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Choice Experiment Approach on Evaluation of Non-Market Farming System Outputs: First Results from Lithuanian Case Study

A. Novikova, L. Rocchi, G. Startiene

Abstract**—**Market and non-market outputs are produced jointly in agriculture. Their supply depends on the intensity and type of production. The role of agriculture as an economic activity and its effects are important for the Lithuanian case study, as agricultural land covers more than a half of country. Positive and negative externalities, created in agriculture are not considered in the market. Therefore, specific techniques such as stated preferences methods, in particular choice experiments (CE) are used for evaluation of non-market outputs in agriculture. The main aim of this paper is to present construction of the research path for evaluation of non-market farming system outputs in Lithuania. The conventional and organic farming, covering crops (including both cereal and industrial crops) and livestock (including dairy and cattle) production has been selected. The CE method and nested logit (NL) model were selected as appropriate for evaluation of non-market outputs of different farming systems in Lithuania. A pilot survey was implemented between October–November 2018, in order to test and improve the CE questionnaire. The results of the survey showed that the questionnaire is accepted and well understood by the respondents. The econometric modelling showed that the selected NL model could be used for the main survey. The understanding of the differences between organic and conventional farming by residents was identified. It was revealed that they are more willing to choose organic farming in comparison to conventional farming.

Keywords**—**Choice experiments, farming system, Lithuania market outputs, non-market outputs.

I. Introduction

AGRICULTURAL activity beyond supply of food and fibre, provides natural resources, shapes the landscape and preserves biodiversity. It also has an important role in the contribution to the viability of rural areas and their development, food security, and preservation of cultural heritage. Positive externalities of farming activities assert in the form of environmental and social public goods, whereas intensive agricultural activity causes damage to the environment and human well-being. All these outputs are especially important for Lithuania, which is designated as a rural country. Globally, more than 80% of its area is classified as rural and more than 50% as agricultural: its largest part (47%) is covered by arable land [18]. Conventional farming is the main type of farming in Lithuania; however, organic farming is steadily expanding as well [24]. The market crop production comprises the major share of the agricultural output. In the period 2013–2017, crop output accounted for about 60–65% of all agricultural output, the remaining share is livestock production [24]. However, the country's official statistics do not cover the data about of non-market agricultural outputs [19]. Therefore, specific valuation methods should be employed for this kind of evaluation. Specific techniques such as stated preferences methods, in particular CE are used for evaluation of non-market outputs in agriculture. Researchers have been applying CE widely to evaluate different farming system outputs as valuation of livestock/dairy non-market effects [3], crops [6], [20], olives [2], pastures [4] or focusing on the effects of low input farming system as organic farming [1], [11]. However, the analysis of the relation between farming systems and non-market output is still rare. Therefore, this paper focuses on evaluation of the main non-market farming system outputs in Lithuania (scenic views and their aesthetic value, water quality, soil erosion, diversity of flora and fauna species and agrobiodiversity, and climate change) for Lithuanian residents, and, in particular, on development of the framework for estimation of consumers' willingness to pay for different non-market outputs from conventional and organic farming. The main aim of this paper is to present construction of the framework for estimation of consumers' willingness to pay for different non-market farming outputs through CEs in Lithuania; then, to show the results of the framework pre-test and identify applicability of the framework designed.

The paper is structured as follows: First, the main aspects of the chosen CE method and NL for econometric modelling are presented; second, the survey and questionnaire design, revealing the goals of CE survey and selection of the attributes are shown; the results and discussion part present the empirical research findings revealing suitability of the framework designed. Conclusions are drawn in the last section of the paper, providing the main points for the improvement of the methodology created and future research.

Anastasija Novikova is with the School of Economics and Business, Kaunas University of Technology, Gedimino 50, 44239, Kaunas, Lithuania (corresponding author, phone +37067261959, e-mail: anastasija.novikova@ktu.lt).

Grazina Startiene is with the School of Economics and Business, Kaunas University of Technology, Gedimino 50, 44239, Kaunas, Lithuania (e-mail: grazina.startiene@ktu.lt).

Lucia Rocchi is with the Department of Agricultural, Food and Environmental Sciences, University of Perugia, Borgo XX Giugno, 74 – 06121, Perugia, Italy (e-mail: lucia.rocchi@unipg.it).

