Chapter 7

Cognitive and emotional factors influencing the propensity to insure oneself against disaster

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7.1 INTRODUCTION

Imagine that your family house is located in a beautiful village, near a mountain stream. This year, the stream has flooded, destroying most of your personal belongings. Moreover, an expert has said that your house must be rebuilt if you intend to remain living there safely. This will be very expensive and you do not know if you can afford it.

doi: 10.2166/ 9781780408606_119

Despite the disastrous outcomes associated with natural hazards such as those described above, people often tend to restrain themselves from purchasing insurance against them (Zaleskiewicz *et al.* 2002; Kunreuther & Pauly, 2004). People may downplay their evaluations of environmental threats, including the expected severity of negative consequences (such as death, injury, property damage, etc.). They also downplay, or even ignore, information about probabilities (Slovic *et al.* 1977). Rather than basing their decisions on cognitive processes, people facing natural hazards may base their insurance decisions on emotional reactions (e.g., fear) evoked by personal experience of a disaster (Zaleskiewicz *et al.* 2002). In the present study we attempted to identify which factor – cognitive evaluations or feelings – is more decisive in insurance purchasing decisions. Specifically, we hypothesized that personal experience of severe negative outcomes would increase feelings of worry which, in turn, would influence decisions to pay more for insurance.

7.1.1 Cognitive factors influencing the propensity to insure oneself against disaster

Buying insurance against a natural hazard can be regarded as a decision to reduce a low-probability risk of severe negative consequences. Thus, the disastrous consequences of losing all of one's belongings as the result of a flood might be compensated by purchasing insurance that transfers the risk of a financial loss to the insurer. Normative theories of choice (e.g., expected utility [EU] theory) posit that a rational decision-maker weights outcomes by probabilities in order to choose an alternative characterized by the highest expected utility (von Neumann & Morgenstern, 1944). Following this assumption, it is argued that optimal decisions to purchase insurance are made by people considering factors such as its price, their wealth, and the potential magnitude of loss and its probability (Mossin, 1968; Raviv, 1979; Dong *et al.* 1996).

The EU approach is accepted by Lindell and Perry (2012) in their multistage Protective Action Decision Model (PADM), which describes several phases of the protective decision-making process. The process begins with observing environmental and/or social cues. For example, when one observes that one's neighbors are flooded or are buying insurance against flooding, or that authorities in the mass media have identified a flood threat and have suggested taking protective action, one starts to think about the threat. This leads to perception of the threat, mainly in terms of the probability of a disaster and its consequences (i.e., the expected personal impact, such as injury or property damage). When the probability of a disaster and its negative consequences are judged to be at an unacceptable level people are motivated to decide whether to invest money in property insurance or whether to take protective actions. The PADM involves many specific factors and processes influencing insurance purchase decisions.

Summarizing, according to the approach commonly accepted in decision theory, the subjective probability of a disaster should be one of the most important

cognitive factors in deciding whether to purchase insurance. However, Kunreuther and Pauly (2004) posit that objective information about the probability of a disaster is rarely available and people are generally not interested in searching for such information (Tyszka & Zaleskiewicz, 2006; Huber & Kunz, 2007). Furthermore, probability information is usually poorly understood even it is known (Kunreuther *et al.* 2001). For example, people judging the safety of a hypothetical chemical facility did not distinguish between a 1 in 100,000 and a 1 in 1,000,000 probability of a disaster. According to prospect theory (Kahneman & Tversky, 1979), objective probabilities are transformed non-linearly and extremely low probabilities (such as the probability of a natural disaster) are likely to be ignored or underestimated. This effect appears to be even more pronounced under the influence of affect (Traczyk & Fulawka, 2016). In the case of insurance decisions, whether the subjective probability of such risks exceeds a detection threshold appears crucial (Kunreuther, 2006; Huber, 2012; Ranyard & McHugh, 2012).

