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MARKET KNOWLEDGE AND DECLARED PREFERENCES IN THE CVM (USING WIND POWER PLANTS AS AN EXAMPLE)

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ABSTRCT: The article attempts to assess the impact of the factor related to the knowledge of the real estate market on the declared preferences in the CVM. A set of factors widely described in the literature, potentially affecting the outcomes of the frame experiment (such as gender, education, social status) has been enriched with the factor related to market knowledge.

The research was conducted on a group of 1,200 people by the CATI method in 2015. Due to the level of knowledge of the market, respondents were divided into four groups. Measures determining the degree of dependence of features (market knowledge and WTP declarations) were used: independence tests, medium difference tests (ANOVA).

It was found that knowledge of the market determines the willingness to pay (WTP). Knowledge of the market is an important factor affecting the discrepancies between the respondents' declarations to pay for the good valued. Therefore, meteorological indications for conducting CVM studies should be enriched by considering this circumstance.

KEY WORDS: contingent valuation, wind power plants, CVM study methodology

Introduction

Contingent valuation method – CVM is currently one of the key methods facilitating the analysis of relations between economy and the natural environment, allowing for valuation of environmental goods and services that are not subject to market exchange. Tomasz Żylicz draws attention to this question, writing: "if we want environmental protection to be undertaken in a way that is consistent with social preferences, we should be able to value it in money. This is an urgent need, because we would like to see improvements in the natural environment to become as quickly as possible, without waiting for changes in the ecological awareness that require generations" (Żylicz, 2014).

The result of the CVM survey is the determination of the respondents' average readiness to pay for a specific improvement or maintenance of a resource, asset or service of the environment. The basis for valuation is the construction of a hypothetical situation in the form of an event scenario in which the state of non-marketable assets is modified (Czajkowski). The research can be carried out by two techniques: "by asking the users of the non-market good under investigation if they are willing to pay (WTP – willingness to pay) to be provided with that good, or what compensation they are willing to accept (WTA – willingness to accept) for the fact that the good they have right now will be taken from them" (Żylicz, 2004).

Despite its popularity, the method of contingent valuation is sometimes criticized as being inaccurate and unrepresentative. On the other hand, however, the Contingent Valuation Panel (CVP) chaired by Kenneth Arrow and Robert Solow (Arrow, Solow et al., 1993, p. 5), which was set up to assess the usefulness of CVM in economic research, concluded that it could be used as a reliable way of measuring values, provided that certain methodological guidelines were followed(Arrow, Solow et al., 1993, p. 17). The observance of these indications is aimed at minimizing the difference between actual and declared willingness to pay for a given good, and their essence is boiled down to an attempt to predict circumstances influencing these discrepancies.

In a modern perspective, CVM is treated as one of the experimental economics methods. According to the classification of J. A. List (List, 2008), the method of contingent valuation method is a framework experiment. It differs from standard economic experiments in that it is not carried out in the laboratory, and therefore it is necessary to examine carefully and control the external factors influencing the environment of the experiment. Most often, in the case of the contingent valuation method, sociological factors such as gender, age, education, social status and specific factors such as protesting respondents are subject to scrutiny. Their control allows to some extent to

predict circumstances affecting potential discrepancies between declared and actual preferences.

In the authors' opinion, these well-known factors should be supplemented by the problem of knowledge of the market based on which a hypothetical research scenario is constructed. In this article, the real estate marked is used as an example, and market knowledge is assessed based on respondents' declarations that they made or intended to make a property purchase/sale transaction.

The purpose of the article is to verify the following hypotheses:

- there is a relationship between the knowledge of the market, and a declaration expressed in a qualitative way, concerning the influence on the change of the value of properties located near wind power plants,
- the knowledge of market is a significant factor modifying the amount of declared impairment loss of the property in the studies using the contingent valuation method.

Research methodology

It was decided in the research to select a targeted sample by selecting four counties: Puck, Suwałki, Żuromin, and Ełk. The main reason for the selection of these counties was the fact that there were there both concentrations of wind power plants (or wind farms) and individual turbines scattered in the county. According to the authors, the mere presence of wind plants may influence their perception of the landscape (Marcinkiewicz, Poskrobko, 2015) and in relation to the assessment of their impact on the value of property. To be sure of this, the authors, apart from three counties with considerable numbers of wind power plants (i.e. the counties of Puck, Żuromin and Suwałki), also chose one control county without such power plants – the county of Ełk. The location of these counties is shown in the figure below.

