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Assessment of the Environmental Public Goods of the Organic Farming System: A Lithuanian Case Study

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Abstract: Organic farming is a farming system that combines environmental farming practices, a high degree of biodiversity, and the protection of natural resources. All these environmental services are used in society as public goods, contributing to societal welfare. Understanding the opinions of residents on these environmental public goods is essential because they are both consumers and financial contributors to the common agricultural policy. Therefore, it is imperative to further existing scientific knowledge in the field of consumer behaviour. Using Lithuania as a case study, the present study focuses on analysing societal opinion and willingness to pay (WTP) with respect to the environmental public goods (reflected in three components: the reduction in water, soil, and air pollution) of organic farming. This study uses the contingent valuation (CV) method to obtain the WTP for public goods. The median WTP was calculated for multiple environmental public goods from organic agriculture, excluding the protest zero. This study revealed that the residents of Lithuania understood the contribution of organic farming in creating environmental public goods and were concerned about environmental issues. It was crucial for them to have a clean environment with, for example, better drinking water quality, lower air pollution and soil erosion. The application of the CV method showed a median WTP of EUR 24.58 annually per family for environmental public goods. The preference towards environmental public goods differs depending on the socioeconomic characteristics and knowledge about organic farming. These findings provide quantitative information regarding the demand for the environmental effects of organic farming, which could be useful for policy-makers. Such research could also prove useful in setting the future direction of the common agricultural policy. The example of Lithuania was used to present a universal research problem that concerns European countries, especially those in the European Union.

Keywords: contingent valuation; organic farming; public goods; willingness to pay

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1. Introduction

Agriculture is an area of the economy that uses natural resources in its production processes. Farmers play a significant role as the owners of these resources on a local, regional, national, economic, and global scale. Because of the rational use of resources, agricultural producers have a significant impact on the shaping of the natural environment. This state of affairs has substantially influenced the formation of cultural ecosystems and the provision of ecosystem services in rural areas, including healthy and safe food; the quality of soil, air, and surface water; biodiversity; and a rich landscape [1,2].

The concept of ecosystem services came into circulation in 1981. It was a joint initiative of economists and ecologists. It was then found that accounting for the services of nature in economic services could contribute to the correction of erroneous assessments of the relationship between man and nature. Costanza et al. proposed a universal definition

of ecosystem services as the benefits to humanity that directly or indirectly derive from ecosystem services. Initially, ecosystem services used to be recognised as a domain of natural ecosystems only [3]. However, this view was quickly extended, emphasising that, besides producing food, feed, and raw materials, agriculture could also provide ecosystem services similarly to natural ecosystems.

Agriculture affects the environment, climate, and human health in a variety of ways. We need agriculture to produce food, but certain unsustainable farming practices result in soil, water, air, and food pollution. Furthermore, plants need nutrients to grow, while intensive farming may deplete nutrients from the soil faster than the nature replenishes them. The purpose of fertilisers is to compensate for this deficit and introduce additional nutrients. Overdosing of nitrogen fertilisers, failure to comply with the schedule, and conditions of their application contribute to the eutrophication of water and land ecosystems. Excess nitrogen in the water often leads to overgrowth of plants and algae, the decomposition of which may lead to a severe reduction in the oxygen level in the water, thereby damaging the animal and plant species in this ecosystem. Similar outcomes could be observed when phosphate fertiliser is overused in comparison to the actual need of the crop. Irrational management of manure, liquid manure, and slurry on a farm pursuing animal production may lead to air pollution (ammonia emission) and cause damage to sensitive ecosystems. Greenhouse gas emissions contribute to climate change, e.g., in animal husbandry, and result from the use of fertilisers and enteric fermentation.

An analysis of soil samples from across Europe confirmed the presence of chemicals from the long-term use of pesticides. More than 80% of the soil samples contained pesticide residues and 58% contained at least two types of residues [4]. Therefore, it is necessary to seek and promote agricultural systems that are the least burdensome for the environment and humans.

In addition to the traditional functions related to food production, agro-ecosystems (man-controlled ecosystems wherein the processes of the natural environment are transformed by agricultural activity) have been assigned with increasingly more new functions linked to the provision of numerous services that are important for human well-being [5,6]. In this context, the contribution of organic farming could be important as many agro-ecosystem services are developed through organic farming [7,8]. This system of agriculture integrates the sustainable use of land and the protection of agricultural biodiversity [2]. The unique biophysical and social interactions in the landscape result in the sustainable use of soil, water resources and biodiversity. Agro-ecosystem services yield positive externalities, and their emerging social benefits are often greater than expected.

The ecological farm management model ensures sustainable soil fertility, high biological quality of crops, and animal health [9]. The application of organic farming results in lower nutrient leaching, lower erosion rates, and lower pesticide levels in water bodies as well as greater soil carbon storage [10].

Organic farms use environmentally friendly methods of agricultural production as mandated by a certificate issued by an authorised unit or in the process of conversion to this production system under its control. The rules on their functioning are provided in both the national and European Union (EU) legal regulations. The fundamental principles of organic farming are as follows: health, ecology, justice, and caring [11]. Organic farming is an alternative farming system to conventional farming and combines the best environmental farming practices, a high degree of biodiversity, the protection of natural resources, an application of high animal welfare standards and production methods that are based on natural substances and processes [12].

Political support for organic farming was strengthened through the changes that were introduced in the common agricultural policy. In relation to certain resources for the rural development pillar of agricultural policy, the creation of positive externalities by agricultural producers was promoted [13]. European agricultural policy drew attention to this in as early as the late 1980s, and the development of agri-environmental programmes was introduced in 1992 as an obligation for the member states under the Mac Sharry Reform.

