DOI:10.17951/h.2022.56.3.149-168

A N N A L E S
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN – POLONIA

VOL. LVI, 3 SECTIO H 2022

MAGDALENA ANNA SWACHA-LECH

m.swachalech@gmail.com
Wrocław University of Economics and Business. Faculty of Economics and Finance
118/120 Komandorska St., 53-345 Wrocław, Poland
ORCID ID: https://orcid.org/0000-0003-0129-2968

MATEUSZ GAWIN

mateusz.gawin@ue.wroc.pl
ORCID ID: https://orcid.org/0000-0002-8680-5437

Why Don't Local Governments Buy Catastrophe Insurance? Biased Decision-Makers

Keywords: catastrophe insurance; low-probability and high-consequence risk; human biases and heuristics

JEL: G4; H79; Q54

How to quote this paper: Swacha-Lech, M.A., & Gawin, M. (2022). Why Don't Local Governments Buy Catastrophe Insurance? Biased Decision-Makers. *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia*, Vol. 56, No. 3.

Abstract

Theoretical background: Incorporating behavioral analysis into finance allows for finding responses to many questions that researchers have not been able to answer by relying on assumptions characteristic of the traditional, normative approach. One of the areas where recently the achievements of behavioral finance have been used to analyze selected problems is public finance. In this article, we use the achievements of psychology, incorporating them into public finance, which allows us to shed new light on decisions made by public managers in Poland.

Purpose of the article: The aim of this paper is to present the reasons why local governments do not buy insurance that would protect them against potential losses resulting from the occurrence of a catastrophic event. In this paper, we rely on responses from 303 municipalities, following the premise that an obvious way to learn about motives, constraints, and the decision-making process is to ask decision-makers.

Research methods: This paper examines the influence of behavioral determinants and the level of tax revenue *per capita* on the decisions made by public managers. The CART method was used for this purpose. The necessary empirical data were obtained through a CAWI survey conducted in 2020 between August 1 and September 21 by a consortium of two research agencies: Biostat Research & Development Sp. z o.o. and Biostat Sp. z o.o.
Main findings: The analysis conducted in this paper demonstrates that behavioral factors significantly impact public managers' decisions not to purchase catastrophe insurance. Our results confirm the significant role of a decision maker's traits, judgments, views, feelings, and experiences in the decision-making process.

Introduction

An analysis of world literature shows that many authors have used the behavioral perspective to explain the reasoning process underlying decision making in a variety of companies over the past years. Public finance is one of the relatively new areas in which behavior economics and finance are used for research. As noted by Alm and Sheffrin (2017), incorporating a psychological perspective into public finance is a promising area of research. Behavioral economics in public finance helps find answers to many questions, replies that failed to be seen through studies based on the traditional, normative approach – in which an individual is assumed to be an entirely rational, self-controlled, and maximizing decision-maker.

The behavioral approach is applied, among others, to problems related to tax strategies and to establish if monetary incentives crowd out altruistic intentions. An exciting area of behavioral public finance studies is the analysis of local authorities' decision-making process. By transferring the conclusions of studies conducted on managers in companies to decision-makers in public administration, many known research problems can now be analyzed in a completely different light, with interesting results obtained.

In this paper, the authors applied the behavioral approach to analyzing purchasing catastrophic loss insurance decisions made by municipalities (the lowest-level units of public administration in Poland). Catastrophic events often cover large areas and can significantly impact local communities. Recently, the problem of increasing exposure to this type of risk has also been recognized. People are concentrated in larger and larger metropolitan areas and the value of a property they own continues to rise due to economic development. Moreover, catastrophic loss insurance is related to low-probability events of high-impact risk, which makes them particularly interesting from the behavioral perspective.

The aim of this paper is to present the reasons why municipalities do not buy insurance that would protect them against potential losses resulting from the occurrence of a catastrophic event. In this study, the authors assumed that the behavioral approach has the potential to identify reasons why municipality decision-makers do not take out catastrophic loss insurance. The authors also assume that for municipalities with high revenue levels, psychological factors will be less important, while for municipalities with significant budget constraints, behavioral determinants may play a key role. Hence, in addition to the catalog of behavioral variables, the level

of municipalities' tax revenues in 2019 *per capita* (G-index) was also included in the analysis. We adopted the hypothesis that behavioral factors significantly impact municipalities' decisions not to purchase catastrophe insurance.

This paper is a continuation of the research conducted in 2021. In their article, Gawin and Swacha-Lech (2021) examined whether municipality income levels have a decisive impact on decisions about the purchase of insurance against catastrophic losses. The results proved that the economic factor does not have a decisive impact on these decisions, thus, confirming the importance of behavioral determinants. To deepen the analysis, in this paper, the research was carried out on two groups: rural municipalities and urban-rural municipalities. Our study presents empirical data from 303 municipalities in Poland obtained through a CAWI survey conducted in 2020.

Theoretical background

Behavioral decision-making

A significant event for developing the new behavioral economics was the emergence in the 1970s of a new branch in psychology, referred to as behavioral decision research (BDR) or behavioral decision-making (BDM). Based on the assumption of bounded rationality introduced in 1957 by Herbert Simon, BDR focuses on the human mind's properties and limitations of the cognitive apparatus responsible for deviating individuals' decisions from optimal choices. In this way, the descriptive approach characteristic of behavioral economics was incorporated into the study of decision-making.

As a descriptive science, behavioral economics assumes that in the process of decision-making, individuals are prone to making numerous mistakes and using simplifications. BDR considers, among other things, the presence of a shortage of information necessary to make rational choices, analytical errors, succumbing to short-sighted impulses, a tendency to inertia, and a lack of appropriate attention levels and concentration.

As Redlawsk and Lau (2013) emphasize, the basis of behavioral decision theory is the assumption that the best way to learn how decisions are made is observing them in the making. Points of interest to researchers using psychological aspects to analyze decision-making should also include the following aspects: how (and whether) decision-makers evaluate potential consequences of their choices, the extent to which they accurately identify all relevant repercussions, as well as how they make final choices (Frisch & Clemen, 1994). Many intervening biases and the complications of the entire decision-making process – such as the framing effect or loss aversion – are presented in a study by Takemura (2014). Dawes (1998) focuses on violating the sure-thing principle and attending to sunk costs, which undeniably affect the decision-making process. Research on decision-making from a behavioral perspective conducted in organizations shows that not only individuals,

but also organizations are subject to heuristics and biases. The decision-making process is entirely dependent on people and is a central activity of the manager (Omarli, 2017).

Low-probability and high-consequence risk

In the literature on risk and its transfer under insurance contracts, low-probability and high-consequence risk (LPHC) is a particular area of interest. LPHC is characterized by very low historical representation, but it causes huge losses to people, companies, and local governments when it does occur. The perception of risk within this group has been the subject of research since the perspective theory (Kahneman & Tversky, 1979). Catastrophe insurance, which is the focus of this study, belongs to a group of insurances characterized by low-probability and high-consequence.