II. Materials and Methods

A. Framework Modelling

The CE method is a stated preference technique widely applied to estimate non-market goods from farming systems [11], [12], [1], [3], [4]. Hypothetical choice scenarios are used for eliciting the willingness to pay of the respondents for the goods analysed. The CE are based on Lancaster's Theory of Value [15] and the Random Utility Theory (RUT) [21]. According to Lancaster's Theory of Value, the utilities for goods can be decomposed into individual utilities by their characteristics or attributes, while RUT explains the diversity of the opinions choosing the offered combinations. Following Lancaster, consumers gain their utility not from goods, but rather from the attributes these goods render. According to RUT, the subject chooses the alternative that gives the highest utility. Within this theoretical framework, respondents choose among alternatives according to a utility function with two components: a systematic (i.e. observable) component plus a random term (non-observable by the researcher) [17]. Mathematically:

$$U_{in} = V_{in}(Z_i, S_n) + \varepsilon_{in} \quad (1)$$

where, U_{in} is the utility provided by alternative i to subject n, V_{in} is the systematic component of the utility, Z_i is the vector of attributes of alternative i, S_n is the vector of socio-economic characteristics of the respondent n, and ε is the random term [5].

Different models such as multinomial logit, conditional logit, and mixed logit, etc., are used for the analysis of consumers' choices. Among them is the NL model [23], which is used in the current research because of its ability to accommodate differential degrees of interdependence between subsets of alternatives in a choice set. It is one of the most attractive characteristics of NL models [9]. Moreover, they are relatively easy to estimate and computationally straightforward.

In NL model, the observed utility associated to the kth alternative is defined by four parameters associated with the explanatory variables β, an alternative-specific constant, αk, a scale parameter, θ, and the explanatory variables, **x** [9]. Therefore, adding the random component (ε_{tk}) the utility of alternative k for individual t is:

$$U_{tk} = g_k(\alpha_k, \beta' x_{tk}, \varepsilon_{tk}) = g_k(V_{tk}, \varepsilon_{tk}) = \alpha_{tk} + \beta' x_{tk} + \varepsilon_{tk} \quad (2)$$

$$Var[\varepsilon_{tk}] = \vartheta^2 = k/\theta^2 \quad (3)$$

The scale parameter (θ), is proportional to inverse of the standard deviation (σ) of the random component in the utility expression, and is critical input into the setup of the NL model [9]. The aim of this research is to assess the non-market outputs of different farming systems, conventional and organic, using CE and applying NL specification (Fig. 1). In this context, the probability of choice among Conventional alternatives is given by:

$$P(i|C) = \frac{e^{V_i}}{e^{V_{crop1}} + e^{V_{live1}}} \quad (4)$$

where i= crop1, crop2. Then, it is possible to calculate I, the inclusive value, which is the expected utility from given branch choice:

$$I_C = \ln(e^{V_{crop1}} + e^{V_{live1}}) \quad (5)$$

At the same time for organic:

$$P(i|O) = \frac{e^{V_i}}{e^{V_{crop2}} + e^{V_{live2}}} \quad (6)$$

$$I_O = \ln(e^{V_{crop2}} + e^{V_{live2}}) \quad (7)$$

Then, the model of the choice between farming systems on the basis of the produced ecosystem services is:

$$P(C) = \frac{e^{\mu(\beta'_C + I_C)}}{e^{\mu(\beta'_C + I_C)} + e^{\mu I_O}} = \frac{e^{\beta_C + \mu I_C}}{e^{\beta_C + \mu I_C} + e^{\mu I_O}} \quad (8)$$

$$P(O) = \frac{e^{\mu I_F}}{e^{\mu(\beta'_C + I_C)} + e^{\mu I_O}} = \frac{e^{\mu I_F}}{e^{\beta_C + \mu I_C} + e^{\mu I_O}} \quad (9)$$

where, I_C and I_O are attributes of the nest conventional and organic, respectively; $\beta_C = \mu\beta_M$ and μ are unknown parameters which are to be estimated.