Further reforms (such as Agenda 2000 or the Fischler Reform) contributed to the support of organic farming activities [14,15]. Currently, it is important to provide society (and, in particular, an increasingly more aware and demanding consumer base) with healthy, tasty, and safe food as well as public goods.

The ecological reconstruction of the EU economy proposed in the European Green Deal sets new tasks for agriculture and rural areas. As agriculture takes on a new dimension, it becomes an increasing part of the production sphere of environmental public goods. Moreover, the political importance of the role of farmers in adapting to climate change and its mitigation is also growing. Lithuanian citizens are the consumers of such environmental public goods. At the same time, they contribute financially to the agri-environmental policy as taxpayers. Thereby, their opinion, knowledge about organic farming and preferences should also be considered. In this context, the present study focuses on analysing societal opinion and willingness to pay (WTP) for the environmental public goods of organic farming, using Lithuania as a case study. It identifies the respondents' socioeconomic and knowledge characteristics that determine WTP. This study uses the stated preference method contingent valuation (CV) to obtain the WTP for public goods. In addition, this study makes an attempt to demonstrate the importance of environmental public goods, taking organic farming as the case study. The paper is structured as follows: Section 2 describes the main materials and methods, including the theoretical and empirical background for the evaluation of public goods from organic farming, features of organic farming in Lithuania, and explains the methodology applied in the research. Section 3 explains the results of the empirical application. Finally, Sections 4 and 5 present the discussion part and the main conclusions.

2. Materials and Methods

2.1. Theoretical and Empirical Background

Currently, the relationship between agriculture and the environment is becoming increasingly important. Because both are at the level of economic groupings, e.g., in the EU and national agricultural policies, attention needs to be given to supporting agricultural producers in the development of innovative and sustainable farm management strategies.

As part of the reformed common agricultural policy (CAP 2021–2027), the new eco-schemes are expected to provide a substantial amount of funding to stimulate sustainable practices such as precision farming, agro-ecology, soil carbon-friendly farming, and the agroforestry system. In addition, one important goal of the strategy is to devote at least 25% of EU agricultural land to organic farming by 2030. This is an extremely ambitious goal because according to the EUROSTAT statistics, the share of agricultural land that was covered by organic farming in the total agricultural area in the EU in 2020 was 8.49% (with the highest in Austria at 25.33%). In Lithuania, the rate was 7.60%.

In 1991, organic farming was formally regulated at the EU level. Since 2018, European requirements for organic production have been defined in Regulation (EU) No. 848/2018 of the European Parliament of the Council of 30 May 2018 and have been followed since 2021 [14]. The dynamically developing trend of sustainable consumption is manifested, inter alia, in a growing interest in organic products from consumers [16].

Organic farming is also of particular importance because there is a clear tendency to 'make public' the activity of agriculture and the goods that it produces (both production goods, i.e., market and non-market, and non-production goods, i.e., environmental, social, and cultural). The identification and appreciation of the many positive externalities of agricultural production in relation to natural resources, culture, and social life of rural areas as well as society's readiness to reward them prompt a consideration of whether these effects can be achieved in isolation from agricultural production. The multi-functionality of agriculture is becoming the most important basis for the socio-political legitimacy of the agricultural policy (especially the common agricultural policy) and an important argument in the trade negotiations of the World Trade Organisation. Thus, it seems justified to question the possibility of distinguishing between the production and commercial matters

of agricultural activity and subjecting them to international regulatory mechanisms. These questions are related to the main issue of the inseparability of the market and non-market functions in agriculture [15]. This phenomenon—the inseparability of the market and non-market functions of agriculture—forms the basis (ideological, political, and substantive) of supporting agriculture (including ecological), which is treated as remuneration for the services to the natural and sociocultural environment that are provided by farmers. This issue is an important component in changing the philosophy and legitimacy of supporting agriculture: from protectionism and sectoral policy (traditional agricultural policy) to the idea of rewarding farmers for providing public goods and services to society [17].

The market system cannot, by itself, lead to the optimal allocation of public goods. Market exchange leads to a scarcity of public goods compared to the socially optimal level. In every sector of the economy, and particularly in agriculture, public goods constitute a socioeconomic, isomorphic system. Organic farming is an excellent example of the provision of public goods. First, it provides nutritious and healthier food to society; second, it focuses on the preservation of nature, providing environmental public goods, such as water quality and the preservation of biodiversity [12].

Previous research has focused mainly on the production functions of organic farming. Further, agricultural production systems (intensive–conventional) and organic farming systems have also been compared in terms of economic efficiency and product health. According to the results of research by Mie et al. [18], eating organic food can reduce the risk of allergic diseases as well as overweight and obesity. French research results from David et al. [19] showed that farmers working in the organic system have better mental and physical health than those working in the conventional system.

Falcone et al. [20] showed that agricultural systems should be planned such that they provide an appropriate level of economic viability while ensuring an efficient use of energy to implement environmentally friendly production strategies. Among other things, the results of a study by Latruffe and Nauges [21] that compared the performance of conventional and organic farming in France showed that food security and scientists' growing concern about the sustainability of ecosystems make organic farming an attractive option for both the government and consumers. In addition, most governments, especially in the United States and the EU, are encouraging farmers to switch to an organic farming system.

The growing population and limited energy supply from fossil fuels pose a serious challenge to society, and there is a real need to develop forms of agriculture that are less dependent on scarce energy sources. It has been suggested that organic farming can provide a more energy-efficient approach owing to its focus on sustainable production methods. Smith et al. [22] suggested that organic farming performs better than conventional farming for almost all types of crops.