As indicated by Laury et al. (2009), in case of this group of risks, the policyholder's problem with a proper estimation of the probability of occurrence of such events is observed. Kunreuther et al. (2001) and Kunreuther and Pauly (2004) indicate that those who choose to purchase catastrophic damage insurance are unable to distinguish between an event with a low probability of occurrence and one with no chance of occurrence. Tversky and Kahneman (1992) found that for risks with a low probability of occurrence, people "round down" the probability values to zero or strongly overestimate them, which is reflected in research results on the phenomenon of underinsurance for insurance belonging to the LPHC group. As numerous studies show, people exposed to such risks have two possible attitudes – exaggerated risk aversion (relative to the actual level of probability) and complete disregard for risk (Browne et al., 2015; Botzen & van den Bergh, 2012; Schade et al., 2011).

Explanations for the first attitude are seen, among others, in the role of worry and affection to the object of insurance. The fear of losing property or life (Baron et al., 2002) in the face of low-frequency risk realization can significantly affect the propensity to insure (Schade et al., 2011). It has also been noted that more fear is felt in the context of property than health and life (Roder et al., 2019).

The neglect of low-probability risks is justified by the fact that decision-makers have too little experience with these types of losses, which does not allow them to consider their probability enough to care about them (Hertwig et al., 2004; Viscusi & Zeckhauser, 2015). Even if they can benefit from the collective experiences of others, indirect experiences no longer have such an impact on their decision-making process.

Research on these issues in catastrophe insurance has been conducted, among others, by Slovic et al. (1977), Schoemaker and Kunreuther (1979), and McClelland et al. (1993). A common point in their findings was the observation that experimental participants are unlikely to purchase insurance with a low probability of loss, but their propensity to purchase insurance is higher for insurance with a high probability of loss but low consequences.

Heuristics and biases that disrupt the decision-making process of managers and public managers

As Simon (1956) noted, bounded rationality is present in the decision-making process of individuals. The rational choice to purchase insurance is limited by the cost of gathering information and the lack of reliable calculations. Problems in accurately perceiving data are almost as important as the lack of data (Schwartz, 2006). Heuristics and biases that shape individuals' choices can be seen at each stage of the decision-making process: information selection, information processing, and decision making.

Table 1. The critical heuristics and biases which disrupt the decision-making process of public managers

Heuristics	Definition	Public finance
Framing effect	People decide on options based on whether the options are presented with a positive or negative context	Cullis et al. (2012), Belardinelli et al. (2018), Nicholson-Crotty et al. (2019)
Loss aversion / Tax aversion / Penalty aversion	Being more sensitive to outcomes considered as losses than gains	McCaffery and Baron (2004), Fennell (2006)
Myopia/hyperopia	It refers to a lack of foresight and a focus on the present time	Fennell (2006)
Hyperbolic discounting	It illustrates an individual preference for immediate, less beneficial payoffs over options that could provide more significant future benefits	Fennell (2006), Fang and Silverman (2009)
Availability bias	Decision making based on events that are more likely or accessible to recall	Podgor (2009), Haynes et al. (2013), Tomal M. (2019)
Habits	The multiple processes by which past behavior predicts future behavior	West and Berman (2011), Jastrzębska et al. (2014)
Risk aversion	The tendency to prefer outcomes with low uncertainty to those outcomes with high uncertainty – even if the average outcome of the latter is equal to or higher in monetary value than the more certain outcome	Buurman et al. (2012), Nicholson-Crotty et al. (2019)
Optimism	The belief that favorable future events are more likely than they really are	Barrows et al. (2016), Tomal (2019), Schaupp and Carter (2010)
Affection effect	Individuals estimate the risk higher if they are more affectionate to the risk subject	Du Gay (2008)
Overconfidence	The tendency to overestimate the accuracy of their information and their ability to control risk	Fang and Silverman (2006), Liu et al. (2017)
Representativeness heuristics	People estimate probability by the degree of similarity to something they have already experienced	Tomal (2019), Stolwijk and Vis (2020)
Budgeting heuristic	Capital constraints relating to the ability to purchase insurance against low-probability risks mean that decision-makers may not even analyze the benefits of purchasing this insurance (abandoning the benefit versus cost analysis of insurance)	Kunreuther and Heal (2012)

Source: Authors' own study based on literature review.

The questions in the survey questionnaire designed for the purpose of the research used in this paper were constructed in such a way that they enabled the analysis of the influence of most of the heuristics and errors listed in Table 1 on the behavior of decision-makers in Polish municipalities when making decisions about the purchase of catastrophe insurance.

Research methodology and conceptual framework

The necessary empirical data was obtained through a CAWI survey conducted in 2020 between August 1 and September 21 by a consortium of two research agencies: Biostat Research & Development Sp. z o.o. and Biostat Sp. z o.o. The research questionnaire was sent out to 2,016 Polish municipalities, which account for 81.4% of Poland's municipalities. The response rate was at the level of 19%, which created a research sample of 348 municipalities upon rejecting the questionnaires incorrectly completed. The sample was selected randomly and covered all types of municipalities in Poland, i.e. rural, urban-rural and urban – including towns with district rights. The direct respondents were local authorities' officers responsible for risk management or deciding on taking out insurance for their local authority.

The whole sample covers 14% of the total number of Polish municipalities as of January 1, 2020. Among the 348 municipalities surveyed, 202 were rural (13.2% of the total number of rural municipalities), 101 – urban-rural (15.7% of the total), and the remaining 45 municipalities represented the urban municipalities (14.9% of the total).

Among the entire sample surveyed, 226 (64.9%) municipalities declared to have catastrophic loss insurance. Among rural municipalities, 123 had such insurance, which

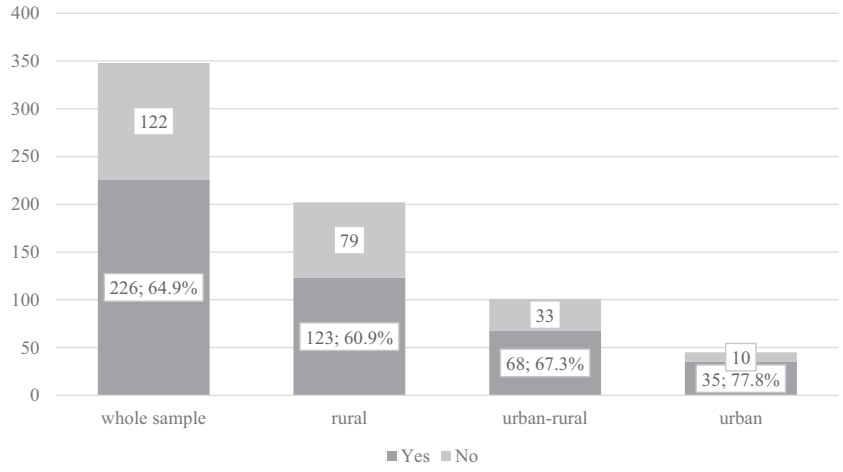

Figure 1. Share of the surveyed municipalities which have bought the insurance against catastrophic loss

Source: Authors' own study.

constituted 60.9% of the entire group. The percentage of insured urban-rural municipalities against catastrophic loss was 67.3% (out of 101) (see Figure 1). While urban-rural municipalities show a higher propensity to purchase catastrophic insurance than we observe for the entire survey sample, rural municipalities show a lower propensity.