$$0 < \mu \leq 1$$

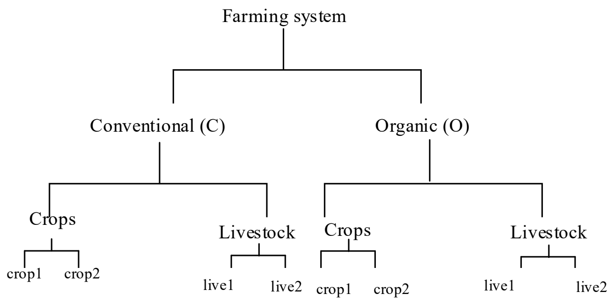

Fig. 1 Alternatives scheme (C= conventional; O= organic)

B. Survey and Questionnaire Design

This research reports on the use of a survey-based CE method, where repetitive choice situations about alternatives of different farming non-market outputs are created. This will help to reveal how the inhabitants of Lithuania value public goods created in agroecosystems, where different farming practices are explored. The survey is also focused of determining consumers' attitudes and demand towards the public goods created in conventional and organic farming systems, considering crop and livestock production. This paper is focused on the presentations of the pre-test results and the suitability of the chosen model for the application in the main survey.

Following the analysis of recent studies on the application of CE in the evaluation of non-market outputs of agriculture [13], [10], [14], [7], [2]-[4], [8], [20], and the analysis of Lithuanian agriculture (more in [19]), five attributes were selected, with the levels representing different farming types:

- scenic views, aesthetic value of the landscape,

- water quality,
- soil erosion,
- diversity of flora and fauna species and agrobiodiversity,
- climate change.

The CE survey has been designed to contain multiple choice questions (choice cards) about alternative (conventional and organic) non-market farming outputs, which are received from crop and livestock production in Lithuanian. The questionnaire consists of three parts.

The first part presents the aim of the survey and contains three questions regarding respondents' opinions and their awareness of environmental impacts caused by farming systems.

- The first question is dedicated to reveal how respondents rank the impact of different farming types on the natural environment/human wellbeing. The second is aimed at identifying the respondents' worries about environmental aspects in Lithuania caused by agriculture. The third question is dedicated to identification of the respondents' opinion about the impact of different farming types/styles on environment/human welfare.

The second part of the survey presents the impact of different farming systems on the environment and human wellbeing and contains the choice cards with different combinations of farming system attributes. Thereby, this part of the questionnaire has been aimed at determining the public view on the role conventional and organic farming, covering crops (including both cereal and industrial crops) and livestock (including dairy and cattle) production in terms of affecting the scenic views and aesthetic value of agricultural landscapes, the quality of drinking water, soil erosion, diversity of flora and fauna species for crop production and agrobiodiversity for livestock production, and climate change. These attributes are mostly impacted by different farming systems positively or negatively and have also been presented to the respondents:

- *Scenic views and their aesthetic value*. Sustainable agricultural activity could improve the aesthetic value of landscape. Under good practice farming (depending on the land use, crop structure, intensiveness of the agricultural activity, greening and implementation of other agri-environmental measures), open and different mosaic landscape could be created. A colourful and variable landscape such as rapeseed could be very attractive, giving an aesthetic value for the visitors to rural areas.
- *Water quality and Nitrate Leaching.* Pesticide, nitrate, phosphate, organic waste pollution could have an impact on human health and damage water safety due to its presence in drinking water. The main source of drinking water is underground water, and only in exceptional cases, the surface water could be used for preparation of drinking water.
- *Soil erosion.* The effects of soil erosion go beyond the loss of fertile land. It has led to increased pollution and sedimentation in streams and rivers, causing declines in fish and other species. And degraded lands are also often less able to hold onto water, which can worsen flooding. Sustainable land use and increasing perennial grasslands areas can help to reduce the impacts of agriculture and livestock, preventing soil degradation and erosion and the loss of valuable land to desertification.
- *Diversity of flora and fauna species and agrobiodiversity.* Extensive farming could play a significant role in preserving and improving biodiversity. Due to intensive farming, the areas of natural grasslands, pastures, and swamps are decreasing, and the landscape becomes monotonous due to the small diversity of crops. The use of pesticides and fertilizers, as well as livestock urine leaching result in the decline of rare and important plant species. These changes in agroecosystems, mostly through food chain relations, have a negative impact on other animals like birds and other mammals.
- *Climate change.* Agriculture contributes to climate change through generation of greenhouse-gas emissions, for example, considerable amounts of methane are released by animal urine, while most of the nitrous oxide gases are released from fertilized soil. Lithuania needs to reduce its greenhouse-gas emissions from agriculture and adapt its food-production system in order to cope with climate change. Therefore, creation of environmentally-friendly farming areas by increasing dry pulses area or reducing the total amount of polygrastic herd could contribute to climate change mitigation.