7.1.2 Emotional factors influencing the propensity to insure oneself against disaster

There is increasing empirical evidence that cognitive processes may be less important than affective processes in risky decision-making. A growing body of research has accumulated over the past two decades showing that affect and feelings have a core role in risk-taking behavior (Bechara *et al.* 1996; Lerner & Keltner, 2000; Loewenstein & Lerner, 2003; Bechara, 2004; Slovic *et al.* 2007; Lerner *et al.* 2015). For example, Damasio (1994) proposed the somatic marker hypothesis, according to which, feelings generated from secondary emotions predict future outcomes and guide rational decisions. Similarly, Slovic *et al.* (2007) posited that positive or negative affect in response to a stimulus serves as a cue altering perceptions of risks and benefits, although other authors have demonstrated that feelings' influence on decisions is not simply dependent on emotional valence (Lerner & Keltner, 2000).

The role of affect and feelings in risk-taking behavior may be especially important for low-probability, high-loss events such as natural hazards (Ranyard, 2017). Probability information may be difficult to understand and process in such situations (Kunreuther *et al.* 2001). Instead of considering the abstract concept of probability, people may take more concrete and easily accessible factors into account such as affect (Slovic *et al.* 2007).

A theoretical distinction between how emotional reactions and cognitive evaluations can influence decision-making was proposed by Loewenstein *et al.* (2001) in their risk-as-feelings hypothesis. Their model assumes that both emotional and cognitive factors influence risk-taking behavior (see Figure 7.1). Importantly, the above authors emphasize that negative feelings (e.g., fear or worry) associated with risky decisions are highly influenced by the vividness of mental images of risk: the more vivid that the mental images of the consequences of risk taking are, the more intense will be the evocation of negative feelings and

the greater the influence on subsequent behavior. Vividness of mental images may account for the crucial role that personal experience of a disaster plays in risk perception and protecting oneself against similar disasters (e.g., by buying insurance).

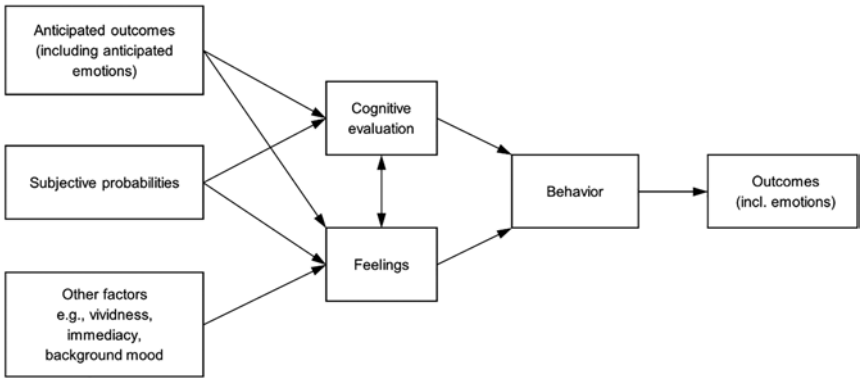

Figure 7.1 The risk-as-feelings model, adapted from Loewenstein *et al.* (2001).

7.1.3 The role of personal experience in the propensity to insure oneself against disaster

Besides cognitive and emotional factors, personal experience appears to be extremely important in decisions about purchasing insurance against natural disasters. For example, Weinstein's (1989) review article pointed to the important role of past experience in many self-protective behaviors, such as using seat belts, quitting (or reducing) smoking and, importantly, in natural hazard preparedness. Based on previous research, he concluded that experience of flood damage was related to greater fear, higher subjective probability of future disaster, and to the more frequent purchasing of insurance and making of other adjustments with respect to this hazard. Although the results of the studies reviewed were more inconsistent with respect to other natural hazards, such as tornados and earthquakes, many more recent studies have revealed that personal experience of a natural disaster is positively related to greater perceived risk (Keller *et al.* 2006), self-protective behavior (Tyszka & Konieczny, 2016), tendency to buy insurance (Browne & Hoyt, 2000; Papon, 2008; Hung, 2009), and disaster preparedness (Miceli *et al.* 2008).