The method of classification and regression trees was used to analyze the main drivers of acquiring insurance against catastrophic loss. Due to the insufficient sample size, urban municipalities were excluded from the analysis, so the analysis considers only 303 municipalities (representing the rural and urban-rural types of the municipality). The trees developed separately for rural municipalities and urban-rural municipalities were prepared using Statistica 13.0 statistical software. The assumptions used in individual analyses are presented in Table 2.

Table 2. The basic assumption used in the CART algorithm

Specification	Rural	Urban-rural
Costs of misclassification	Equal	
Fit measures (partitioning rule)	Gini index	
Stopping rule	If misclassification	
Prior probabilities	Estimated	
Minimum number	20	10
Maximum number of nodes	25	25
Error estimation	10-fold test validation	

Source: Authors' own study.

The dependent variable shows whether the surveyed municipality acquired insurance against catastrophic losses. Its values could be 0 – where the municipality does not have such insurance or 1 – where the municipality has such insurance.

Seven independent variables were used in the analysis, six of which were developed based on responses to a questionnaire distributed to municipal officials. The seventh predictor refers to the amount of municipal tax revenue *per capita* (G-index) – according to data for 2019 published by the Ministry of Finance.

The survey questions were developed based on the literature on the decision-making processes related to purchasing catastrophic loss insurance as insurance against low-frequency but high-loss risk. The statements used in the study (see Table 3) were developed using the 5-point Likert scale. The responses were coded as follows: 1 – *I strongly disagree*, 2 – *I disagree*, 3 – *I don't know*, 4 – *I agree*, 5 – *I strongly agree*.

Table 3 shows the association of the statements used to examine the attitudes and behaviors of public managers with the variables used in the cart method. The survey questions were designed to reveal certain behavioral propensities that characterize decision-makers involved in municipalities' decisions to purchase catastrophe insurance. Hence, the table also presents the corresponding heuristics and biases (described in Table 1) that were assigned to each predictor. Showing the connection between the selected variables and the associated heuristics is extremely important for interpreting the results obtained by the CART algorithm.

Table 3. Model's variables summary: statements used in the survey (Q), predictors description (X) and G-index distribution

Statements from the survey	Predictors description	Heuristics and biases
Q1. Government financial support in the event of catastrophic loss is sufficient	X1. The assumption that someone else will cover the loss	Availability bias Representativeness bias Overconfidence Optimism
Q2. The catastrophic risk is too low, and the price (premium) of the insurance is too high for such a security measure (insurance policy) to be profitable	X2. The assumption that the price of insurance is too high in relation to the risk of such low probability	Myopia/hyperopia Framing Overconfidence Optimism
Q3. The price (premium) of this kind of insurance is too high for our municipality	X3. The assumption that budget constraints limit the local community to such an extent that it does not even consider purchasing catastrophe insurance	Framing Budgeting heuristic
Q4. The history of catastrophic losses in our municipality makes us consider such insurance unnecessary	X4. Subjective perception of risk	Availability bias Representativeness bias Risk aversion
Q5. We continue the previous insurance policy of our predecessors instead of allocating resources to the continuous development of new Terms of Reference for insurance purchases	X5. Buying catastrophe insurance based on a habit	Habit
Q6. It is more certain to save on not buying such insurance than to suffer such loss and damage	X6. Willingness to buy catastrophe insurance in the view of hyperbolic discounting	Loss aversion Myopia/hyperopia Framing Overconfidence Optimism Hyperbolic discounting

Source: Authors' own study.

Figure 2 shows the distribution of responses given by the respondents to the research survey questions.

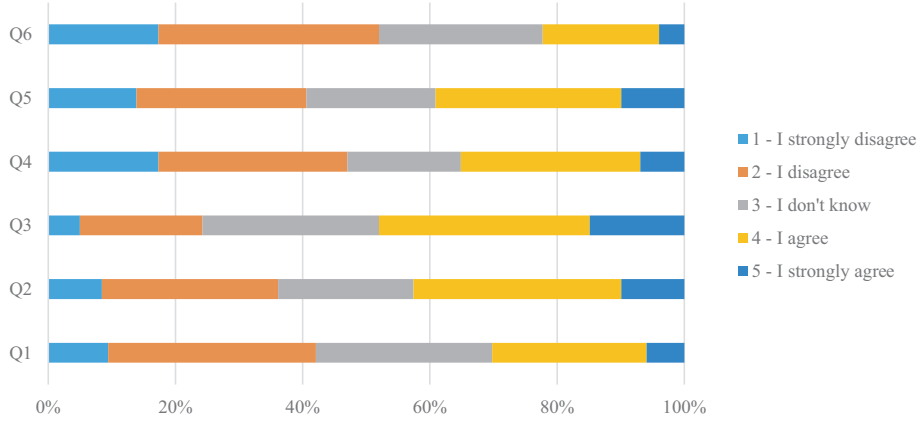

Figure 2. Share of responses from the surveyed municipalities

Source: Authors' own study.

According to the assumption adopted in this article, variables of behavioral character are also accompanied by an economic variable. G-index describes the level of tax revenue *per capita* for the analyzed municipalities.

Table 4. G-index distribution

G-index variable distribution for the surveyed sample		
Class	Percentiles	Amount (PLN)
1st class	(0.8–1>	(1,837.47–10,145.42>
2nd class	(0.6–0.8>	(1,477.80–1,837.47>
3rd class	(0.4–0.6>	(1,192.76–1,477.80>
4th class	(0.2–0.4>	(970.56–1,192.76>
5th class	<0.0–0.2>	<563.86–970.56>

Source: Authors' own study.

Thanks to such a selection of variables, the authors of the study were able to broadly analyze the impact of behavioral factors and demonstrate the importance of how risk or insurance prices are perceived for the municipalities' decisions on the purchase of catastrophic loss insurance. Additionally, the inclusion of an economic determinant in the analysis shows the significance of behavioral factors' impact against a given municipality's economic realities.

Combining the output from all the theories presented in the literature review section, the authors developed Figure 3, which summarizes the theoretical background for the problem of purchasing catastrophe insurance.

