$$P_i = P(Y = 1|X) = P(I_i^* \leq I_i) = P(Z_i \leq \beta_1 + \beta_2 X_i) = F(\beta_1 + \beta_2 X_i) \quad (7)$$

Where $P(Y = 1|X)$ indicates the probability of an event occurring given the value of the independent variable X, and where Z_i is the standard normal variable, *F* is the standard normal cumulative distribution function, the probit function, and can be expressed as follows:

$$F(I_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{I_i} e^{-z^2/2} dz = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta_1+\beta_2 X_i} e^{-z^2/2} dz \quad (8)$$

From the estimation of I_i, we estimate β_1 and β_2. The index I_i will be negative whenever $P_i \leq 0.5$. This means that if $P_i > 0.5$, the event occurs and if $P_i \leq 0.5$, the event does not occur.

The results obtained from logit and probit are similar, the difference is that in the logistic distribution the conditional probability P_i approaches 0 or 1 slower in logit compared to probit. In this way, both models could be used, however, many researchers prefer the logit model for its mathematical simplicity.

Tests for model adjustment

After defining the variables used to estimate the logit and probit models, built from the application of the questionnaires, it is necessary to carry out some adjustment tests of the models. The first step is to verify the degree of multicollinearity of the explanatory variables. According to Fávero (2015), among the known assumptions of regression estimated by ordinary least squares, this is the only assumption to be concerned about in binary models. This procedure is recommended to verify that the independent variables do not contain similar information to explain the same phenomenon. According to Hill, Griffiths and Judge (2003), as a rule of thumb, when the Tolerance value is less than 1 there is no multicollinearity or when the Variance Value Inflation Factor (VIF) is in the range of 1 to 10 multicollinearity is acceptable. If any variable presents non-acceptable multicollinearity, it needs to be removed from the analyses.

The next step is to verify the significance of each parameter of the models through Wald's z statistic. The null hypothesis of this test is that the parameter value is equal to zero, so it is necessary to reject the null hypothesis (AMARAL, 2019; NICKEL, 2019). According to Freitas (2013) the Wald test is similar to the values of the F or t test of significance in linear regression. When the coefficients are significant they can be used to identify the relationships that affect the probabilities. Initially, all the variables in Chart 1 are included in the analysis and the variables that do not present a minimum significance of 10% will be removed from the models. This will be done through the *stepwise procedure backward* (step regression). The software used in this work will be Stata.

An important statistic to analyze the fit of binary models is through the likelihood ratio test. This test verifies the significance of the coefficient of a variable by comparing the observed values of the response variable with the predicted values. It does this for two models, the first with the variable present and the second without this variable. Thus, it serves to compare models when it is intended to include or remove variables and to verify the global adjustment when the comparison is made with the model only with the constant. The null hypothesis of this test is that the models are equal (PEREIRA; TEIXEIRA; LIMA, 2009; AMARAL, 2019). Freitas (2013) considers this test asymptotically equivalent to the Wald test, but more powerful due to a greater increase in the probability of rejecting the null hypothesis.

Likewise, another valuable test to measures the degree of accuracy of the logistic model is Hosmer and Lemeshow. This test corresponds to a Chi -square test (2) that divides the number of observations into ten classes and then compares the predicted frequencies with those observed. The purpose of this test is to verify if there are significant differences between the model predictions and the observed reality. We seek not to reject the null hypothesis, i.e., that there are no differences between the predicted and observed values (AMARAL, 2019).

In binary models, as the dependent variable is qualitative, it makes no sense to discuss the percentage of its variance that is explained by the predictor variables, i.e., in binary models, R^2 does not have the same interpretation. Similar measures are calculated, called Pseudo R^2, and are only for comparing models, where the highest value denotes the best model. Thus, what matters are the expected signs of the regression coefficients and their statistical and/or practical significance. Even so, these values will be presented as a way of comparing logit and probit (FÁVERO, 2015; GUJARATI; PORTER, 2011).