In addition, Smith et al. [23] showed that organic farming contributes to the reduction in greenhouse gas emissions by reducing the use of agricultural inputs and increasing carbon sequestration in the soil, but it can also exacerbate emissions by increasing food production elsewhere to compensate for lower organic yields.

The debate on whether organic farming can feed the world's population has been on-going for decades. Some of the latest research, analysing the yields of individual crops, showed significant differences in yields between organic and conventional farming (lower by approximately 25–30%) [24].

Furthermore, Seufert et al. [25] indicated that, in general, the yields from organic farming are usually lower than those from conventional crops. However, under certain conditions (good management practices as well as certain types of crops and growing conditions), the organic system can almost match conventional yields. For organic farming to become an important tool in sustainable food production, there is a need to better understand the factors that limit yields in organic farming and to evaluate the numerous social, environmental, and economic benefits of organic farming systems.

The research of Czech scientists showed that the crops from organic farming consume 1.7 times more direct energy than the crops obtained from conventional farming. The worse

the natural conditions for agriculture are, the greater the difference between the organic and conventional systems is in terms of their efficiency and energy consumption. The conclusions from the aforementioned research can help shape agricultural policy in the Czech Republic, where organic farming receives systematic political support, which leads to an increase in the share of organically farmed arable land, and can be helpful in the decision-making of other countries in this regard [26].

Cisilino et al. [14], who conducted a study in Italy and aimed to perform an environmental and economic assessment of the effects of organic farming subsidies under the area development policy for rural areas in 2007–2013, provided evidence that the environmental performance of organic farming is statistically higher than that of conventional farming and that the considered income indicators do not differ statistically between the two groups.

The benefits of organic farming for biodiversity in agricultural landscapes are still hotly debated, highlighting the importance of precisely quantifying the impact of organic farming compared to conventional farming. Research has confirmed that organic farming has a substantial and positive impact on biodiversity compared to conventional farming, but the magnitude of the effect varies with the group of organisms and the crops tested and is greater in more land-intensive landscapes [27]. As highlighted by Stein-Bachinger and co-authors [28], organic farming has gained widespread scientific and policy recognition for its environmental benefits, although the share of organically farmed land is still small and the extent to which organic farming contributes to promoting biodiversity remains controversial.

In an attempt to create a conceptual framework for economic rent valuation (ERV), which estimates this type of rent resulting from randomness, the endogenous impact of public goods on factors of production in rural areas was evaluated by Czyżewski et al. [17]. The ERV method tries to reduce the systematic errors of the market and conditional valuation methods.

As previously mentioned, farmers are not adequately rewarded for their delivery of public goods, although their role in the production of this quantity of goods is significant and important to society as a whole. Thus, it is important to develop a clear methodology for the valuation of these goods. It is not an easy task because these goods are jointly characterised with the market goods that are provided by farmers. Moreover, another important issue is the assessment of society's readiness to reward farmers for providing these goods (this is one of the basic elements of the socio-political legitimacy of the agricultural policy, particularly the common agricultural policy). Such an attempt was made in this study.

2.2. Research Methodology

2.2.1. Case Study: Lithuanian Organic Agriculture

Lithuania is a rural country. More than 80% of the area is rural, while 52% of the surface land is agricultural land and 46% is arable land [29]. Conventional farming is the most common type of farming in Lithuania and has been used for hundreds of years. Nonetheless, organic farming has been steadily expanding in Lithuania; in 2020, it covered 8% of the national agricultural area. According to the official statistics portal of Statistics Lithuania, the number of organic farms has been steadily increasing: from 9 organic farms in 1993 that covered 148 ha to 2586 farms in 2020 covering almost more than 235,471 ha. Lithuanian organic farms produce both livestock and crop outputs/products. Crop production covers around 52%, and the remaining share consists of livestock production, whereas other organic farming activities such as processing, fishery, and other activities farms, account for only approximately 3% (the data were taken from the Official Statistics portal Statistics Lithuania, available at https://www.stat.gov.lt/home, accessed on 11 February 2020). Arable land comprised the largest share of the organic utilised agricultural area in 2020 at 63.1%, with meadows and pastures at 34.9% and permanent crops at 2% (the smallest share). At the same time, the share of meadows and pastures have been showing an upward trend in the overall structure. The growth in the share of meadows and pastures has been propelled by the payments for organic farming received by farmers. The

payments are granted on the basis of the key criterion of well-maintained fields. Cereals accounted for the largest share in the structure of certified organic agricultural area, i.e., 42%. Wheat made the largest share of crops grown on the certified utilised agricultural area, i.e., 35.6%. Fallow land accounted for the smallest share in the structure of the certified agricultural area, i.e., only 3%, while legumes and protein crops accounted for about 10% in the overall structure (the data were taken from the Official Statistics portal Statistics Lithuania, available at https://www.stat.gov.lt/home, accessed on 11 February 2020).

In recent years, the number of high-quality sources of protein-rich raw materials has been increasing. The production of vegetable protein saves resources (nitrogen, water, etc.) compared to the production of animal protein. Legumes naturally fix atmospheric nitrogen, enrich the soil, and benefit cropping systems (increasing soil fertility and yields in subsequent crops, potentially reducing greenhouse gas emissions, and supporting biodiversity) [30–34].