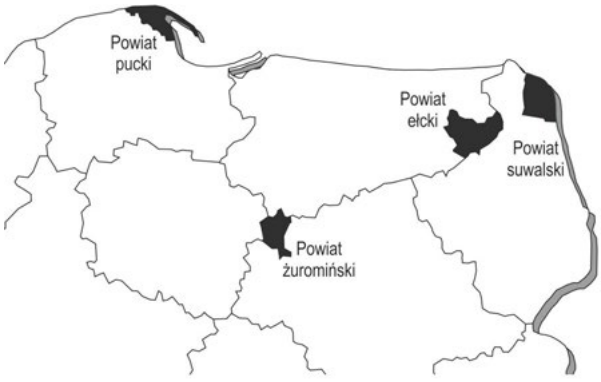

Figure 1. The location of the counties covered by the study

Source: authors' own work.

Another criterion for the selection of counties was their tourist attractiveness. It has been assumed that people living in areas where tourism is a significant branch of economy in the region will be more sensitive to landscape quality problems. In this case, the control sample was Żuromin county, where tourism is only marginally developed, the other counties: Puck, Suwałki and Ełk, are characterized by considerable touristic values, resulting from natural and landscape features. The northern and eastern borders of Puck county are delimited by the shoreline of the Baltic Sea, while from the south and south-west they are bounded by large woods of Darzlubska Forest, waters of Lake Żarnowiec, and moraine hills. Ełk county, which is in Masuria, is characterized by two types of landscape. The northern and eastern parts are highly undulating, with numerous moraine valleys filled with lakes. In the central and southern parts, the terrain goes into the Plain of Augustów. The county of Suwałki is a transitional region between the Masurian Lake District, the Lithuanian Lake District and the Plain of Augustów. Suwałki county is characterized by a very varied post-glacial landscape with numerous hills and moraine depressions.

The research scenario presents a hypothetical situation in which it is possible to introduce an absolute ban on the location of wind power plants in the county. However, such a ban would entail some financial burdens. It has been assumed that if people perceive a decline in the value of the property because of the location of wind power plants in their vicinity, they will be willing to pay a certain amount of money in exchange for the certainty that such power plants will not be built in their vicinity. It was also assumed that an economically rational entity would not be willing to pay more than the decrease in the value of the property. On this basis, it is possible to determine what is the change in the value of the property because of the location of wind power plants in their vicinity. Economic value is by its very nature subjective and depends on the decision of individual participants of a market exchange. Since, in the proposed scenario, the respondents were willing to pay a certain price for the lack of wind power plants, it is expected that in real life situations they expect at least such a decrease in value if they were real estate sellers or offer at least the same lower price if they were buyers (Ligus, et al., 2015).

In the study, the format of closed questions asked in the form of a referendum, recommended in the subject literature (Garrod, Willis, 1999), was used. The research was carried out on a group of 1200 people using the CATI method (computer-assisted telephone interview). Interviews with respondents were conducted in the first quarter of 2015 by a company specializing in survey research.

Respondents were divided into four groups due to their level of knowledge of the market:

- group A – a prominent level of knowledge of the real estate market – persons who have made transactions of purchase or sale of real estate in the last five years and within next five years are planning to make such transactions again;
- group B1 – average knowledge of the real estate market – persons who have not made any real estate purchase or sale transactions in the last five years, but within next five years they plan to make such transactions;
- group B2 – average knowledge of the real estate market – persons who have made transactions of purchase or sale of real estate in the last five years but have not planned to make such transactions within next five years;
- group C – low knowledge of the real estate market – persons who have not made any transactions of purchase or sale of real estate in the last five years and who do not plan to make any such transactions within next five years.

The results of the study were subject to statistical analysis. Measurements were used to determine the degree of dependence of features, including the independence test. As a zero hypothesis, it was assumed the independence of the examined features, i. e. the lack of relation between the level of knowledge of the market and the influence of wind power plants on the value of real estate against the alternative hypothesis assuming their statistically meaningful relationship. The analysis was supplemented by an average difference test (ANOVA) performed with reference to the respondents' declared WTP levels. The ANOVA test assumes that the analyzed features should be subject to normal distribution and have homogeneous variances. Due to the specific nature of the data (closed questions in the form of a dispute), the assumption of normality of distribution was impossible to fulfill. Some authors (Glass, et. al., 199=72) have shown that in large samples the analysis of variances is quite resistant to breaching this assumption. Due to the large sample used in the study, the authors concluded that the lack of normal distribution in it does not constitute a barrier to the use of ANOVA test.