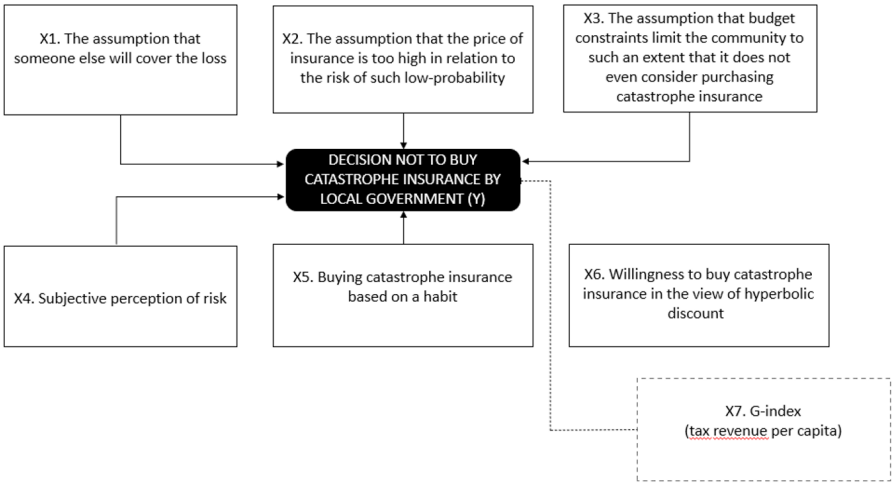

Figure 3. Determinants of the decision not to buy catastrophe insurance by the local government – behavioral factors and the G-index as the economic factor

Source: Authors' own study.

The diagram is an analytical framework for the CART model used in this paper.

Results

Two decision trees for the surveyed sample were obtained using the CART method – for urban-rural municipalities and rural municipalities. The tree made for the group of surveyed urban-rural municipalities is shown in Figure 4.

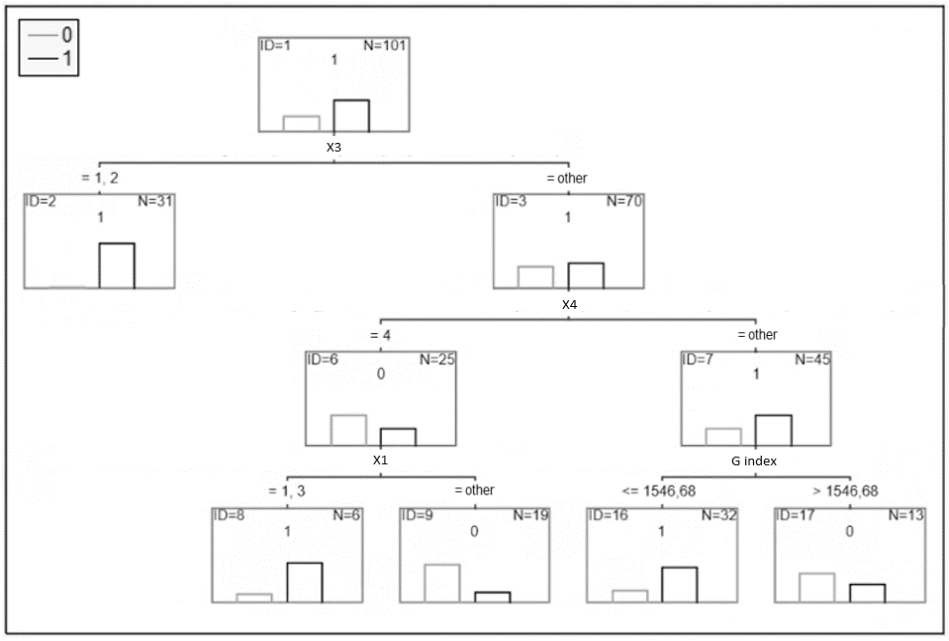

Figure 4. Decision tree for urban-rural municipalities

Source: Authors' own study.

Figure 5 presents the decision tree made for the group of surveyed rural municipalities.

An important observation from the analysis is that only one factor is not present in any tree of the seven predictors adopted for the analysis, namely X5 (Buying catastrophic insurance out of habit).

Analyzing the impact of the variables that entered the analysis, it should be noted that the first and crucial predictor for the group of urban-rural municipalities is X3 (The assumption that budget constraints limit the community to such an extent that it does not even consider purchasing catastrophe insurance). The second most important predictor is the variable X4 (Subjective perception of risk).

In the group of rural municipalities, the most critical determinant that split the surveyed population into two classes was X2 (Assumption that the price of insurance is too high in relation to the risk of such low-probability), and the second in importance for the decision to purchase insurance was the level of G-index.

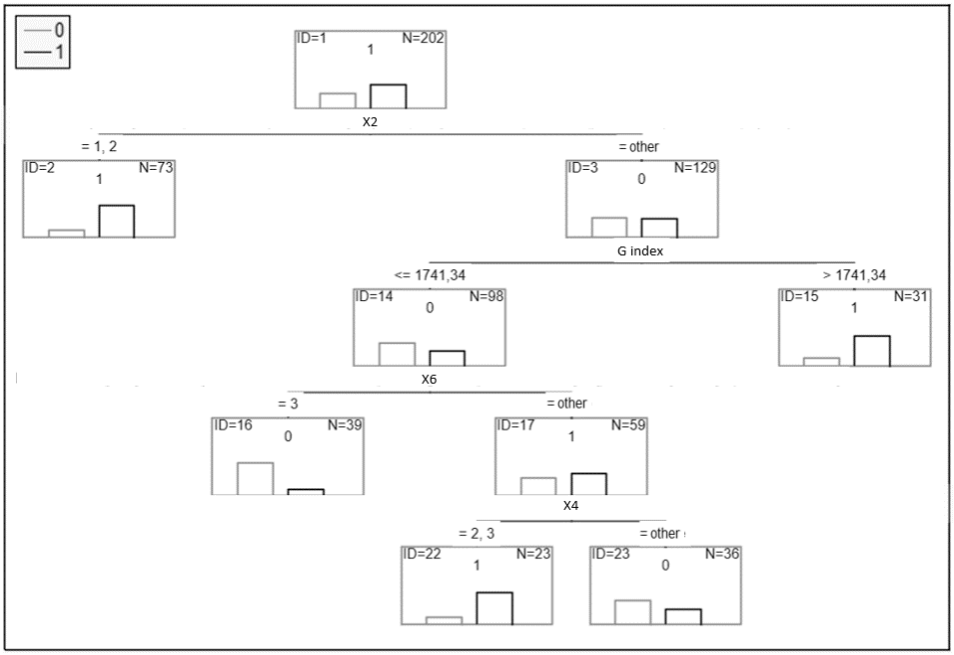

Figure 5. Decision tree for rural municipalities

Source: Authors' own study.

In the group of rural municipalities, we observed that, in general, the higher the value of the G-index was, the stronger the tendency to purchase insurance. In this group, the objects identified as having the highest G-index in the CART model were those that achieved tax revenues *per capita* over PLN 1,741.34 (node with ID = 15). As many as 77% of municipalities purchased catastrophic loss insurance in this group. With the remaining respondents, this rate was 32% (ID = 14).

Meanwhile, this relationship was not confirmed among the urban-rural municipalities that showed the G-index's highest level. With the group of urban-rural municipalities, the top level of tax revenues *per capita* was above the 67th percentile (PLN 1,546.68). The decision-makers representing the municipalities with the top level of tax revenues *per capita* decided not to purchase the catastrophic loss insurance.