In Lithuania, organic production farms are primarily engaged in livestock production, and 58.7 thousand units of livestock were reported in the country in 2020. It should be noted that the last five years have been marked by consistent growth in the numbers of certified livestock, sheep, and poultry in Lithuania's organic farms. For example, the number of organically farmed cattle has more than doubled. An increase in the number of sheep of 127.8% has also been observed. The volumes of organic poultry production have also been growing (the data were taken from the Official Statistics portal Statistics Lithuania, available at https://www.stat.gov.lt/home, accessed on 11 February 2020). The growth in the numbers of certified livestock and poultry was determined by the certification of new farms and an increase in the demand for organic meat and eggs.

Organic farming in Lithuania is governed by the Rules of Organic Farming developed on the basis of the Council Regulation on organic production of agricultural products and indications referring thereto on agricultural products and, the standards of the International Federation of Organic Agriculture Movements, and Lithuanian hygiene norms. From 2014 to 2020, the Lithuanian Rural Development (LRD) measure 'Organic Farming' provided support for organic farming. The rules on the implementation of the LDP 2014–2020 programme 'Organic Farming' stipulated the following priorities of the measure: (i) the restoration and improvement of agriculture-related ecosystems and (ii) the preservation and improvement of soil quality. According to the strategic plans that are related to the 2021–2027 multiannual financial framework of the European Union (EU)'s agricultural policy, it is obvious that organic farming will continue to be supported by annual payments for the maintenance and establishment of land areas allocated to organic production.

Research by Novikova and co-authors [35], which was carried out in Lithuania, showed that, in previous programming periods under the common agricultural policy (measure: agri-environmental payments), farmers received the most payments under the scheme of organic farming (approximately 50% of all the financial resources under the agri-environmental payments).

The EU support to Lithuanian farmers for organic farming is one of the main incentives for the increase in the number of organic farms. Recently, support for organic farming has been provided according to the budget of the Lithuanian agricultural and rural development strategic plan 2023–2027. EUR 327.25 million has been allocated to supporting organic farming. According to the Agricultural Support Measures, the support to organic farming aims to preserve the ecosystem, promote biodiversity, maintain and improve soil quality, avoid the problem of soil erosion, maintain employment in rural areas, and create new jobs. Support is provided for the agricultural area of organic products where production takes place [36].

Therefore, organic agriculture might be considered as being under governmental support, with a strong focus on the supply of environmental public goods, such as water, air, and biodiversity. All citizens of Lithuania receive benefits from these public goods. The demand for organic products among people is increasing because these products are healthy and nutritious. Organic farming is also more environmentally friendly and sustainable

compared to conventional farming. Therefore, it can be stated that Lithuanian organic farming provides multiple environmental public goods commonly used by all citizens. Thus, understanding and analysing their opinions and valuation of the environmental public goods acquired from organic farming could provide valuable information for policy-makers in the context of formulating a macroenvironmental policy for allocating payments to farmers. This information could be useful for identifying local residents' environmental awareness in the context of the goals of the Green Deal.

2.2.2. CV and the Survey Design

The contingent valuation (CV) method was employed in this study to measure and obtain a discrete value for the environmental public goods produced by organic farming. CV is a stated preference technique and is used to estimate the value of goods or services that have no market prices [37]. The application of the CV method to the valuation of environmental public goods or ecosystem services has been commonly used by other researchers [38]. CV is the only established approach for estimating environmental values, including passive use values, and is frequently used in the context of government cost–benefit analysis of natural resources [39]. The selection of environmental public goods was performed after the literature analysis on organic farming and its attributes. Organic farming was found to have a wide range of public goods. Hence, this study considered only a small part of environmental public goods from organic farming, defining them by the following attributes: the reduction in water, soil, and air pollution. These attributes were presented and explained to the respondents in a simple way by linking the way of farming to a possible component of environmental public goods. The main determining components and their explanations in view of the value of organic farming were presented as follows:

- Organic farming prevents the entry of chemical substances into the environment because only organic/biobased fertilisers are used in it. Therefore, with the reduction in underground water pollution, consumers receive drinking water of better quality, and, as a consequence, better health conditions;
- The pursuit of organic farming, sustainable land use, and the expansion of permanent meadow areas can help reduce the negative impact of agriculture, and prevent soil degradation and erosion, as well as the loss and desertification of valuable land;
- Organic farming enables a reduction in the release of greenhouse gases into the environment through proper processing of the waste accumulated from farms and by foregoing chemical fertilisers. Therefore, the reduction in the emission of greenhouse gases into the environment leads to cleaner air and better well-being.

A questionnaire (Appendix A) was designed in accordance with the CV methodology proposed by Carson, Hanemann [40]. The questionnaire first introduced the general topic, followed by the question about respondents' knowledge and attitudes about it. Then, the CV scenario was presented, and the respondents were asked about their WTP for the good and requested to identify the reason of such decision. The final part of the questionnaire was designed to collect the information about the respondent's socioeconomic status. The questions were prepared to enable identification of the benefits provided by organic farming in terms of the production of multiple environmental public goods, i.e., lower water, air, and soil pollution.

The CV studies found in the literature usually apply a single-bounded dichotomous choice format or a double-bounded choice format. The single-bounded format is employed when each individual is presented with just one choice question. Conversely, the double-founded format is used when, after an initial bid, the second bid is proposed. If, in the latter case, the initial response is affirmative, the subsequent bid is higher, but if the initial response negative, the second bid is lower [41]. Single-bounded dichotomous choice formats are more frequently used in CV [37,42]. According to Carson and Groves [43], the single-bounded dichotomous choice method is viewed as an incentive that is appropriate under certain assumptions, i.e., individuals have no incentive to respond dishonestly. On

the other hand, double-bounded dichotomous choice CV models are known to be more information-intensive and asymptotically more efficient than single-bounded methods [44]. For this study, a single-bounded dichotomous choice question form was selected to determine the locals' WTP for a cleaner environment, because the single-bounded procedure was easier to implement than the double-bounded one, in particular, in data collection and estimation.