Another simple measure of the goodness of fit of the models is the count R^2. It is nothing more than the number of correct predictions divided by the total number of observations. Let's use the cutoff, called the *cutoff*, of 0.50, so if the predicted probability is greater than 0.5, we classify it as 1, but if it is less than 0.5, we classify it as 0 (GUJARATI; PORTER, 2011). According to Fávero (2015), the Count R^2 measures the global efficiency of the model and is more suitable for evaluating the performance of a model than Pseudo R^2.

Derived from this measure of correct classification, there are sensitivity and specificity measures that will also be presented. Sensitivity refers to the percentage of success, for a *cutoff* here, too, 0.5, which is the default, considering only observations that are actually events. In other words, it is the ability of the model to predict which people would pay more for organic products, since it was assigned in database 1 if the person said they would pay more (FÁVERO, 2015).

Specificity, on the other hand, refers to the percentage of success, given a certain *cutoff*, considering only observations that are not events, that is, the model's ability to predict who would not pay more for organic products[1]. Both sensitivity and specificity, the higher its value, the better, more adjusted is the model (FÁVERO, 2015).

4 Results and discussion

Analysis descriptive

In this section, a descriptive analysis of the information collected through the application of the questionnaire to the 204 respondents will be presented, starting with the socioeconomic profile. People between 20 and 72 years old were interviewed. The mean age of the sample was 38 years old. Among the interviewees, 6.37% (13 people) were 28 years old, 5.39% (11) were 37 years old, 4.41% (9) were 26 years old, 4.41% (9) were 40 years old and also 4.41% (9) aged 42 years, these being the main frequencies.

Concerning the respondents, 16.18% (33) declared themselves to be male and 83.82% (171) female. Those who declared themselves whites were 85.78% of respondents (175 people). Regarding marital status, 76% (155 people) stated that they were married or in a stable relationship, 17.1% (35 were single) and 6.9% (14) were divorced.

The personal income that appeared most frequently was between 2 and 3 minimum wages (49 people or 24%). Then, tied, between 3 and 5 salaries (42 people or 20.6%) and between 5 and 7 (42 people or 20.6%).

The education most observed among respondents was complete or incomplete postgraduate education (73 respondents or 35.8%), then complete higher education (49 respondents or 24%) and complete secondary education (41 respondents or 20.1%).

[1]Considering that organic products in general have higher prices than non-organic products, willingness to pay for organic products will be considered synonymous with willingness to pay more for organic products or simply consumption of organic products.

Regarding the number of people living in the residence, for 65 respondents or 31.86% the number was 4 people. Then, for 57 respondents or 28%, the answer was 2 people, and for 48 people or 23.53%, 3 people. Only 1 respondent reported living in a home with 7 people and 12 reported living alone.

Table 1 shows the frequency of respondents and the percentage for the other variables (8th to 26th). The data refer to whether the respondent presented the given attribute.

Table 1 - Frequency and percentage of responses

Variable	Variable Name	Frequency	percentage %
X8	Risk group	118	57.84
X9	Relative with cancer	115	56.37
X10	Work in the health field	19	9.31
X11	Test / government	36	17.65
X12	Reads labels	131	64.22
X13	Risk perception	72	35.29
X14	Attitude	181	88.73
X15	Never bought organic	19	9.31
X16	Purchase organic	128	62.75
X17	Difficult to find	49	24.02
X18	Concern about health	191	93.63
X19	Concern about the environment	82	40.20
X20	Incentive to the producers	50	24.51
X21	Economic reasons	144	70.59
X22	Lack of certification	25	12.25
X23	Not knowing brands	23	11.27
X24	Problem in the packaging	11	5.39
X25	Do not have the habit	17	8.33
X26	Do not know the benefits	19	9.31

Source: survey results (2021).

Regarding Table 1, it should be noted that more than half of the respondents reported having or having had a family member with cancer. Only 19 never bought organic fruits and vegetables. Also 19 people claimed to have difficulty finding organic products, these numbers, although small, may be an opportunity for a niche market and also public policy actions to encourage the sector, as indicated by Aquino, Gazolla and Schneider (2017). Less than 10% of the interviewees pointed out that they do not have the habit of consuming organic products and that not knowing the benefits of the products discourages consumption. A positive point is that for more than 90% of those interviewed, the reason why they consume organic products is the perception that they are healthier. These numbers indicate that respondents have knowledge about the subject. Despite this, increasing knowledge of these products can serve as an incentive for other people to consume, as almost 5% of the sample was withdrawn due to respondents not knowing the correct definition of organic.