Miceli *et al.* (2008) examined disaster preparedness and risk perception of floods among Italian adults living in areas previously affected by floods. Participants were asked to complete a questionnaire measuring the adoption of protective behaviors (e.g., taking out insurance against natural disasters, the protection of

important objects, attendance on a first-aid course, keeping a list of emergency phone numbers), damage experienced in the past due to natural disasters, and perceptions of flood risk (the likelihood of risky events occurring and feelings of worry associated with these events). Participants were asked to imagine a flood disaster occurring in their area in the next five years and to assess their worries about such an event. The authors found that the most important source of feelings of worry was previous experience of personal damage. Personal experience affected not only risk perceptions but also disaster preparedness.

Another important empirical test examining the specific role of personal experience in perceptions of natural hazards and the tendency to protect against them was conducted by Siegrist and Gutscher (2008). These authors interviewed two groups of Swiss people living in flood-prone areas: those who were personally affected by floods in 2005 and those who were not affected (the unaffected group was instructed to imagine that they had experienced flooding). The study's results revealed significant differences between the two groups in the emotional reactions elicited when thinking about the disaster. Participants in the affected group recalled these reactions with very high frequency and intensity even nine months after the floods. In contrast, people unaffected by floods barely mentioned negative feelings as being the worst thing about a flood, and focused mostly on material aspects. Feelings, such as fear, insecurity and helplessness were dramatically underestimated by participants who only imagined a disaster. Taken together, the study's results indicate that it is extremely difficult to visualize how one would feel during and after a flood when one has no previous experience of them. Moreover, people who had experienced floods took more preventive actions and pointed to fear as an important motivating factor.

There are at least two possible explanations of the above effects. On the one hand, experience of a natural disaster may increase subjective evaluations of the probability that a similar event will occur in the future (i.e., if something occurred in the past, it is possible that it will also occur in the near future). On the other hand, experiencing a disaster with dramatic consequences (e.g., part of a property being destroyed) evokes strong negative feelings such as fear and insecurity.

We argue that there are at least two major concerns with the large amount of research which has attempted to identify predictors of insurance-taking behavior. First, the research has been unable to control confounding variables (e.g., variations in local government support for preventive actions against natural disasters) and has also been unable to introduce experimental manipulations of personal experience in field studies. Second, due to their designs being focused tightly on studying probability processing in insurance-taking behavior (e.g., manipulating several probability levels of a fictitious disaster), laboratory experiments have often failed to reproduce the real-life psychological effects of a disaster. To the best of our knowledge, the present study is the first to address the above-mentioned concerns.

7.1.4 Overview of the present study and hypotheses

In a series of three experiments, we aimed to determine whether cognitive or emotional factors have the greatest influence on how much one will pay to insure oneself against a disaster. We designed an original task mimicking real-life insurance-related behavior in a laboratory setting (the Experimental Insurance Task, EIT). Specifically, we asked participants to build a house from cardboard which could be insured against a disaster (a windstorm caused by running a fan). To test the roles of cognitive and emotional factors in determining how much people were willing to pay for insurance, we monitored the time course of changes in feelings of worry and ratings of subjective probability. We hypothesized that personal experience of low-probability severe negative outcomes would increase feelings of worry – but not ratings of subjective probability – which, in turn, would influence the decision to purchase more expensive insurance.

7.2 EXPERIMENT 1

7.2.1 Method

7.2.1.1 Subjects

Seventy undergraduate students (88% females, ages ranging from 18 to 35 years) participated in the study in exchange for course credits or 30 PLN compensation. None of the participants was excluded from data analysis. Each participant gave their informed consent before the experiment.

7.2.1.2 Design

All participants were informed that they would take part in a simple game in which they would have to build their own cardboard building and protect it from a disaster for a time span of several virtual years. Participants were randomly assigned to one of two conditions. Those in an experimental condition experienced a disaster: a windstorm that destroyed their cardboard building. Those in a control condition experienced no such disaster. To monitor the time course of insurance decisions, participants were given the opportunity to purchase an insurance policy at the beginning of each year of the game. Buying the insurance policy compensated them for possible losses in case of a disaster. Additionally, each quarter, participants assessed their feelings of worry and provided a subjective probability that a disaster would happen within the next three months.