Each person is associated with the utility function $u\ (j,\ Y, S)$, where j is the binary variable/parameter that represents the good to be evaluated: if j equals 1, the individual may gain benefits from the consumption of the good; otherwise, j = 0, Y = income, and S = vector of the individual's socioeconomic characteristics. The design process for the model follows the assumption that each individual's utility is determined by both the provided good and the individual's income. Another assumption is that the utility is stochastic and expressed by the following formula:

$$u(j,\ Y,\ S) = v(j,\ Y,\ S) + e_j \tag{1}$$

where e_j is a random factor, v is the systematic component of utility, and $j = (0, 1)$.

Once the data were collected, econometric modelling was carried out. The logit regression function was used for the calculations, as proposed appropriate for single-bounded dichotomous choice question analysis [45]. The residents' WTP for the environmental public good was determined using the following formula [46]:

$$WTP = -\frac{\beta_0}{\beta_{bid}} \tag{2}$$

where β_0 is the specific constant and β_{bid} is the contribution ratio.

The effect of the respondent's socioeconomic characteristics and awareness of organic farming on their WTP for the environmental public goods of organic farming was determined as follows:

$$\text{WTP} = -\frac{\beta_0}{\beta_p} \tag{3}$$

where β_p is the analysed socioeconomic or awareness characteristic.

The CV survey was used to ascertain the residents' opinions of these environmental public goods, the relevance of the outputs to the residents, and how much the residents would be willing to pay for the maintenance of those outputs. The main aim of the survey was to find out the consumer's WTP for environmental public goods, i.e., to design a hypothetical market and identify the market price of these goods.

The first unit of the CV questionnaire questions was aimed at identifying the importance of organic farming for the respondents. Moreover, the respondents' awareness of the impact of conventional and organic farming on the environment and human well-being was determined. The respondents were then asked about the specific environmental public good—'cleaner environment'—and their WTP for the provision of this public good. Here, three levels of bid were chosen and submitted to three different groups of respondents: 12, 23, and 46 EUR proposed as the additional 5 years of a family tax. This was addressed for specific environmental public good (cleaner environment, reduction in water, soil, and air pollution). The third group of questions was dedicated to collecting information regarding the respondents' socioeconomic characteristics.

The socioeconomic characteristics of the respondents, their opinions about the impact of conventional and organic farming on the natural environment and human well-being, their concerns about environmental phenomena, and their awareness of the impact of different farming systems/methods on the natural environment and human well-being were chosen for this study.

Independent variables, tested as explanatory variables, were socioeconomic characteristics: gender (GENDER), age (AGE), place of residence (RESID), household size (SIZE_H), education (EDU), and monthly household income (INCOME). Other explanatory variables

of consumers' opinions about the impact of conventional and organic farming on the natural environment and human well-being, their concerns about environmental phenomena, and their awareness of the impact of different farming systems/methods on the natural environment and human well-being, coded to a Likert scale, had the values of 1 to 5. In total, 20 (13 knowledge and 7 socioeconomic variables) characteristics were analysed individually in logit models and checked. All statistically insignificant variables were excluded from the final analysis. Therefore, 7 explanatory variables, which affected respondents' WTP, were analysed (Table 1). All these characteristics were analysed individually to identify the characteristics that influenced the consumers' WTP for the analysed public good, expressed as the choice of the respondent to pay (yes = 1; no = 0).

Table 1. Socioeconomic and knowledge variables included in logit model.

Variable	Code	Description
Net monthly family income	INCOME	<EUR 350 = 1; EUR 351–600 = 2; EUR 601–900 = 3; >EUR 900 = 4
Education	EDU	High school = 1 Comparative, special secondary, secondary, and elementary = 0
Assessment of the negative effect of the livestock urine and manure release	L_AU	1 = very small; 5 = very big
Assessment of the negative effect of the use of mineral fertilisers	U_MF	1 = very small; 5 = very big
Concerns about air pollution	W_AQ	1 = never; 5 = always
Concerns about soil erosion	W_SE	1 = never; 5 = always
Opinion about the positive effect of organic crop production	IMP_OC	1 = very negative; 5 = very positive

2.2.3. Sampling Characteristics

A pre-test of the questionnaire was performed in November–December 2019. The questionnaire was given to Lithuanian residents. The pre-test enabled the researchers to check the applicability of the questionnaire and verify the feasibility of the bids. Based on the results provided by the pilot survey, certain amendments were made in the questionnaire and were largely related to the formulation of the questions/statements, making them more understandable for respondents, as supposed by [47].

The main survey was conducted online from February 2020 to April 2020 through random sampling. In total, 400 questionnaires were sent out to the residents, with 326 of the returning questionnaires being completed. Of these questionnaires, a share was rejected as completed inappropriately. Thus, the data of 265 questionnaires were registered and analysed. According to Israel [48] and the target population size, the number of questionnaires collected (n = 265) would reflect the total sample (N = 2794 thousand), with a confidence level of 95% and sampling error of ±7%. The sample presented in Table 2 shows the residents' sociodemographic profile in terms of their gender, area of residence, education, and income.

Table 2. Respondents' socio-demographic profile (N = 265).