In rural municipalities, the variables that affected the decisions to purchase catastrophe insurance taken by municipalities with a lower G-index were the X6 (Willingness to buy catastrophe insurance in the view of hyperbolic discount) and X5 predictor (Buying catastrophic insurance out of habit).

It is also worth noting that the CART model results revealed two more features that distinguish the group of urban-rural from rural municipalities. The distinctive feature was that their decision to purchase catastrophic loss insurance depends on the decision-makers' perception of the role of state aid in such losses. Another feature

that distinguishes the result of the CART analysis for urban-rural municipalities is the presence of a variable that drove nearly 100% of them to acquire insurance. This is the predictor X3 (The assumption that budget constraints limit the municipalities to such an extent that it does not even consider purchasing catastrophe insurance).

Discussion

Our study shows that the most important predictor in the group of urban-rural municipalities is variable X3 (The assumption that budget constraints limit the municipalities to such an extent that it does not even consider purchasing catastrophe insurance). This variable informs about decision-makers' subjective perception of the insurance price level. Interesting observations were obtained after linking responses of all the municipalities who agreed with the statement: The price (premium) of this kind of insurance is too high for our municipality (Q3), with the level of the G-index (X7). It turned out that the perceived insurance price was too high for decision-makers representing each of the five classes distinguished by the G-index, which confirms the subjectivity of the assessments.

The second most important determinant for the group of urban-rural municipalities in our study was predictor X4 (Subjective perception of risk). It is closely related to the availability and representativeness heuristics. The occurrence of these heuristics in the decision-making process means that decision-makers refer to their experiences related to the area to which the decision applies. As Schwartz (2006) noted, reasoning by analogy from experience is particularly common. The results of our study show that municipalities that have not experienced catastrophic damage in previous periods repeat the decision not to purchase insurance. Indeed, the analysis of respondents' answers shows that in municipalities that did not experience a catastrophic event in 2018–2019, 58.26% purchased insurance in 2020 (compared to 76.15% among municipalities that experienced catastrophic damage). It should be noted that the group of urban-rural municipalities shows a greater awareness of exposure to catastrophic losses, as variable X4 had a greater influence on their decision-making process, than rural municipalities.

Viscusi and Zeckhauser (2015) also came to a similar conclusion in their study, noting that beliefs about environmental risk are more influenced by direct experiences than indirect experiences of others. This proves the presence of representativeness heuristic – decision-makers mainly rely on their own experiences, which may be limited, and assign less weight to the experiences of other municipalities, even if they are more extensive. As a result, many municipalities perceive the catastrophic loss risk as too low to consider. The subjective perception of risk may also be a factor of greater importance for the decisions made than the region's characteristics – especially with the risks whose materialization is rare. The research concluded that the willingness to purchase insurance is greater when the risk is considered subjectively

than based on regional features (Delbufalo, 2015; Babula, 2010). Also, Schade et al. (2011) stressed that the willingness to buy insurance was higher when the occurrence probability was not presented to the study participants, and lower when it was calculated, and relevant information was provided.

However, when dealing with events with a low probability of occurrence, learning from experience is not an adequate solution. Studies on catastrophe risk (Munich RE, 2018a, 2018b, 2020; PIU, 2019) show that the frequency of such events has been increasing. Therefore, the assumption that a natural catastrophe will never occur because it has not happened in the past is wrong – especially in the context of the increase in the risk of catastrophic events.

Among rural municipalities, the most crucial determinant that split the surveyed population into two classes was X2 (The assumption that the price of insurance is too high in relation to the risk of such low-probability). As Botzen and van den Bergh (2012) found, the greater the respondents recognize their flood risk, the higher their willingness to pay for insurance value. The second most important factor affecting decisions on purchasing the insurance was the G-index level.

According to the results of the CART analysis (Figure 5), in rural municipalities with lower wealth and thus lower risk exposure, variables related to the insurance price and the size of the municipality's revenues played a vital role in the decision-making process. This problem had already been discussed by Kunreuther and Heal (2012), who emphasized the importance of budgeting heuristics. This type of heuristic refers to the regularity that with no capital, decision-makers may not analyze the benefit-cost ratio of insurance. The authors point out that financial limitations may make a given project unreasonable at the beginning of the decision-making process. The low probability factor in catastrophic loss insurance undoubtedly affects price perception. On the one hand, the low probability of a disastrous event diminishes the readiness to take out insurance. On the other hand, it brings down the level of acceptance of higher prices (Botzen & van den Bergh, 2012).

Identification of the determinants driving the purchase of catastrophic loss insurance in rural municipalities proved the impact of G-index level to be significant. We observed that the higher the value of tax revenue *per capita* was, the stronger the tendency to purchase catastrophic loss insurance. This tendency was not observed among the urban-rural municipalities. The behaviors observed in urban-rural municipalities may be surprising. A detailed analysis of the responses of municipalities belonging to the ID = 17 node (Figure 4) proved that a vast majority (85%) of those municipalities stated that the risk of catastrophic loss is too low, and the insurance price is too high to make having such a policy profitable for their municipality. Underestimating the risk of a natural disaster may be explained by decision-makers' excessive self-confidence, optimism, and myopia/hyperopia.

Research shows that both optimism and overconfidence accompany decisions made by managers very often. Both biases contribute to a positive perception of the future. Optimism and overconfidence are the traits that most often come together, prompting

managers to make riskier decisions. Optimism means the belief that favorable future events are more likely than they really are. Gervais (2010) emphasizes that, in general, people are unrealistically optimistic about future events. These heuristics explain underestimating the risk of a natural disaster by managers responsible for purchasing insurance in urban-rural municipalities. However, it should be stressed that they do not always have the adverse effect of causing erroneous, irrational, and misguided decisions.

In addition to the heuristic of optimism and overconfidence, the decisions not to purchase catastrophic loss insurance made by municipalities with a high level of tax revenues per capita may also explain the existence of the problem of myopia/hyperopia. As Shefrin and Thaler (1988) assumed, inside each person, there is a "farsighted planner" responsible for the rational earmarking of funds between consumption and saving, which coexists with a "myopic doer" – eager for the on-the-spot consumption of the revenues obtained. Myopia means the inability to predict and focus on the present.

The prevalence of hyperopia in public finances has been confirmed in a study by Fennell (2006). Myopia and hyperopia in the time-preference context suggest that decision-makers perceive differently the relative size or attractiveness of rewards that can be obtained at different times. Thus, such an approach to the problem analysed may explain underestimating the risk of a natural disaster occurrence. When deciding to purchase insurance or not, the decision-makers focus on the present, perceiving the necessity to incur expenses (insurance premium). In behavioral economics, there is a phenomenon known as "pain of paying", denoting the negative perception of spending (Prelec & Loewenstein, 1998), which, in turn, favors a tendency not to assign proper weights to the long-term consequences of decisions made. Managers guided by the pain of paying and regret avoidance heuristics, decide not to buy insurance.