7.2.1.3 The Experimental Insurance Task (EIT)

At the beginning of the experiment, each participant received 100 tokens. Participants were instructed to aim to have as many tokens as possible at the end of the game (they were not informed about the exact length of the game). First, they were asked to build a cardboard building (prior to this, individuals received

precise instructions about the construction of the building). The value of the building was assessed at 50 tokens (another 100 tokens were left in participants' accounts). If the building stood until the end of the game, participants would keep their 50 tokens. However, if the building was destroyed participants would have to invest 50 tokens from their account to rebuild it. The current account balance was updated after each insurance decision and displayed to participants on a computer screen.

Each virtual year, participants had the possibility of choosing from 10 insurance policies prepared to compensate them for losses caused by a disaster (i.e., insurance premiums ranging from 1 to 10 tokens). For example, paying 1 token for an insurance policy covered the loss of 5 tokens of their building's value in the event of a disaster. On the other hand, paying the maximum price of 10 tokens covered the loss of 50 tokens (i.e., the entire value of the building) in the event of a disaster. Insurance coverage increased by 5 tokens for each 1 token in premium until the maximum amount of 50 tokens of coverage was reached. Tokens used for buying insurance were not returnable if a disaster did not occur. The decision to buy insurance was voluntary (i.e., participants had the opportunity not to buy insurance). When insurance was purchased it was valid for only one year.

7.2.1.4 Procedure

Participants were tested individually in a laboratory. The experiment lasted for three virtual years (from 1st January 2014 to 1st January 2017). Each successive virtual day of the year (e.g., 3rd March 2015) was automatically displayed for 500 ms at the central position of the computer screen. At the start of each year the same graphical information was presented about the objective probability (10 in 10,000) of a disaster occurring. Subsequently, participants made their insurance decision (making four decisions during the entire experiment) by giving tokens (from 0 to 10) to the experimenter. Additionally, every three months, participants assessed their feelings of worry and provided a subjective probability using 10-point rating scales (Figure 7.2).

On the fixed date of 28th November 2015 participants in the experimental condition experienced a disaster: a 'Disaster' caption in red-font was displayed centrally on the screen and the experimenter ran a fan which destroyed the cardboard building. In this case, participants lost 50 tokens minus their insurance coverage. Then, they had to invest 50 tokens from their account to rebuild their house. Participants in the control condition did not experience a disaster.

To increase participants' engagement in the game, they were told they had an opportunity to prevent their cardboard building from being destroyed. To do this, they needed to press the space bar key as quickly as possible when the 'Disaster' caption was displayed on the computer screen. If their reaction time was longer than 200 ms they failed to save their building. Before the main experiment, participants could test their reaction time using a computerized procedure unrelated to the main

task. None of the participants responded within a 200 ms time window during both the practice tests and the main experiment.

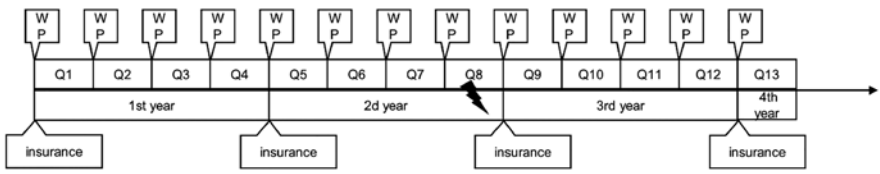

Figure 7.2 A schematic illustration of the procedure in the experimental condition (disaster). The lack of a disaster was the only difference between the experimental and control conditions. *Notes:* Thunder – disaster (building is destroyed by a windstorm: a fan run by the experimenter); W – 'To what extent are you WORRIED that your building will be destroyed in the next three months?' (*1* – not at all, *10* – extremely); P – 'What do you assess the CHANCES are of your building being destroyed in the next three months?' (*1* – low, *10* – high); Insurance – 'How much will you pay for a one-year insurance policy covering the loss of your building which is worth 50 tokens?' (from 0 to 10 tokens covering the value of the cardboard building from 0 to 50 tokens, proportionally).