Variables	Study Sample		General Population	
	N	**%**	***N* (Thousands)**	**%**
Gender				
Male	63	23.8	1086.4	45.2
Female	202	76.2	1319.4	54.8

Table 2. *Cont.*

Variables	Study Sample		General Population	
	N	%	*N* (Thousands)	%
Age				
18–39	128	48.3	763.3	34.1
40–65	131	49.4	1023.2	45.8
Over 65	6	2.3	449.2	20.1
Area of residence				
City	197	74.3	1875.4	67.1
Village	68	25.7	918.8	32.9
Education				
High school	209	78.9	747.9	37.3
Comparative, special secondary, secondary, and elementary	56	21.1	1255.6	62.7
Income				
<350	25	9.4	522.4	17.7
351–600	65	24.5	627.6	21.2
601–900	99	37.4	743.7	25.2
>900	76	28.7	1063.0	36.0

Notes: (1) The breakdown of the Lithuanian population by gender, age, and area of residence used data obtained from the Lithuanian Statistics, 2018. (2) The data on the educational attainment of the population were obtained from the Lithuanian Statistics, 2017 (the data were taken from the statistics portal of Statistics Lithuania, available at https://www.stat.gov.lt/home, accessed on 15 of January 2020). (3) The data concerning the income of Lithuanian population were obtained from the Survey of Households, 2018.

3. Results

According to the data in Table 3, the Lithuanian residents found it important for the environment to be maintained in a clean and safe condition, i.e., clean air, water, and soil. The majority of the respondents specified that they were thinking extremely often or always about air pollution (72.1%) and drinking water quality (65.3%). The residents were mainly interested in air pollution: 22.3% of the respondents thought about it always and 49.8% very often. The respondents also frequently thought about the drinking water quality (approximately 65%). Soil erosion caught the respondents' interest the least: only 26.1% thought about it very often or always, while 65.7% thought about it occasionally or rarely. Moreover, a share of the respondents (8.3%) never thought about the soil quality.

Table 3. Distribution of the respondents' opinions about the environmental public goods of organic farming.

How often do you think about the following environmental phenomena in Lithuania (%)?					
	Always	Very often	Occasionally	Rarely	Never
Drinking water quality	24.5	40.8	28.3	5.3	1.1
Air pollution	22.3	49.8	24.5	2.6	0.8
Soil erosion	5.7	20.4	37.0	28.7	8.3
How do you assess the impact of conventional and organic farming methods on the natural environment and human well-being (%)?					
Elements	Very positive	Positive	No effect	Negative	Very negative
Conventional farming (crops)	13.9	38.5	11.7	33.6	2.3
Conventional farming (livestock)	11.3	33.6	9.4	33.2	12.5

Table 3. *Cont.*

How often do you think about the following environmental phenomena in Lithuania (%)?					
Organic farming (crops)	49.8	42.7	6.0	1.1	0.4
Organic farming (livestock)	41.1	44.2	10.5	3.8	0.4
Assess the negative impact of different farming practices on the natural environment and human well-being (%).					
Elements	Very high	High	Average	Low	Very low
Use of mineral fertilisers	19.6	41.5	32.8	5.7	0.4
Use of organic fertilisers	5.3	17.0	34.3	26.4	17.0
Use of plant protection products	27.5	38.1	27.2	6.4	0.8
Livestock manure leaching	34.7	39.6	21.9	3	0.8
Environmentally friendly crop production	7.2	9.4	21.5	37.7	24.2
Livestock keeping conditions	14.3	30.6	43.4	7.9	3.8

The respondents' opinions regarding the negative effects of conventional and organic farming on the environment and human well-being showed that a fairly large share of the respondents had negative views towards conventional crop production (35.9%) and livestock farming (45.7%), while only a small share expressed negative views towards organic crop production and livestock farming (1.5% and 4.2%, respectively). This suggested that the majority of the respondents had positive opinions about organic crop production (92.5%) and livestock farming (85.3%).

The respondents were also asked about their opinions regarding the negative environmental effects of agricultural activities due to the use of mineral fertilisers, organic fertilisers, plant protection products, and livestock urine and manure leaching into groundwater, rivers, and lakes as well as the positive environmental effects of agricultural activities due to environmentally friendly crop production.

To explore the price that the residents were willing to pay for the non-commodity outputs of organic farming, the respondents were asked whether they would be willing to pay for an environmental benefit, namely, a cleaner environment—the reduction in water, soil, and air pollution. The answers received suggested that a majority of the respondents (70.6%) were willing to additionally allocate the indicated amount of funds from the family budget in the form of taxes for the environmental benefit. The respondents who refused to pay an additional amount for the environmental benefit (29.4%) most often cited the non-transparent activities of the respective authorities, the lack of clarity as to where the money would be used and a mistrust of the state authorities as the reasons for their choice. The respondents suggested that it would be more productive to educate the public on environmental issues and that people would then naturally contribute to the promotion of sustainable economic activity and a healthier environment by buying organic products. Several respondents also answered that Lithuania was already imposing considerable taxes and that they had no more funds for an additional tax.

A model based only on the proposed bid as an explanatory variable and a respondent's socioeconomic and knowledge model were applied [44]. It included the following variables: (i) variables of the consumers' socioeconomic characteristics: education and income; (ii) variables of the consumers' opinions and awareness regarding the environmental effects of the organic and conventional farming: assessment of the negative effect of livestock urine and manure release; assessment of the negative effect of the use of mineral fertilisers; concerns about air pollution; concerns about soil erosion; opinion about the positive effect of organic crop production. The econometric results are presented in Table 4. Here, the upper part of the table shows the results of the proposed bid, while in the lower, results with the socioeconomic characteristics and knowledge variables are presented.

Table 4. CV modelling results.