The analysis of results

The knowledge of the market and perception of the influence on the value

It was decided to study the hypothesis that there is a relationship between the knowledge of the market and a declaration concerning the influence on the change of the value of the property located near wind power plants. The

researched were given the possibility to assess the overall impact of wind power plant locations on the value of properties located in their vicinity. Three answers were possible to choose from in this part of the study:

- increasing the value of property;
- no impact on the value of property;
- the reduction of property value.

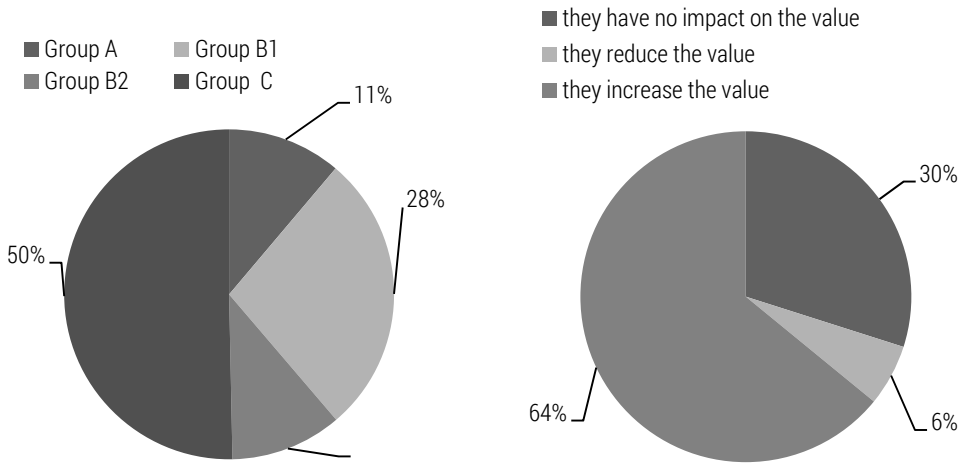

Figure 2. The structure of respondents due to their market knowledge (a) and declarations on the impact of wind power plants on the value of real estate (b)

Source: author's own work.

More than half of the respondents are in the group of people who do not know the market (group C). The clear majority of respondents believe that wind power plants reduce the value of properties located in their vicinity, and only 6% believe the other way round. Nearly one third of surveyed people do not see the relationship between the location of wind power plants and the value of the property.

Research show that there is a statistically meaningful relationship between market knowledge and the perception of the impact of wind power plants on the value of property. The distribution of responses according to age is presented in table 1, and in brackets the calculated theoretical numbers are given, i.e. "artificially created" numerical values that would have taken place in the case of the independence of the stochastic characteristic. The greater differences between empirical numbers and theoretical numbers, the stringer the correlation of the examined features was.

Table 1. The relationship between market knowledge and position regarding the impact of wind power plants on the value of property

Position regarding the impact of wind power plants on the value of property	Market knowledge				Total
	Group A	Group B1	Group B2	Group C	
They have no impact on the value of property	33 (40,1)	73 (99,0)	39 (39,2)	214 (180,7)	359
They reduce the value of property	97 (85,9)	235 (212,1)	86 (83,9)	351 (387,1)	769
They increase the value of property	4 (8,0)	23 (19,9)	6 (7,9)	39 (36,2)	72
Total	134	331	131	604	1200

Source: author's own work.

Declarations of non-impact on the value of real estate most often appeared in group C, i. e. among people who were least familiar with the market (35.4% of responses). A significant percentage of such responses leads to the logical conclusion that people who are not familiar with the real estate market do not have a definite view on the effects of wind power plants on the real estate market. This may be due to the fact that such people do not try to predict potential effects of wind power plants' location. Even partial knowledge of the market can change this situation. There is a clear decrease in the number of declaration of no influence in groups A, B1 and B2. The average percentage of respondents in these groups was 24.3%. The percentage of respondents who believe that wind power plants negatively affect the value of real estate increases together with the increase in the knowledge of the market. The largest is in group A (72.4%), and the smallest in group C (58.1%). Data show that among those unfamiliar with the market, 58.1% of respondents perceive property value loss because of its location near a wind farm. Regardless of market knowledge, the percentage of people declaring a positive influence of power plants is low and does not exceed 7%. Respondents may indeed perceive a positive relationship, but to a certain extent, these attitudes can be explained by the phenomenon of so-called protestors (Arrow, et al., 1993). The protest may be related to the willingness to manifest his or her attitude towards the development of renewable energy sources.