In the case of rural municipalities, the decision to purchase catastrophic loss insurance by municipalities with a lower G index was driven by the X6 variable (Willingness to buy catastrophe insurance in the view of hyperbolic discount) and the X4 variable (Subjective perception of risk).

The explanation of the high significance of the X6 variable for the analysed group is the hyperbolic discounting related to the issue of intertemporal choice. Many decisions have an intertemporal dimension because they involve flows of future costs and benefits (Fehr & Zych, 2000). The municipalities with lower levels of the G-index value the savings resulting from not having to pay the premium higher than the benefit of receiving indemnity. The pain of paying associated with the premium would occur immediately, while the benefit of being compensated for losses incurred due to the materialization of catastrophic loss risk is distant and uncertain. By its very nature, insurance involves the fact that the payment of compensation is not certain and is related to the probability of the damage occurrence. Due to the low probability of catastrophic loss, decision-makers may perceive this benefit as highly unlikely and uncertain. Among the decision-makers who experience the hyperbolic discounting effect, assessing benefits and costs may bring a municipality's decision not to purchase catastrophic loss insurance.

The decision to purchase catastrophic loss insurance also depends on the decision-makers' perception of the role of state aid in the event of such losses. This constitutes a distinctive feature of the CART model results for urban-rural municipalities. However, the analysis of this variable's impact on the population surveyed has shown that the impact on municipalities' decisions on purchasing catastrophic loss insurance is not unequivocal. The classes identified on this basis represent the nodes with ID = 8 and 9 (Figure 5). The first leaf refers to 6 municipalities only – which is less than 10% of the sample analyzed – and, therefore, it is not statistically significant. The second leaf, in turn, includes both those respondents (42%) who agreed with the statement that government financial support in the event of catastrophic loss is sufficient (X1: Assumption that someone else will cover the loss), and those who did not agree with this view (58%).

Additionally, the questions Q2, Q3 and Q6 included in our research survey were planned in such a way that we could identify the framing effect occurrence and its impact on decisions on the purchase of catastrophic loss insurance within the studied group of municipalities. Q2 and Q3 relate to the price/premium paid for catastrophic loss insurance. In Q2, the price was related to the low risk of an insured event, while Q3 confronts the amount of the premium with the budgetary capacities of a given municipality. In the case of municipalities who agreed with the statement in Q2 and at the same time disagreed with the statement in Q3, the decision not to purchase insurance is due to perceiving the risk of an event as too low, and not to budgetary constraints. The analysis of responses shows that from the perspective of individual municipality types, only a small part of the municipalities gave such a response.

Considering the responses given by the urban-rural and rural municipalities that agreed with the statement in Q2 while contradicting the statement contained in Q3, it should be noted that the results obtained are very similar. In the first case, the percentage of municipalities that responded negatively to Q3 is also slightly more than 7% among the municipalities that agreed with the statement in Q2. In the group of rural municipalities, it was slightly more than 8%.

When analysing the framing effect, it is also observed that people tend to avoid risk when a positive frame is presented but seek risks when a negative frame is presented (Tversky & Kahneman, 1981). To confirm this phenomenon's occurrence among the municipalities analysed, the authors designed the questions so as the insurance price was shown both in the context of profits and losses. Q2 emphasizes the low risk of an insured event and undermines the profitability of such an expense by a given municipality (profit is highlighted in the question). In contrast, Q6 emphasizes the risk of damage (highlighting possible losses). It can, therefore, be seen that municipalities that agree with the statement in Q2, while denying the statement in Q6, suffer from the framing effect caused by the change of context from positive to negative. Among the 101 urban-rural municipalities, 16.83% of respondents were affected by this phenomenon, while in the group of 202 rural municipalities, 14.36% of such municipalities were observed.

Conclusions

Our research is part of a relatively new trend of incorporating the achievements of psychology into public finance. By applying this eclectic approach, we extend and complement previous research results. The introduction of the assumption of the presence of cognitive and motivational limitations, weaknesses, simplifications and biases in the decision-makers allows for a new approach to the problems studied. This paper sheds new light on the identification and influence of behavioral determinants on the local government's decision not to purchase catastrophe insurance. Thus, the considerations in this paper extend the research in behavioral public finance.

The results support the hypothesis that behavioral factors significantly impact municipalities' decisions not to purchase catastrophe insurance. Our results confirm the considerable role of the decision-maker in the final decision. Therefore, public managers' traits, evaluations, views, feelings, and experiences have a significant impact on municipalities' decisions to purchase or not to purchase catastrophe insurance. The CART analysis shows that tax revenue – an economic factor – has less influence in these cases. In the case of rural municipalities, income turned out to be the second most important determinant, but for municipalities with not the highest level of tax income *per capita* – which prevail numerically – further analysis shows that there is a strong influence of behavioral determinants (predictors: X6 and X4).

The findings presented in the article can contribute to a better understanding of the factors that impact policyholders' decision-making process regarding the purchase of catastrophe insurance (already addressed by Kuligowska, 2021; Jastrzębska et al., 2014; Gallagher, 2014). This includes not only factors that increase willingness to buy the insurance, but also information about biases and probability miscalculations that may dissuade them from this decision. The influence of media coverage on willingness to buy catastrophe insurance is repeatedly raised in the literature (Johnson et al., 1993; Gallagher, 2014). Therefore, it is possible to conclude that appropriate information tools can contribute to increased awareness of the likelihood and magnitude of this risk.

The applicability of the present research also relates to legal and regulatory solutions in the context of catastrophe insurance. In the face of increasing exposure to the risk of natural disasters and their growing frequency, these findings can be used to develop a model of government support and incentives to purchase such insurance. Compensation in the event of such loss in the future would help to rebuild infrastructure more quickly, repair damages and restore a full range of services provided by the local municipality. In the case of insurance for local governments, the government could also consider a program of compulsory (and perhaps subsidized) insurance against catastrophic risk – at least for local governments in areas which according to risk analyses and calculations are more exposed to possible floods, earthquakes or landslides.

Considering the experience of other European countries concerning the organization or regulation of the catastrophe insurance market, we have access to an overview of several strategies. From Germany, where extending the standard (covers damage caused by fire or windstorm) property insurance coverage with additional catastrophic risks (flood) is optional, resulting in low market penetration at the level of 10%, through Switzerland, where a dual insurance system is in place, imposing an obligation to insure against catastrophic risk in selected cantons (19 out of 26 cantons) to Great Britain, where it is not possible to establish a mortgage without taking out an appropriate catastrophic policy (Kondratowicz, 2012).