In the choice cards, respondents have been asked to select the combination they favour the most out of the four alternatives (two for organic farming and two for conventional farming) and the status quo (expressed as no choice) provided. Each option contains different combinations and levels of the attributes as well as the personal contribution in EUR. The no choice situation meant that the same situation remains and results in no cost to the respondent. Each respondent is given six cards with choice situations (three cards dedicated to livestock production and three cards for crop production), where he/she had to choose one of five alternatives. After each card, the follow up question is provided, which asks the respondents about their motivation for their choices in the case of selection of non-choice options. In order to verify that the respondents made choices honestly, the cards are followed by a question about the importance that the respondents attributed to their choices and to each of the factors of choice.

The third part contains questions about the economic and social status of the respondents. It is designed to gather the socio-economic data of respondents such as age, gender, education, profession and income. These data are important for the analysis of respondents' choices, as the differences in the socio-economic characteristics of respondents influence their willingness to pay for non-market outputs [22]. After a review of recent studies [14], [7], [8], [1]-[4], [16], [20], the following socio-economic characteristics have been selected: gender, age, area of residence, involvement to agricultural activities, preferences to organic products, status of the household, education, monthly net income of household members. Questions related to the appeal and difficulty of the questionnaire have also been included in the last part of the survey in order to understand the interest and importance of the current topic for the respondents.

III. Results and Discussion

The pilot survey of CE was carried out in September–October, 2018. Five attributes of non-market farming outputs, such as Landscape, Soil erosion, Climate change, Water quality and Wild life, and the cost attribute expressed as Payment for five years in the future were included during the pre-test. These covered 500 combinations ($5^3\times 4^1$) in the full factorial design, resulting in excessive numbers of combinations to be presented to the respondents. Therefore, D-efficient experimental design of the survey has been developed using the SAS Studio program. As a result, 30 choice cards have been developed and divided randomly into five blocks, each consisting of six sets. These contain five attributes delivered at three levels and the cost attribute delivered at four levels. In all, 56 questionnaires were distributed, 37 questionnaires were filled in, and three questionnaires were eliminated due to the incorrect completion of the survey. The data from 34 valid questionnaires have been analysed. The questionnaire delivered 102 choice observations for livestock production and the same number of observations for crop production. All respondents agreed to answer fairly the questions of the survey. The survey was implemented randomly by selecting respondents during seminars and other events. The examples of the choice card in the livestock and crop questionnaires are shown in Tables I and II.

TABLE I
EXAMPLE OF A CHOICE CARD IN THE QUESTIONNAIRE FOR LIVESTOCK

	ORGANIC-1	ORGANIC-2	CONVENTIONAL-1	CONVENTIONAL-2	
Landscape	30% more scenic views like trees, plantations on pastoral farms	10% more scenic views like trees, plantations on pastoral farms	No variety on pastoral farms	No variety on pastoral farms	NO CHOICE
Soil erosion	30% increase in perennial grasslands	10% increase in perennial grasslands area	30% increase in perennial grasslands	10% increase in perennial grasslands area	
Climate change	Reducing by 20% the total amount of polygrastic herd	No changes	No changes	Reducing by 10% the total amount of polygrastic herd	
Water quality	20% reduction in the maximum amount of fertilizer permitted (included manure)	Current ground water pollution due to nitrates and urea	Current ground water pollution due to nitrates and urea	10% reduction of the maximum amount of fertilizer permitted (included manure)	
Wild life	Using only 1 race in each farm for type of output	Using only 1 race in each farm for type of output	Using only 3 races in each farm for type of output	Using only 2 races in each farm for type of output	
Payment for 5 years in future	48	12	6	24	
Your choice	☐	☐	☐	☐	☐