The analysis shows that there is a link between market knowledge and the perception of the impact of wind power plants on the value of property. This confirms the value of statistics $\chi 2 = 24{,}73$, which, at the significance level of 0.0004, allows to reject the zero hypothesis of no relationship between the examined features, and thus to consider market knowledge as a factor influencing the perception of the impairment of properties located in the vicinity of wind power plants.

Market knowledge and WTP declarations

The conducted research prompts the authors to make a hypothesis: the knowledge of the market is a significant modifying factor in the amount of declared value loss of real estate, in research using the contingent valuation method. This in turn may deform the value assessment of a good, valued with using CVM method. The authors attempted to verify this hypothesis based on empirical studies.

In the case when the researched person was convinced of the negative impact of power plants on the value of property, a hypothetical scenario was presented to him or her with the following wording: "It is possible to introduce an absolute ban on the construction of wind power plants in the county, however, this would involve the introduction of a tax on real estate purchase and sale transactions. Such a tax would be paid equally by the buyer and seller of the real estate". After the interviewer described and possibly fine-tuned the hypothetical situation, the respondent was asked questions about the amount of tax in the form of: PLN X for each 100,000 of transaction value (Y% of the transaction value), where, after each positive answer, the value of X (and thus of Y) was increased. Four thresholds were applied in the study:

- PLN 300 for each 100,000-transaction value (0.3% of the transaction value)
- PLN 1000 for each 100,000-transaction value (1% of the transaction value)
- PLN 3000 for each 100,000-transaction value (3% of the transaction value)
- PLN 5000 for each 100,000-transaction value (5% of the transaction value)

Respondents declaring no impact of wind power plants on the nearby properties and respondents declaring their positive impact were included in the group with zero readiness to pay WTP = 0.

Respondents declaring a negative impact of wind power plants on the properties located in their vicinity, however, who are not willing to pay a 0.3% tax on the purchase/sale transaction, were included in a group declaring the WTP in the range of 0 to 0.3%. It was assumed that their propensity to pay is 0.15%. It was decided to choose the middle of the range because in this case, the estimation error is the smallest. Similarly, amounts were allocated to thresholds, assuming that WTP was set at 0.65% (for responders declaring readiness to pay not less than 0.3%), 2% (for respondents declaring readiness to pay no less than 1%), and 4% 9for respondents declaring to pay not less than 3%). The remaining respondents were included in a group declaring WTP = 5%.

Table 2. The distribution of responses by groups depending on the assigned WTP

WTP	Group A	Group B1	Group B2	Group C	Total
0%	37	96	45	253	431
0,15%	62	143	58	233	62
0,65%	15	41	16	73	15
2%	7	29	7	24	7
4%	7	7	2	5	7
5%	6	15	3	16	6

Source: author's own work.

Among all the respondents, the average willingness to pay did not exceed 0.5%. However, some differences can be observed depending on the degree of knowledge of the market. With the growing knowledge of the real estate market, the average willingness to pay increases. In group A, the average WTP is the highest (0.68%) and it is the smallest among people who do not know the market (group C).