7.2.2 Results

7.2.2.1 The effects of personal experience on insurance purchasing decisions

In a first step of analysis we tested whether the experimental manipulation of personal experience of a disaster influenced insurance buying decisions (i.e., the number of tokens spent on purchasing insurance on a scale from 0 to 10). A mixed 2 (group: experimental, control) × 4 (year of insurance: first, second, third, and fourth) analysis of variance (ANOVA) was performed. There was no main effect of group, $F(1,68) = 2.33$, $p = 0.131$, $\eta^2 = 0.033$. However, there was a significant main effect of the year of insurance, $F(3,204) = 7.28$, $p < 0.001$, $\eta^2 = 0.097$, and also a significant interaction between the year and group, $F(3,204) = 4.24$, $p = 0.006$, $\eta^2 = 0.059$. Post-hoc tests with a Bonferroni correction revealed that the only significant differences between the experimental and control conditions were for the third ($p = 0.028$) and fourth year ($p = 0.025$) of insurance decisions (Figure 7.3). No differences were found in the first ($p = 0.928$) and second year ($p = 0.927$). Thus, participants who experienced loss (their cardboard building being destroyed) between the second and third years of the game, paid more for an insurance policy during the next two years than participants in the control group experiencing no such loss (descriptive statistics for ratings of worry, subjective probability and insurance decisions in all three experiments can be found in the appendix).

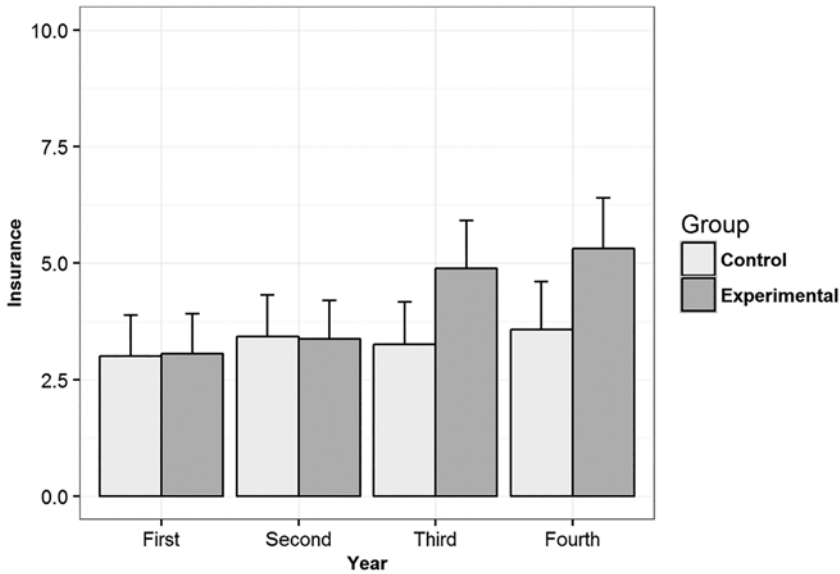

Figure 7.3 Mean number of tokens paid for an insurance policy during a four-year long game as a function of personal experience (i.e., loss of a cardboard building after the second year as a result of a disaster). Error bars represent the upper limit of 95% bootstrapped confidence intervals.

An additional analysis revealed that participants who experienced a disaster in the experimental condition ended the game with fewer tokens ($M = 50.23$, $SD = 7.93$) than participants in the control condition ($M = 86.74.23$, $SD = 10.11$), $t(68) = -16.813$, $p < 0.001$.

7.2.2.2 Indirect effects of personal experience of a disaster on insurance decisions. The role of feelings of worry and subjective probability

In the second step of analysis we verified whether personal experience of a disaster influences feelings of worry and subjective probability ratings, which, in turn, affect insurance buying decisions. We employed the PROCESS macro for SPSS (Hayes, 2013) to determine whether personal experience of a disaster (independent variable, X) exerted an effect on insurance policy buying decisions (dependent variable, Y) via changes in two mediator variables: feelings of worry and ratings of subjective probability. We computed measures of amount payed for insurance, worry and subjective probability by subtracting mean amount payed for insurance, and mean ratings of worry and subjective probability before disaster struck from mean ratings after disaster struck (mean number of tokens spent on insurance in

the third and fourth year minus mean number of tokens spent on insurance in the first and second year). Therefore, higher values indicated that participants paid more for insurance, felt more worried and rated subjective probability as higher.