TABLE II
EXAMPLE OF A CHOICE CARD IN THE QUESTIONNAIRE FOR CROPS

	ORGANIC-1	ORGANIC-2	CONVENTIONAL-1	CONVENTIONAL-2	
Landscape	2 different crops at the same time every 10 ha	2 different crops at the same time every 10 ha	2 different crops at the same time every 10 ha	4 different crops at the same time every 10 ha	NO CHOICE
Soil erosion	30% increase in perennial grasslands area	No changes	10% increase in perennial grasslands area	No changes	
Climate change	30% increasing dry pulses area	30% increasing dry pulses area	30% increasing dry pulses area	20% increasing dry pulses area	
Water quality	No changes	20% reduction of ground water pollution	20% reduction of ground water pollution	No changes	
Wild life	Enhancing of flora and fauna diversity by reducing the actual level of pesticides by 20%	Enhancing of flora and fauna diversity by reducing the actual level of pesticides by 10%	No changes	Enhancing of flora and fauna diversity by reducing the actual level of pesticides by 10%	
Payment for 5 years in future	6	6	12	24	
Your choice	☐	☐	☐	☐	☐

The pre-test of the questionnaire showed the feasibility and interest of the current topic for the respondents, as more than 60% of them stated that the topic is interesting or very interesting for them, while about 65% highlighted that the questionnaire was clear or absolutely clear.

Approximately about 60% of the respondents are women; mean age of the respondents is approximately 36 years old. About 60% of the respondents live in urban areas. The majority of households are comprised of two members, and about half of the respondents had children. Respondents are earning about 650 EUR monthly net income per person on average.

More than 95% of the respondents think that organic farming, including livestock and crop production, has a positive impact on the natural environment and human wellbeing. Respondents' opinions concerning conventional farming is slightly different; about 60% of them think that crop production, and about half of them - livestock production, has a positive impact on the natural environment and human wellbeing. Respondents stated that they are mostly worried or are thinking about water quality (about 80%), climate change (about 55%) and landscape formation (45%).

In order to check applicability of the framework created for the analysis of consumer preferences towards different non-market farming outputs from conventional and organic farming systems, the MNL model and NL were run with NLOGIT 6 separately for livestock and crop production systems. The first model, named MNL model, showed the importance of the choice attributes in explaining consumer preferences towards different options of non-market farming outputs (i.e. Landscape, Soil erosion, Climate change, Water quality and Wild life). Here, the utility was determined by the levels of five attributes (Landscape, Soil erosion, Climate change, Water quality and Wild life, personal contribution) in the choice sets. The second model, named NL model, in addition to consumer preferences towards the attributes analysed, demonstrates the possibility to analyse the respondents' opinion in making choices toward an organic or conventional farming system. Results obtained from the MNL and NL models for livestock and crops are shown in Tables III and IV, respectively.

TABLE III
RESULTS OBTAINED FROM MNL AND NL MODELS: LIVESTOCK

Variables	MNL model			NL model		
	Coefficients	S.E.	p-Value	Coefficients	S.E.	p-Value
LANDSCAPE	0.02768***	0.00992	0.0053	0.01846**	0.00787	0.0190
SOIL EROSION	0.01237	0.01493	0.4075	0.00808	0.01205	0.5023
CLIMATE CHANGE	-0.00890	0.01287	0.4892	-0.00584	0.00905	0.5188
WATER QUALITY	-0.06523***	0.01305	0.0000	-0.04053***	0.01294	0.0017
PRICE	-0.03233***	0.00941	0.0006	-0.01888**	0.00826	0.0222
CONVENTIONAL				1.50396**	0.65261	0.0212
ORGANIC				1.92981***	0.69728	0.0056
NONE				2.65663*	1.41945	0.0613
Model fit statistics						
Log-likelihood	-158.84203			-156.34872		
Inf. Cr. AIC	350.0			328.7		
AIC/N	3.125			2.935		
McFadden Pseudo R^2	0.0493635			0.1308293		
Observations	102			102		