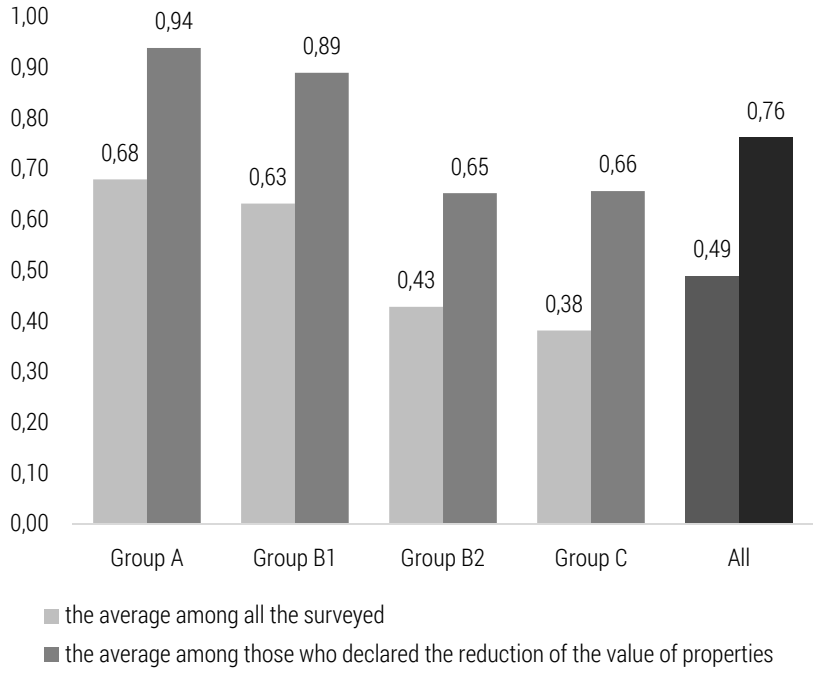

Figure 3. The average WTP level depending on the level of market knowledge

Source: author's own work.

An ANOVA test was carried out to investigate the relevance of differences between the declared averages. The result is presented in table 3. The significance of the text below 0.001 allows to reject zero hypothesis of equal mean values groups. Thus, statistically significant differences can be observed between average WTP in individual groups.

Table 3. ANOVA variance analysis based on all replies

SUMMARY

Groups	Number	Mean	Variance
Group A	134	0,68	1,773
Group B1	331	0,63	1,489
Group B2	131	0,43	0,916
Gorup C	604	0,38	0,869

VARIANCE ANALYSIS

The source of variance	SS	df	MS	F	The p value
Between groups	19,07	3	6,36	5,55	0,00088
Within the groups	1370,55	1196	1,15		
Total	1389,62	1199			

Source: author's own work.

The above average distribution in individual groups is partly due to the aforementioned share of declarations of no impact or positive influence of wind power plants on the value of real estate in the distribution of the responses (table 1). To mitigate the impact of this type of responses, the average WTP was also calculated only among people who perceive the impact of wind power plants on the value of property as negative. However, this treatment did not change significantly the arithmetic means in individual groups. Still the highest willingness to pay is declared by those who are most familiar with the market (group A).

Table 4. ANOVA variance analysis carried out based on the replies of the persons declaring value reduce of the property

SUMMARY

Groups	Number	Mean	Variance
Group A	97	0,94	2,211
Group B1	235	0,89	1,869
Group B2	86	0,65	1,252
Group C	351	0,66	1,317

VARIANCE ANALYSIS

Variance source	SS	df	MS	F	The p value
Between groups	11,81	3	3,94	2,47	0,0604
Within the groups	1217,07	765	1,59		
Total	1228,88	768			

Source: author's own work.

The effect of narrowing the sample to people who perceive the negative impact of wind power plants on the value of real estate is to reduce disproportions between the number of individual groups and to reduce disproportions between variants in individual groups. Similarly, to all the surveyed, in the group of people declaring that the value of property tends to decrease due to its location in the vicinity of a wind power plant, statistically significant differences can be observed between the average value of declared WTP. Although the significance of the ANOVA test was higher than 0.05 ($p = 0.06$), the authors found the results interesting and encouraging further analysis. In the next step (due to the similarity of averages) the aggregation of groups A and B1 as well as the aggregation of groups B2 and C were performed and the average difference test was carried out. The results are presented in table 5.

The test of average differences in aggregated groups indicates that differences between WTP means are statistically significant ($p<0.001$). This allows a zero hypothesis of the same mean in the aggregated groups to be rejected. The observed differences posed a question to the authors about the actual differentiating factor declared WTP, i. e. the purchase within the last five years or the intention to make a purchase within the next five years.

Table 5. Difference test results for averages in groups A + B1 and B2 + C

	A+B1	B2+C
Mean	0,904	0,656
Variance	1,963	1,301
Observations	332	437
Summary variance	1,587	
The difference in averages according to the hypothesis	0	
df	767	
t Stat	2,709	
P(T<=t) unilateral	0,003	
Test T unilateral	1,647	
P(T<=t) bilateral	0,007	
Test t bilateral	1,963	

Source: author's own work.