Dependent Variable	*Coefficient*	*Standard Error*	*p Value*
Constant	0.89313	0.23894	0.0002
Contribution/bid/price	−0.03633	0.01000	0.0003
LL	−182.16435		
McFadden's pseudo R^2	0.45788		
AIC/N	1.390		
Explanatory variables	*Coefficient*	*Standard error*	*p value*
INCOME	2.00118	0.97851	0.0408
EDU	3.26821	0.34886	0.0000
L_AU	3.36991	0.73095	0.0000
U_MF	3.02089	0.80869	0.0002
W_AQ	2.89226	1.39507	0.0382
W_SE	2.06950	0.85776	0.0158
IMP_OC	3.72933	0.80925	0.0000

INCOME—net monthly family income; EDU—education; L_AU—level of knowledge about agricultural effects; U_MF—assessment of the negative effect of the use of mineral fertilisers; W_AQ—concerns about air pollution; W_SE—concerns about soil erosion; IMP_OC—opinion about the positive effect of organic crop production.

Using Equation (2), the median WTP was calculated for multiple environmental public goods from organic agriculture, excluding the protest zero. The median WTP was calculated as per previous research [49]; the model was run with only the constant and the personal contribution/price proposed as the explanatory variables. It was determined that the residents of Lithuania were willing to pay EUR 24.58 annually from their family budget for the environmental public goods of organic farming. The median WTP was used as it is supposed to be more precise than the average value according to the previous research [50].

The ratio of the contributions for the environmental benefits of organic farming was negative (−0.03633). This indicated that the modelling was appropriate and in line with economic theory [44]. Furthermore, this indicated that the consumers were inclined to choose the environmental public goods at a lower cost for them. The Wald test p value for all the variables was <0.05, indicating that all of them were statistically significant.

Considering the second model—which includes the explanatory variables, i.e., the consumers' socioeconomic characteristics and their awareness of the environmental effect of agriculture—first, it was found that the WTP would increase by EUR 2 on average for each additional EUR 100 of the residents' income. This result reveals a situation similar to that of other studies [51] and agrees with economic theory. Second, it was determined that the higher the consumer's education was, the higher the WTP was. It was also found that residents with a higher level of knowledge about the effects of agriculture and more concerns about the negative effects on the environment (air pollution and soil erosion) were more willing to pay than those who were not concerned. As supported by Perni et al. [52], the access to information about the situation with environmental public goods may have influenced public perception. Consequently, the respondents who were better informed had more WTP, and vice versa.

4. Discussion

Determining an appropriate path or solution for comparing the results regarding the valuation of the public goods of agricultural ecosystems across studies remains difficult because of the high variation in research goals and natural and social contexts [53]. Owing to these reasons, methodological difficulties and uncertainty analyses could transpire during a comparison with the previous research. For our study, we attempted to quantify the environmental benefits received by Lithuanian consumers from organic farming public

goods on the basis of consumer demand. The present study showed that consumers in Lithuania were willing to pay EUR 24.58 on the average for the non-commodity outputs. As stated by Alcon et al. [54], different countries have different levels of income, so this could strongly affect their WTP for environmental public goods. For example, residents from Nordic countries are likely to have a higher WTP for the same environmental public goods than Lithuanian residents even if the residents from both countries consider environmental public goods to be essential. Such a difference could be explained by a more positive appreciation of public goods in more economically developed countries. Therefore, usually in high-income countries, considerable focus is placed on environmental protection, and public goods are more appreciated. Loureiro and Loomis [55] found that economic downturns, leading to the changes in personal income and people's confidence, could also affect the WTP for environmental public goods. Therefore, during times of economic stability and with confidence in the future, a higher WTP could be expected.

In accordance with the literature, our results indicated that socioeconomic characteristics impacted consumers' WTP for environmental public goods [54,56]. For instance, people with a higher level of education are more willing to pay for environmental public goods from organic farming. Similar tendencies were found in other studies [56–58]. Our research has shown a statistically significant interaction of WTP with income: the respondents from higher income groups are willing to pay more for environmental public goods, which was also found in previous studies [51]. However, our research has not found any statistically significant interaction of WTP with gender, although gender is usually a strong predictor of respondents' WTP [59].

The existing research suggests that respondents who have knowledge about agriculture's effects on nature and are concerned about it are willing to pay more for services related to agro-ecosystems. For example, Chen et al. [60], evaluating the benefits of eco-agriculture in Taiwan, determined high importance for environmental protection; Kvakkestad et al. [59] noticed that environmentally engaged individuals are more willing to pay for environmental public goods from organic agriculture in Norway. This tendency was also found in the current research. Our research revealed that the respondents who had more knowledge about the negative effects of agriculture and were concerned about the negative effects on the environment were more willing to pay than those who were not concerned. Therefore, following Kataria et al. [61] the respondents' WTP could vary not only due to socioeconomic characteristics, but also due the consequence of having better access to information about environmental situation status.

The literature suggests that the residents' WTP for environmental benefits could be used for determination of the hypothetical value of environmental public goods by multiplying the residents' WTP by the number of households [51]. Following this assumption, the present research found that the value for Lithuanian residents was EUR 33.1 million (WTP: EUR 24.58 $\times$ 1347.9 thousand households in Lithuania) higher than the current funding (according to the data reported by the National Paying Agency, the funding for organic farming was approximately EUR 30 million during 2020). Therefore, the authors of the present paper suggest that payment for the environmental benefits of organic farming should remain within the framework of public policies. This could encourage farmers to move towards genuinely sustainable production systems. It might be worth considering the Lithuanian respondents' demand for environmental public goods from organic farming, as expressed by their WTP, because they are both the payers for such policies and the consumers. This could also help to address the policies and incentives that allow for better management of agriculture.