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

TABLE IV
RESULTS OBTAINED FROM MNL AND NL MODELS: CROPS

Variables	MNL			NL		
	Coefficients	S.E.	p-Value	Coefficients	S.E.	p-Value
LANDSCAPE	0.23562***	0.08531	0.0057	0.42274***	0.15207	0.0054
SOIL EROSION	-0.01579	0.01337	0.2377	-0.00817	0.02686	0.7610
CLIMATE CHANGE	0.02745**	0.01276	0.0314	0.02810	0.01897	0.1385
WATER QUALITY	-0.05060***	0.01440	0.0004	-0.07549**	0.02992	0.0116
PRICE	-0.02093*	0.01200	0.0812	-0.05704**	0.02412	0.0180
CONVENTIONAL				0.35156	0.22298	0.1149
ORGANIC				0.57948***	0.21040	0.0059
NONE				-0.36692	0.40783	0.3683
Model fit statistics						
Log-likelihood	-130.82205			-125.87384		
Inf. Cr. AIC	271.6			267.7		
AIC/N	2.953			2.910		
McFadden Pseudo R^2	0.0558			0.1849907		
Observations	102			102		

Note: ***, **, * ==> Significance at 1%, 5%, 10% level.

First, the MNL model was run including five variables (Landscape, Soil erosion, Climate change, Water quality, Wild life and Payment) separately for livestock and crop production with the aim to explain consumers' choices. However, it did not show any information concerning the choices towards conventional and organic farming. Therefore, the second NL model was run in order to see the difference between respondents' choices for organic and conventional farming. The results reveal that the people understand the differences between organic and conventional farming and are more willing to choose organic farming in comparison to conventional farming.

Comparison of the Log-likelihood of the NL model with that of the MNL model suggests that the NL model is more statistically significant, because its likelihood value is closer to zero (-156.3 for livestock and -125.9 for crops). Due to the small number of observations, not all variables are statistically significant at 0.05 level for both models. The price coefficient is negative in both models, suggesting that people are likely to accept different non-market outputs from farming with lower personal monetary contribution. Also, it shows a good fit of the models. In addition, it should be noted that the NL model could be used for modelling of data generated by main survey and estimation of respondents' willingness to pay for different non-market outputs of farming systems. Moreover, it will reveal the differences of choices not only for crop and livestock production, but for organic and conventional farming as well. At this stage, inclusion of respondents' socio-economics characteristics into the modelling process and estimation of willingness to pay for different non-market outputs of farming systems would be unreasonable due to scarce data. It will be estimated after the implementation of the main survey.

IV. Conclusions

The main finding of this study is testing and improvement of the CE framework for evaluation of different non-market outputs of farming systems in Lithuania for the main research. The results of the pilot survey have demonstrated the relevance and significance of the topic selected, which is substantiated by respondents' answers that it was interesting and understandable. The results revealed that all attributes are suitable for selection for further research, and differences in consumer choice among conventional versus organic farming were identified as well. In particular, they are more inclined to favour organic farming as opposed to the conventional, which supports an important point of the present research.

Although the results of modelling including all attributes (Landscape, Soil erosion, Climate change, Water quality, Wild life and Payment) have not demonstrated a good model fit due to the small number of the respondents, the tested NL still could be claimed to be selected as an appropriate model for further research.

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References

[1] Aldanondo-Ochoa A. M., Almansa-Sáez C. The private provision of public environment: consumer preferences for organic production systems. *Land Use Policy*, vol. 26.pp. 669–682, 2009.

[2] Arriaza M., Gomez-Limon J. A., Kallas Z., Nekhay O. Demand for non-commodity outputs from mountain olive groves? *Agricultural Economics Review*., vol. 9 no.1, pp. 5–23. Jan. 2008

[3] Baskaran R., Cullen R., Colombo S. Estimating values of environmental impacts of dairy farming in New Zealand. *New Zealand Journal of Agricultural Research*., vol. 52 no.4. pp. 377–389, Apr. 2009a.

[4] Baskaran R., Cullen R., Takatsuka Y. Estimating the value of agricultural ecosystem services: a case study of New Zealand pastoral farming. *Australasian Journal of Environmental Management*., vol. 16 no. 2. pp. 103–112, Feb. 2009b.

[5] Bennett J., Blamey R. The Choice Modelling Approach to Environmental Valuation. Cheltenham, UK; Northampton, MA, USA: Edward Elgar. 2001.

[6] Christensen,T., Pedersen, A. B., Nielsen,H. O., Mørkbak, M. R., Hasler,B., Denver,S. Primary Determinants of farmers' willingness to participate in subsidy schemes for pesticide-free buffer zones—A choice experiment study. *Ecological Economics*, vol. 70 no 8. pp. 1558-1564, Aug. 2011.