Based on the above solutions, which significantly contribute to improving the catastrophe insurance market penetration rate, one can outline a proposal to support this market in Poland. It would be reasonable, for example, to introduce an obligation to buy insurance against a catastrophic risk in the area where the chance of its occurrence is particularly high or at least above the average for the whole country. However, limiting the insurance obligation only to these areas could make the price of such insurance too high due to the limited number of policies. A national insurance pool, subsidized by the State, could be used as support. A tax incentive scheme for entities and households buying insurance is also worth considering. Over time, once a satisfactory level of financial security has been achieved in the areas at risk, it would be the responsibility of the pool or other supporting institution to prevent and promote appropriate attitudes and investments to enhance security and mitigation in the event of natural catastrophe.

The research carried out in this study has some limitations, including a limited number of municipalities adopted for the analysis, the adoption of only municipalities for the investigation, and the narrowing down of the area of research only to the local government units in Poland. It would also be worthwhile to support the obtained results by using other research methods, such as the regression model. It also seems valuable to include a broader group of behavioral factors in the analysis and to expand the remaining group of determinants.

References

Alm, J., & Sheffrin, S.M. (2017). Using behavioral economics in public economics. *Public Finance Review*, *45*(1), 4–9. **doi:10.1177/1091142116661411**

Babula, E. (2010). Skłonność do podejmowania ryzyka a zasobność finansowa przedsiębiorstw. In P. Kulawczuk & A. Poszewiecki (Eds.), *Behawioralne determinanty rozwoju przedsiębiorczości w Polsce. Ekonomia behawioralna finansowania przedsiębiorczości* (pp. 156–169). Gdańsk: Fundacja Rozwoju Uniwersytetu Gdańskiego.

Baron, J., Hershey, J.C., & Kunreuther, H. (2002). Determinants of priority for risk reduction: The role of worry. *Risk Analysis*, *20*(4), 413–428. **doi:10.1111/0272-4332.204041**

Barrows, S., Henderson, M., Peterson, P.E., & West, M.R. (2016). Relative performance information and perceptions of public service quality: Evidence from American school districts. *Journal of Public Administration Research and Theory*, *26*(3), 571–583. **doi:10.1093/jopart/muw028**

Belardinelli, P., Bellé, N., Sicilia, M., & Steccolini, I. (2018). Framing effects under different uses of performance information: An experimental study on public managers. *Public Administration Review*, *78*(6), 841–851.

Botzen, W.J.W., & van den Bergh, J.C.J.M. (2012). Risk attitudes to low-probability climate change risks: WTP for flood insurance. *Journal of Economic Behavior & Organization*, *8*, 151–166. **doi:10.1111/puar.12969**

Browne, M., Knoller, C., & Richter, A. (2015). Behavioral bias and the demand for bicycle and flood insurance. *Journal of Risk and Uncertainty*, *50*, 141–160. **doi:10.1007/s11166-015-9212-9**

Buurman, M., Delfgaauw, J., Dur, R., & Van den Bossche, S. (2012). Public sector employees: Risk averse and altruistic? *Journal of Economic Behavior & Organization*, *83*(3), 279–291. **doi:10.2139/ssrn.2094954**

Cullis, J., Jones, P., & Savoia, A. (2012). Social norms and tax compliance: Framing the decision to pay tax. *The Journal of Socio-Economics*, *41*(2), 159–168. **doi:10.1016/j.socec.2011.12.003**

Dawes, R.M. (1998). Behavioral decision making and judgment. In D.T. Gilbert, S.T. Fiske, & G. Lindzey (Eds.), *The Handbook of Social Psychology* (pp. 497–548). New York: McGraw-Hill. **doi:10.1002/9780470561119**

Delbufalo, E. (2015). Subjective trust and perceived risk influences on exchange performance in supplier–manufacturer relationships. *Scandinavian Journal of Management*, *31*(1), 84–101. **doi:10.1016/j.scaman.2014.06.002**

Du Gay, P. (2008). 'Without affection or enthusiasm' problems of involvement and attachment in 'responsive' public management. *Organization*, *15*(3), 335–353. **doi:10.1177/1350508408088533**

Fang, H., & Silverman, D. (2006). Distinguishing between cognitive biases. In E.J. McCaffery & J. Slemrod (Eds.), *Behavioral Public Finance* (pp. 47–81). New York: Russell Sage Foundation.

Fang, H., & Silverman, D. (2009). Time-inconsistency and welfare program participation: Evidence from the NLSY. *International Economic Review*, *50*(4), 1043–1077. **doi:10.3386/w13375**

Fehr, E., & Zych, P.K. (2000). Intertemporal choice under habit formation. *IEW – Working Papers 043*. Institute for Empirical Research in Economics, University of Zurich. **doi:10.2139/ssrn.230025**

Fennell, L.A. (2006). Hyperopia in public finance. In E.J. McCaffery & J. Slemrod (Eds.), *Behavioral Public Finance* (pp. 141–171). New York: Russell Sage Foundation.

Frisch, D., & Clemen, R.T. (1994). Beyond expected utility: Rethinking behavioral decision research. *Psychological Bulletin*, *116*(1), 46–54. **doi:10.1037/0033-2909.116.1.46**

Gallagher, J. (2014). Learning about an infrequent event: Evidence from flood insurance take-up in the United States. *American Economic Journal: Applied Economics*, *6*(3), 206–233. **doi:10.1257/app.6.3.206**

Gawin, M., & Swacha-Lech, M. (2021). Determinants of catastrophe insurance purchasing by communes – behavioural perspective. *Research Papers of Wroclaw University of Economics and Business, Economics and Finance*, *1*(65), 11–27. **doi:10.15611/pn.2021.1.02**

Gervais, S. (2010). Capital budgeting and other investment decisions. In H. Kent Baker & J.R. Nofsinger (Eds.), *Behavioral Finance Investors, Corporations, and Markets* (pp. 413–434). Hoboken: John Wiley & Sons. **doi:10.1002/9781118258415**

Haynes, L.C., Green, D.P., Gallagher, R., John, P., & Torgerson, D.J. (2013). Collection of delinquent fines: An adaptive randomized trial to assess the effectiveness of alternative text messages. *Journal of Policy Analysis and Management*, *32*(4), 718–730. **doi:10.1002/pam.21717**

Hertwig, R., Barron, G., Weber, E., & Erev, I. (2004). Decisions from experience and the effect of rare events in risky choice. *Psychological Science*, *15*(8), 534–539. **doi:10.1111/j.0956-7976.2004.00715.x**

Jastrzębska, M., Janowicz-Lomott, M., & Łyskawa, K. (2014). *Zarządzanie ryzykiem w działalności jednostek samorządu terytorialnego ze szczególnym uwzględnieniem ryzyka katastroficznego*. Warszawa: Wolters Kluwer.

Johnson, E.J., Hershey, J., Meszaros, J., & Kunreuther, H. (1993). Framing, probability distortions and insurance decisions. *Journal of Risk and Uncertainty*, *7*, 35–51. **doi:10.1007/bf01065313**

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*(2), 263–292. **doi:10.2307/1914185**

Kondratowicz, P. (2012). Przegląd systemów ubezpieczenia ryzyk katastroficznych w wybranych krajach Unii Europejskiej. *Wiadomości Ubezpieczeniowe: Powódź – Infrastruktura – Finansowanie*, *1*, 59–63.