5. Conclusions

World agriculture is being assigned increasingly different kinds of functions. This branch of the economy is no longer solely responsible, as it was originally, for ensuring food security and supplying raw materials for industry. The importance of agriculture in the context of ensuring energy security is rising. An increasingly important role of

modern agriculture in the provision of public benefits, in particular in connection to organic farming, is a strong argument for the legitimisation role of subsidies in the common agricultural policy. Owing to the relatively high popularity of organic farming in Lithuania and the assumptions of the agricultural policy of the EU regarding the increase in the share of organic farming in Europe, presenting the situation in Lithuania in this respect was reasonable to ascertain the respondents' opinions on public goods. Because this is a relatively new research direction, it was also justified to search for the most appropriate methods for this type of study.

This study clearly showed that Lithuanian residents were concerned about environmental issues and understood the contribution of organic farming to the creation of environmental public goods. It was extremely important for them to have a clean environment with, for instance, better drinking water quality, less air pollution and soil erosion. Specifically, substantial support was evinced for the provision of water quality. The results herein are in line with similar research performed by other scientists.

Environmental public goods of the organic farming system is an important research problem, both from a cognitive and practical point of view, for many stakeholders, and above all for European consumers and producers. This is one of the reasons why it is important and desirable to conduct universal research and to share its results in the European Research Area.

Unfortunately, this study has limitations, as it only covers environmental public goods from organic farming, which were expressed as a multiple/complex environmental public good reflected in three components: the reduction in water, soil, and air pollution. Therefore, a more complex study should be performed in the future. Further steps of such research could include analysing other non-market outputs such as food security and eco-labelling issues; substantiating the current research from the demand side (consumers); and analysing farmers' willingness to switch their activities to organic farming or to maintain sustainable agri-environmental production over time. Such research could also prove useful in setting the future direction of the common agricultural policy.

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Appendix A

CONTINGENT VALUATION SURVEY/QUESTIONNAIRE

Determination of the value of environmental public goods of organic farming

(The survey was implemented in Lithuanian)

Dear survey participant,

The purpose of this survey is to determine how Lithuanian residents attribute value to a cleaner environment as one of the environmental public goods created by organic farming. This study will determine the general willingness of consumers to pay for the positive environmental impact of organic farming. Organic farming aims to grow/produce products using natural materials and processes, while conventional farming uses chemicals (e.g., fertilisers, growth promoters, antibiotics, etc.). This research will determine the general willingness of consumers to pay for the positive impact on the natural environment created by to organic farming.

The questionnaire is anonymous; we guarantee the confidentiality of the information.

Mark ⊗ or underline your answers.

Thank you for the answers!

A. **DETERMINATION OF POPULATION AWARENESS**

A1. How often do you think about the following environmental phenomena in Lithuania?

	Always	Very often	Occasionally	Rarely	Never
	☐	☐	☐	☐	☐
Drinking water quality	☐	☐	☐	☐	☐
Air pollution	☐	☐	☐	☐	☐
Soil erosion	☐	☐	☐	☐	☐

A2. How do you assess the impact of conventional and organic farming methods on the natural environment and human well-being (%)?

Farming type	Very positive	Positive	No effect	Negative	Very negative
Conventional farming (crops)	☐	☐	☐	☐	☐
Conventional farming (livestock)	☐	☐	☐	☐	☐
Organic farming (crops)	☐	☐	☐	☐	☐
Organic farming (livestock)	☐	☐	☐	☐	☐

A3. How do you assess the impact of conventional and organic farming methods on the natural environment and human well-being (%)?

Factors	Impact on the natural environment and human well-being				
	Very high	High	Average	Low	Very low
Use of mineral fertilisers	☐	☐	☐	☐	☐
Use of organic fertilisers	☐	☐	☐	☐	☐
Use of plant protection products	☐	☐	☐	☐	☐
Livestock manure leaching	☐	☐	☐	☐	☐
Environmentally friendly crop production	☐	☐	☐	☐	☐
Livestock keeping conditions	☐	☐	☐	☐	☐

A4. Would you agree to pay extra in the form of taxes from your family budget for environmental benefits such as a cleaner environment and a reduction in water, soil, and air pollution? EUR 12/23/46 per year. YES NO

If you would NOT agree, please indicate the reason:

B. DEMOGRAPHIC AND SOCIOECONOMIC CHARACTERISTICS OF RESPONDENTS
In this part, please provide information about you and your household (which includes you and other persons living together permanently). Please note that only the aggregated data of all completed questionnaires will be analysed. We guarantee complete confidentiality of your answers.

B1. You are

Male ☐	Female ☐

B2. Your age:

Age, years
☐ 18–39
☐ 40–65
☐ Over 65

B3. Your place of living

Urban ☐	Rural ☐

B4. What is your household status?

Household size (number of persons)
Children under 18 years of age, number

B5. What is your education level?

☐	High school
☐	Secondary vocational
☐	Secondary
☐	Primary or basic

B6. Monthly income per member of your household (family):

☐	<EUR 350
☐	EUR 351–600
☐	EUR 601–900
☐	>EUR 900

C. Evaluation of the questionnaire (applied during the pilot survey)

C1. Rate the clarity of the questions on a scale from 1 to 5 (5 points—very clear; 1 point—very unclear)

	1	2	3	4	5
Degree of clarity and complexity of the answers to the given questions (mark only one answer)	☐	☐	☐	☐	☐

C2. Rate how interesting the survey topic is to you on a scale from 1 to 5 (5 points—very interesting; 1 point—not interesting at all).

	1	2	3	4	5
Interest level of the questionnaire (mark only one answer)	☐	☐	☐	☐	☐

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