Econometric results

Before presenting the results of the binary econometric models, Table 2 shows the results of the test to detect the degree of multicollinearity for the independent variables of the models. To find this result, the LPM was estimated using

the ordinary least squares, because, through the logit and probit, this test is not performed. As the Tolerance values were less than 1 and VIF less than 10, we can proceed with the analyzes with these variables. All the variables in Table 1 obtained with the application of the questionnaires were tested and presented acceptable multicollinearity, however, in Table 2 the statistics are presented only for the variables that were statistically significant at least 10%.

Table 2 - Verification of Multicollinearity

Variable	Tolerance	VIF
Age	0.735	1.36
Education	0.558	1.79
Relative with cancer	0.856	1.17
Perception	0.647	1.55
Test / government	0.806	1.24
Problem in the packaging	0.783	1.28
Not knowing the benefits	0.800	1.25
Economic reasons	0.780	1.28

Source: survey results (2021).

After detecting multicollinearity, the logit and probit model was run with all the variables obtained with the application of the questionnaires. Through the *stepwise procedure* variables that did not show a minimum significance of 10% were excluded. The final models are presented in Table 3. We will only consider logit and probit due to their advantages as pointed out.

Table 3 - Estimation of logit and probit models

	LOGIT			PROBIT	
Variable	Parameter	odds ratio	p -value for Wald test	Parameter	p -value for Wald test
Age	0.041	1.041	0.06***	0.021	0.08***
Education	0.347	1.415	0.00*	0.198	0.00*
Relative with cancer	0.672	1958	0.08***	0.406	0.06***
Risk perception	0.916	2,498	0.04**	0.583	0.02**
Test/government	-0.883	0.414	0.06***	-0.527	0.05**
Problems in the packaging	-1,885	0.152	0.02**	-1.068	0.02**
Not knowing the benefits	-1,421	0.242	0.02**	-0.812	0.02**
Economic reasons	-1,218	0.296	0.01**	-0.680	0.01**
Constant	-1,353	0.259	0.24^	-0.705	0.28^
Likelihood ratio test	significance 0.000* Comparison 0.881^			significance 0.000* Comparison 0.847^	
Hosmer and Lemeshow Test	Significance 0.820^			Significance 0.603^	
Pseudo R^2	0.176			0.175	
Number of observations	204			204	

Source: survey results (2021).
Note: statistically significant at 1%*, 5%**, 10%***, not significant^.

According to Table 3, through the likelihood ratio test, for both probit and logit, it can be concluded that they are adjusted when removing statistically insignificant variables, the models do not lose relevance.

According to Table 3, Hosmer and Lemeshow test, both in logit and in probit, we can conclude that the models are well adjusted.

Regarding the Pseudo R^2, in Table 3, the values for probit and logit were 0.01 of the difference. Despite the small difference, the other results will be analyzed, therefore, based on the logit. It was also chosen because, from it, it is possible to analyze the odds ratios, i.e., the chances of an event happening, or what the variable in question indicates.

Using the Wald test, the variables "age", "relative with cancer" and "test/government" were statistically significant at 10%. "Risk perception", "packaging problem", "not knowing the benefits" and "economic reasons" were statistically significant at 5% and "schooling" statistically significant at 1%. Thus, the estimated coefficients are different from 0 and the analysis continues.

According to the positive sign of the coefficient of the age variable, as the age of the research consumers' increases, the probability of them paying a higher price to consume organic fruits and vegetables increases. Analyzing the odds ratio, each year the consumer grows older, the chance of paying more to consume organic products increases by 4.1%. Schooling had the same behavior, and it can be concluded that more educated consumers are more likely to pay a higher price for organic products. The chance of a consumer to increase their organic consumption is 41.5% higher with each level of education. The signs of the coefficients were as expected.