Kuligowska, A. (2021). *Finansowe aspekty korzystania z ochrony ubezpieczeniowej przez gminy w Polsce*. Toruń: Wyd. Adam Marszałek.

Kunreuther, H., & Heal, G. (2012). Managing catastrophic risk. *NBER Working Paper*, *18136*. **doi:10.3386/w18136**

Kunreuther, H., Novemsky, N., & Kahneman, D. (2001). Making low probabilities useful. *Journal of Risk and Uncertainty*, *23*, 103–120. **doi:10.1023/a:1011111601406**

Kunreuther, H., & Pauly, M.V. (2004). Neglecting disaster: Why don't people insure against large losses? *Journal of Risk and Uncertainty*, *28*, 5–21. **doi:10.1023/b:risk.0000009433.25126.87**

Laury, S.K., McInnes, M.M., & Swarthout, J.T. (2009). Insurance decisions for low-probability losses. *Journal of Risk and Uncertainty*, *39*(1), 17–44. **doi:10.1007/s11166-009-9072-2**

Liu, X., Stoutenborough, J., & Vedlitz, A. (2017). Bureaucratic expertise, overconfidence, and policy choice. *Governance*, *30*(4), 705–725. **https://doi.org/10.1111/gove.12257**

McCaffery, E.J., & Baron, J. (2004).Framing and taxation: Evaluation of tax policies involving household composition. *Journal of Economic Psychology*, *25*(6), 679–705. **doi:10.1016/j.joep.2003.07.001**

McClelland, G.H., Schulze, W.D., & Coursey, D.L. (1993). Insurance for low-probability hazards: a bimodal response to unlikely events. *Journal of Risk and Uncertainty*, *7*(1), 95–116. **doi:10.1007/bf01065317**

Munich RE. (2018a). NatCatSERVICE. Retrieved from https://www.munichre.com/en/solutions/for-industry-clients/natcatservice.html

Munich RE. (2018b). *Topics Geo – Natural disasters 2017*. Retrieved from https://www.munichre.com/topics-online/en/climate-change-and-natural-disasters/natural-disasters/topics-geo-2017.html

Munich RE. (2020). Retrieved from https://www.munichre.com/en/risks/natural-disasters-losses-are-trending-upwards.html#-1624621007

Nicholson-Crotty, S., Nicholson-Crotty, J., & Webeck, S. (2019). Are public managers more risk averse? Framing effects and *status quo* bias across the sectors. *Journal of Behavioral Public Administration*, *2*(1), 1–14. **doi:10.30636/jbpa.21.35**

Omarli, S. (2017). Which factors have an impact on managerial decision-making process? An integrated framework. *Essays in Economics and Business Studies*, 83–93. **doi:10.18427/iri-2017-0068**

PIU (Polska Izba Ubezpieczeń). (2019). *Klimat ryzyka. Jak prewencja i ubezpieczenia mogą ograniczyć wpływ katastrof naturalnych na otoczenie?* Warszawa: PIU.

Podgor, E.S. (2009, April 14). *April 15th – tax day is approaching*. Retrieved from http://lawprofessors.typepad.com/whitecollarcrime_blog/2009/04/april-15th-tax-day-is-approaching.html

Prelec, D., & Loewenstein, G. (1998). The red and the black: Mental accounting of savings and debt. *Marketing Science*, *17*(1), 4–28. **doi:10.1287/mksc.17.1.4**

Redlawsk, D.P., & Lau, R.R. (2013). Behavioral decision-making. In L. Huddy, D.O. Sears, & J.S. Levy (Eds.), *The Oxford Handbook of Political Psychology* (pp. 130–164). Oxford: Oxford University Press. **doi:10.1093/oxfordhb/9780199760107.013.0005**

Roder, G., Hudson, P., & Tarolli, P. (2019). Flood risk perceptions and the willingness to pay for flood insurance in the Veneto region of Italy. *International Journal of Disaster Risk Reduction*, *37*. **doi:10.1016/j.ijdrr.2019.101172**

Schade, C., Kunreuther, H., & Koellinger, P. (2011). Protecting against low-probability disasters: The role of worry. *Journal of Behavioral Decision Making*, *25*, 534–543. **doi:10.1002/bdm.754**

Schaupp, L.C., & Carter, L. (2010). The impact of trust, risk and optimism bias on e-file adoption. *Information Systems Frontiers*, *12*(3), 299–309. **doi:10.1007/s10796-008-9138-8**

Schoemaker, P., & Kunreuther, H. (1979). An experimental study of insurance decisions. *Journal of Risk and Insurance*, *46*(4), 603–618. **doi:10.2307/252533**

Schwartz, H. (2006). In-depth interviews as a means of understanding economic reasoning: Decision making as explained by business leaders and business economists. In M. Altman (Ed.), *Handbook of Contemporary Behavioral Economics: Foundations and Developments* (pp. 356–377). Armonk – London: M.E. Sharpe. **doi:10.4324/9781315703879-28**

Shefrin, H.M., & Thaler, R.H. (1988). The behavioral life-cycle hypothesis. *Economic Inquiry*, *26*(4), 609–643. **doi:10.1111/j.1465-7295.1988.tb01520.x**

Simon, H.A. (1956). Rational choice and the structure of the environment. *Psychological Review*, *63*, 129–138. **doi:10.1037/h0042769**

Simon, H.A. (1957). Models of man: Social and rational. *Economica*, *24*(96), 382. **doi:10.2307/2109314**

Slovic, P., Fischhoff, B., Lichtenstein, S., Corrigan, B., & Combs, B. (1977). Preference for insuring against probable small losses: Insurance implications. *Journal of Risk and Insurance*, *44*, 237–258. **doi:10.2307/252136**

Stolwijk, S., & Vis, B. (2020). Politicians, the representativeness heuristic and decision-making biases. *Political Behavior*, *43*, 1411–1432. **doi:10.1007/s11109-020-09594-6**

Takemura, K. (2014). *Behavioral Decision Theory. Psychological and Mathematical Descriptions of Human Choice Behavior*. Springer. **doi:10.1007/978-981-16-5453-4_1**

Tomal, M. (2019). Behawioralne aspekty decyzji inwestycyjnych samorządów lokalnych – na przykładzie gmin województwa małopolskiego. *Ekonomista*, *2*, 226–242.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and the psychology of choice. *Science*, *211*(4481), 453–458. **doi:10.1126/science.7455683**

Tversky, A., Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, *5*, 297–323. **doi:10.1007/bf00122574**

Viscusi, W., & Zeckhauser, R. (2015). The relative weights of direct and indirect experiences in the formation of environmental risk beliefs. *Risk Analysis*, *35*(2), 318–331.

West, J.P., & Berman, E.M. (2011). The impact of management work habits on public sector performance: A study of local government managers. *Public Personnel Management*, *40*(1), 63–87. **doi:10.1111/risa.12271**