Discussion of results

The studies on the perception between the location of wind power plants and the value of the properties in their vicinity showed a statistically significant correlation between the grouping factor (belonging to group A, B1, B2 or C) and the amount of declarations. This means that market knowledge determines the willingness to pay (WTP). The research results indicate the gradation of the declared WTP size depending on the level of market knowledge. Persons belonging to group C, i.e. those who did not sell or buy in the market and did not intend to do such transactions within the next five years, most often declared a complete lack of willingness to pay. On the other hand, those who carried out transactions in the last five years and intended to carry out such transactions in a five-year perspective showed the highest propensity to pay.

It is quite interesting, somewhat surprising for the authors, to observe the fact that a higher propensity to pay was found in the group of persons intending to carry out transactions within the next five years (group B1) than in the group of persons who had already made such transactions in the recent past (group B2). It was expected that the situation would be opposite, i.e. those who are only just planning to participate in the market will show a lower level of WTP than those who were already in contact with the market.

Unfortunately, the structure of the questionnaire and the results do not allow to formulate a clear explanation of this issue. The observed phenomenon is so interesting it can be a prolegomenon for further empirical research.

Conclusions

During the carried out empirical data analysis, the hypothesis that "there is a relationship between the knowledge of the market and a declaration expressed in a qualitative manner concerning the influence on the change in the value of real estates located in the vicinity of wind power plants" has been positively verified. People who know the market are more likely to see a decrease in the value of properties located close to wind farms than those who do not know the real estate market.

The second hypothesis presented in the article, i.e. that "the knowledge of the market is a significant factor modifying the amount of the declared impairment of the real estate in the studies using the contingent valuation method", is also confirmed in the presented analysis of results. The average value of the declared WTP is the highest in the group that has acquired property over the last five years and intends to carry out a transaction within the next five years.

The positive verification of the hypothesis leads the authors to conclude that the factor of market knowledge is a significant factor influencing the discrepancy between the actual and declared willingness to pay for the value of the asset being valued. Therefore, methodological indications for carrying out studies with using CVM method should be supplemented by considering this circumstance, it seems reasonable, in the context of the shown discrepancies, to ask which group of respondents (having market or non-market knowledge) declares values closer to the actual choices, and thus to the real values of the goods being valued. As the structure of the study was based on a hypothetical situation, there is no reference point against which it is possible to compare the declared preferences of the designated groups. As a result, it is therefore not possible to establish clearly which of the groups is closer to the actual choices. However, logic indicates that priority should be given to declarations of people who know the market based on which a hypothetical scenario is constructed.

The contribution of the authors

Jacek Marcinkiewicz 50% – concept and objectives, literature review, statistical analysis.

Tomasz Poskrobko 50% – concept and objectives, literature review, research.

Literature

Arrow K. et al. (1993), *Report of the NOAA Panel on Contingent Valuation*, January 11

Czajkowski M., *Metody wyboru warunkowego i wyceny warunkowej*, in: *Wartości nierynkowych korzyści z lasów. Metody wyceny oraz zastosowanie wyników w analizach ekonomicznych*, http://www.polforex.wne.uw.edu.pl/docs/przewodnik_v3_final.pdf [23-02-2015]

Garrod G., Willis K.G. (1999), *Economic valuation of the environment, Methods and case studies*, UK

Glass G.V. et al. (1972), *Consequences of failure to meet the assumptions underlying the use of analysis variance and covariance*, "Review of Educational Research" Vol. 42(3), p. 237-288

Hinkle D.E., Wiersma W., Jurs S.G. (1994), *Applied statistics for the behavioral sciences*, Boston

Ligus M., Poskrobko T., Sidorczuk-Pietraszko E. (2015), *Pozaśrodowiskowe efekty zewnętrzne w lokalnych systemach energetycznych*, Białystok

List J.A. (2008), *Field experiments: a bridge between lab and naturally occurring data*, "Experimental Economics" Vol. 11(3)

Marcinkiewicz J., Poskrobko T. (2015), *Wpływ elektrowni wiatrowych na percepcję krajobrazu w świetle badań empirycznych*, "Ekonomia i środowisko" Vol. 2(53)

Żylicz T. (2004), *Ekonomia środowiska i zasobów naturalnych*, Warszawa, p. 41

Żylicz T. (2014), *Cena przyrody*, Białystok