Consumers who reported having or having had a family member with cancer are also more likely to pay a higher price to consume organic fruits and vegetables. The chance of a consumer with a family member with cancer consuming organic products is almost double that of a person who does not have this characteristic, 95.8% more. Those people who are concerned about the presence of pesticides when purchasing fruits and vegetables are also more likely to pay a higher price for these products, as expected. People with this perception of risk are 2.5 times more likely to consume organic products than a person who does not have this concern, or 150% more chance.

According to the negative signs, one of the factors that reduces the likelihood of consumers overpaying for organic fruits and vegetables is problems with the packaging of these products. When a consumer perceives packaging problems, he is 15.2% less likely to pay more for that product. Another factor pointed out that could discourage paying more for these products is the lack of knowledge about organic products, which would discourage consumption by 24.2%.

The higher price of organic products or insufficient income was also significant and is a factor that reduces the likelihood of consumption of organic products. The probability reduction is in the magnitude of 29.6% for respondents with this characteristic. For Mendes (2006) the high price also had a negative sign, indicating that the willingness to pay for organic products decreases. Santos and Silva Júnior (2015) also found a similar relationship, as they found in their study that the main variable determining the odds ratio of consumption of organic food in Pernambuco is income. The fact that organic production incurs higher costs, thus determining also

higher prices, condition that these products are consumed by people with higher incomes.

Among the most challenging factors in the organic market in Brazil, discussed and pointed out by Terrazzan and Valarini (2009), Neto *et al.* (2010), Barbosa and Souza (2012) and Padua -Gomes, Gomes and Padovan (2016), are questions related to the high cost of production, including bureaucracy costs, lack of assistance and technologies, difficulty in accessing credit, among others, which cause the higher value of the price of the organic product compared to the conventional product. For this reason, the rise of this market still includes, in greater proportion, the higher income classes, as well as the richest countries.

The estimated coefficient for the test/government variable showed a negative sign, thus indicating that choosing the government as the certifying body for organic products decreases the likelihood of consumers paying more for these products. Mendes (2006) also found this negative coefficient. A possible explanation is that the consumer is linking in some way that, since the government is the certifying body, there would be no reason to pay more for these products.

As analyzed in the descriptive analysis section, the average profile of the study sample is a 38-year-old respondent with a postgraduate degree, and the most frequent answers were that he/she has or has had a family member with cancer and he/she consider the low income or high price of organic products a consumption limiter. A consumer with this profile is 86.4% likely to pay more for organic fruits and vegetables. If we consider the same profile, changing only education to high school, the probability of consuming organic products increases to 69.2%. If we consider the same initial profile, changing it only to not have a family member with cancer, the probability drops to 77.7%.

A 38-year-old consumer with a postgraduate degree, who has or has had a family member with cancer and who does not consider low income or high price of organic products a limiting factor in consumption, has a probability of 95.5% consumption of organic products. This same consumer profile, changing schooling to high school, presents a probability of 88.3%.

Consumer aged 28 years was the highest age frequency identified in the sample. The 28-year-old profile, with a postgraduate degree, who has or has had a family member with cancer and who considers the low income or high price of organic products a limiting factor in consumption, has a probability of paying more for organic products of 80.75%. This same profile changing from postgraduate to complete higher education the probability becomes 74.8% and changing to high school drops to 59.8%.

A last simulation carried out consists of a 20-year-old consumer, with high school education, does not have a family member with cancer (or would not be concerned about this issue here) and he/she considers income or price an impediment, the probability of consuming organic products is 37 %.

These simulations make clear the impact of age and schooling on the probability of paying a higher price for organic fruits and vegetables. Older and more educated people are more willing to pay more. This happens because these factors positively affect the way people perceive the health risks offered by food. For example, Santos and Silva Júnior (2015) also found this relationship for the

consumption of organic products for the age and education variable, and Mendes (2006) and Corrêa (2016) for education.