As expected, feelings of worry, but not ratings of subjective probability, mediated the relationship between personal experience of disaster and insurance buying decisions. Specifically, using 95% confidence intervals (1000 bootstrap samples), we found a significant indirect effect via feelings of worry, 0.47 [0.01, 1.37], but not subjective probability, 0.07 [−0.12, 0.91] (Figure 7.4).

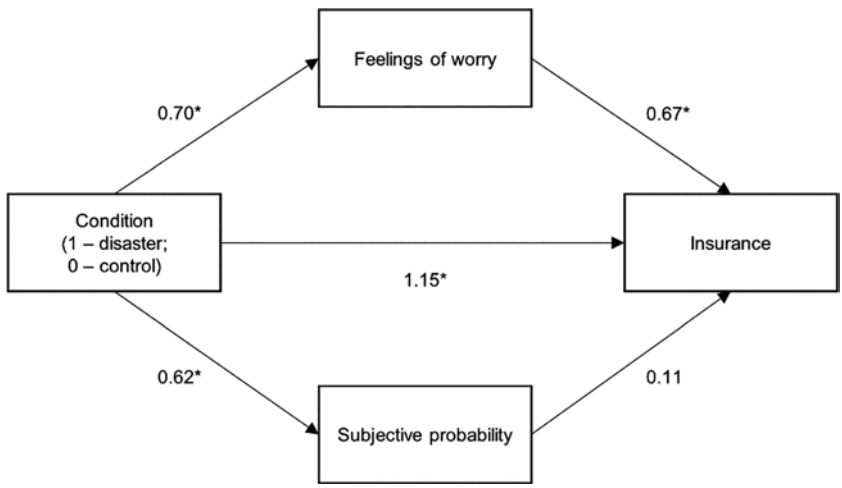

Figure 7.4 Unstandardized beta regression coefficients for the mediation model linking personal experience of a disaster (X) and amount paid to buy insurance (Y) via feelings of worry and subjective probability. The correlation coefficient between feelings of worry and subjective probability was $r = 0.704$, $p < 0.001$.

7.2.3 Discussion

Experiment 1 demonstrated that personal experience of a disaster influenced insurance purchasing decisions. Participants who experienced a windstorm at the end of the second year paid more for insurance in the third and fourth years of the game compared to participants not experiencing this disaster. Importantly, this effect was mediated by changes in feelings of worry but not by changes in ratings of subjective probability.

Our findings are consistent with the results of previous research showing that worry is a more important factor in insurance-taking behavior than ratings of subjective probability that a disaster will occur (Schade *et al.* 2012). However, the design of the game in this experiment might be considered problematic in that participants in the experimental condition always experienced a disaster

that led to more pronounced changes in their budget compared to those in the control condition. To solve this problem, in Experiment 2 we modified the control condition. Specifically, in parallel with the reduced budget associated with participants' experience of disaster in the experimental condition, we reduced the budget of participants in the control condition, telling them that they had spent the money on purchasing a holiday. This allowed us to equalize the number of tokens that were left in participants' accounts at the end of the game across the two conditions. Thus, we tested whether personal experience of a disaster led to purchasing more expensive insurance even when controlling for the final number of tokens in the control condition.

7.3 EXPERIMENT 2

7.3.1 Method

7.3.1.1 Subjects

Seventy undergraduate students (46% females, ages ranging from 18 to 27 years) participated in the study in exchange for course credits or 30 PLN compensation. None of the participants was excluded from data analysis. Each participant gave their informed consent before the experiment.