[7] Goibov M., Schmitz P. M., Bauer S., Ahmed M. N. Application of a choice experiment to estimate farmers preferences for different land use options in Northern Tajikistan. *Journal of Sustainable Development*. vol. 5 no. 5.pp. 2–16. May 2012.

[8] Hasund K. P., Kataria M., Lagerkvist C. J. Valuing public goods of the agricultural landscape: a choice experiment using reference points to capture observable heterogeneity. *Journal of Environmental Planning and Management*., vol. 54 no. 1, pp. 31–53. Jan. 2011.

[9] Hensher D. A., Greene W. H. Specification and estimation of the nested logit model: alternative normalizations. *Transportation Research Part B.,* vol. 36, pp. 1–17. 2002.

[10] Houessionon P, Fonta W. M., Bossa A. Y., Sanfo S., Thiombiano N., Zahonogo P., Thomas B. Yameogo T. B., Balana B. Economic valuation of ecosystem services from small-scale agricultural management interventions in Burkina Faso: A discrete choice experiment approach. *Sustainability*., vol. 9. pp. 1672. DOI: 10.3390/su9091672. 2017.

[11] Jespersen L. M., Baggesen D. L., Fog E., Halsnæs K., Hermansen J. E., Andreasen L., Strandberg B., Sørensen J. T., Halberg N. Contribution of organic farming to public goods in Denmark. *Organic Agriculture*., vol. 7. pp. 243–266. 2017.

[12] Jianjun J., Chong J., Thuy T. D., Lun L. Public preferences for cultivated land protection in Wenling city, China: a choice experiment study. *Land Use Policy*., vol. 30 no. 1. pp. 337–343. Jan. 2013.

[13] Jianjun J., Rui H., Wenyu W., Haozhou G. Valuing cultivated land protection: A contingent valuation and choice experiment study in China. *Land Use Policy*., vol. 74. pp. 214–219. 2018.

[14] Khanal U., Wilson C., Managi S., Lee B., Hoang V., Gifford R. Psychological influence on survey incentives: valuing climate change adaptation benefits in agriculture. *Environmental Economics and Policy Studies,*. vol. 4, pp. 1–21. DOI: 10.1007/s10018-017-0195-4. Aug. 2017.

[15] Lancaster K. J. A new approach to consumer theory. *Journal of Political Economy*., vol. 74. pp. 132–157. 1966.

[16] Madureira L., Lima Santos J., Ferreira A., Guimarães H. Feasibility Study on the Valuation of Public Goods and Externalities in EU Agriculture. European Commission. 2013.

[17] McFadden D. Conditional logit analysis of qualitative choice behaviour. In: ed. P. Zarembka. Frontiers in Econometrics. New York: Academic Press. pp. 105–142. 1974

[18] Nacionalinė žemės tarnyba prie Lietuvos žemės ūkio ministerijos. 2017. Lietuvos Respublikos žemės fondas, 2017 m. sausio 1 d. Vilnius (In Lithuanian).

[19] Novikova A., Rocchi L., Startienė G. Evaluation of farming system outputs in Lithuania: methodological proposal. *Žemės Ūkio Mokslai*. vol. 25 no 4. pp. 205–215. Lietuvos mokslų akademija, 2018.

[20] Takatsuka Y., Cullen R., Wilson M., Wratten S. Values of Ecosystem Services on Arable Land and the Role of Organic Farming. Paper prepared for the 3rd World Congress of Environmental and Resource Economists. Kyoto, Japan, 3–7 July 2006.

[21] Thurstone L. A law of comparative judgement. *Psychological Review*., vol. 34 no. 4. pp. 273–286. Apr. 1927.

[22] Wang, X., Bennett, J., Xie, C., Zhang, Z., Liang, D. Estimating non-market environmental benefits of the conversion of cropland to forest and grassland program: A choice modelling approach. *Ecological Economics*, 63 no. 1, pp. 114-125. Jan. 2007.

[23] Williams H. C. W. L. On the formation of travel demand models and economic evaluation measures of user benefit. *Environment and Planning, Part A*., vol. 9. pp. 285–344. 1977.

[24] Lietuvos Statistikos Departamento duomenų bazė. Available online: https://osp.stat.gov.lt/statistiniu-rodikliu-analize#/ (Accessed 28 November, 2018) (In Lithuanian).