Table 4 shows the classification of the models, for both logit and probit, as these results are the same. Considering 156 respondents who reported being willing to pay a higher price for organic fruits and vegetables, the models were correct in 147, that is, the sensitivity of the model was 94.23%. Regarding the 48 who were not willing to pay a higher price, the model was right in 14, which represents a specificity of 29.17%. It can be concluded that these models are better at predicting consumers willing to pay a higher price and not those who are not willing to pay. Overall, the model was able to correctly predict 161 observations, representing 78.92%.

Table 4 - Classification of models according to *cutoff* of 0.5

	Observed		
Estimated	Willingness to pay more for organic +	Not willingness to pay more for organic -	Total
Willingness to pay more for organic +	**147**	34	181
Not willingness to pay more for organic -	9	**14**	23
Total	156	48	204
Sensitivity	94.23%		
Specificity	29.17%		
Correct classification (Count R^2)	78.92%		

Source: Survey results (2021).

The literature identifies common factors that are challenges to be faced by the organic products market, such as lack of information and high production costs (NETO *et al.,* 2010; BARBOSA; SOUZA, 2012; PADUA -GOMES; GOMES; PADOVAN, 2016) and that the results of this research corroborate. The higher price or even lower incomes is a factor that reduces the probability of purchasing organic products, which means that the higher costs in their production affect the commercialization in lower social classes. In addition, the lack of basic information, such as the concept of organic products, removed from the sample of this research about 5% of the individuals.

In this sense, Aquino, Gazolla and Schneider (2017), place the government as an important actor, capable of encouraging and investing in the structuring of the market through credit, alternative production policies, generation and expansion of information and new technologies, among other aspects of regulation and less bureaucracy.

In addition to the challenges faced by the sector, there are several potential improvements that can be studied and introduced through multisectoral policies, indicated by other research, such as the studies by Khatounian (2001), Santos and Monteiro (2004), Fonseca and Medaets (2005), Schultz (2007), Barbosa and Souza (2012) and Ferreira *et al.* (2016), and reiterated by the results found here for the municipality of São Lourenço do Oeste.

The concern about environmental, social and health well-beings contribute to the increase in the consumption of food free of chemical inputs, providing bases for an increase in the willingness to pay for organic products. In addition, the effect is amplified with the increase in information, either through formal schooling, or even informal campaigns, as well as with the reduction in the price of these products, which can be achieved with the insertion of technologies, with the action of public policies authorities in certification, reducing bureaucracy and regulation, facilitating access to credit and technical assistance.

5 Finals Considerations

The aim of this research was to investigate the determinants of consumers' willingness to pay a higher price for organic fruits and vegetables in the municipality of São Lourenço do Oeste, in the State of Santa Catarina, using binary regression models LPM, logit and probit.

The econometric results indicated that age positively affects the willingness to pay for organic products within the scope of this research. The odds ratio showed that each year the consumer is older, the chance of paying more increases by 4.1%. Schooling also showed a positive relationship with the willingness to pay more for these products. With each additional level of education, the chance of consumers paying more for organic products increases by 41.5%.

Similarly, with a positive relationship, the fact that the individual has or has had a family member with cancer increases the probability of paying more for organic products by 95.8%. Likewise, the risk perception regarding pesticides determined that these individuals are 2.5 times more likely to pay more for organic products.

On the other hand, the factors that negatively impact the willingness to pay more for organic fruits and vegetables are: packaging problems, which reduces the willingness to pay by 15.2%; the lack of knowledge about organic products reduces the willingness to pay by 24.2%; and economic factors such as high prices and insufficient income reduce the probability of paying more by 29.6% for respondents with this characteristic.

It is noted that the concern with health and quality of life contributes to determine the increase in the consumption of organic products. This is demonstrated by the results found here, in which schooling, age, increased information available and price reduction were some key factors to increase the probability of an individual paying more for organic fruits and vegetables. In this sense, multidimensional public actions can improve the dynamics of this market through the insertion of technologies, information dissemination campaigns, certification programs, regulation and reduction of bureaucracy, in addition to facilitating access to credit.

As a proposal for future research, it is recommended to carry out the study in other municipalities and regions, for comparison purposes. Other variables, other methodologies and other approaches can also be used. Research on the demands and difficulties of producers is also essential.

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