7.3.1.2 Design and procedure

There was one substantial modification introduced to the procedure of the EIT designed for Experiment 1. To control the effect of financial loss caused by a disaster, participants in the control condition (i.e., without a disaster) were informed that they had spent an amount of money on a holiday (this information was provided on the same date as a disaster in the experimental condition). The cost of the holiday was related to the insurance decisions made by participants (i.e., 50 tokens minus insurance coverage, as in the experimental condition involving a disaster). For example, participants who paid 5 tokens for an insurance policy were informed that they had spent 25 tokens on a holiday. This made the financial loss due to a disaster equivalent to a loss caused by purchasing a holiday. Participants were not informed about the algorithm used to compute the price of the holiday (i.e., that the cost of the holiday was related to their insurance decisions).

7.3.2 Results

7.3.2.1 The effects of personal experience on insurance purchasing decisions

A mixed 2 (group: experimental, control) × 4 (year of insurance: first, second, third, and fourth) ANOVA was used to predict the amount spent on insurance. We found significant main effects of group, $F(1,68) = 7.98$, $p = 0.006$, $\eta^2 = 0.105$, and year of insurance, $F(3,204) = 4.19$, $p = 0.007$, $\eta^2 = 0.058$. Importantly, the interaction between

these two variables was also significant, $F(3,204) = 7.01$, $p = 0.001$, $\eta^2 = 0.093$. Post-hoc tests with a Bonferroni correction revealed that participants who experienced a disaster paid more for insurance in the third ($p = 0.006$) and fourth year ($p < 0.001$) compared to participants who lost tokens by purchasing a holiday trip (Figure 7.5). No differences were found in the first ($p = 0.742$) and second year ($p = 0.085$).

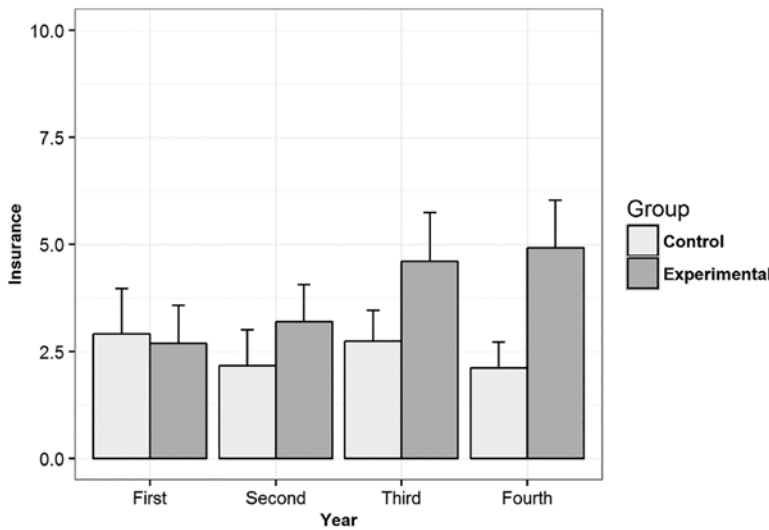

Figure 7.5 Mean number of tokens paid for an insurance policy during a four-year long game as a function of personal experience (i.e., loss of a cardboard building after the second year as a result of a disaster in the experimental condition; in the control condition participants experienced a financial loss unrelated to a disaster). Error bars represent the upper limit of 95% bootstrapped confidence intervals.

It is important to note that participants who experienced a disaster in the experimental condition and those losing money by buying a holiday in the control condition ended the game with similar amounts of tokens ($M = 50.60$, $SD = 9.14$ in the experimental and $M = 50.91$, $SD = 7.37$ in the control condition respectively), $t(68) = -0.158$, $p = 0.875$.

7.3.2.2 Indirect effects of personal experience of a disaster on insurance decisions. The role of feelings of worry and subjective probability

We reran the indirect effects analysis performed in Experiment 1. Here, indirect effects via feelings of worry (0.242, 95% bootstrapped CIs [−0.010, 0.842]) and subjective probability (−0.036, 95% bootstrapped CIs [−0.519, 0.098]) were not significant. However, participants experiencing a disaster purchased more

expensive insurance compared to participants who spent their money on buying a holiday, $b = 1.722$, $p = 0.010$, (see Figure 7.6).

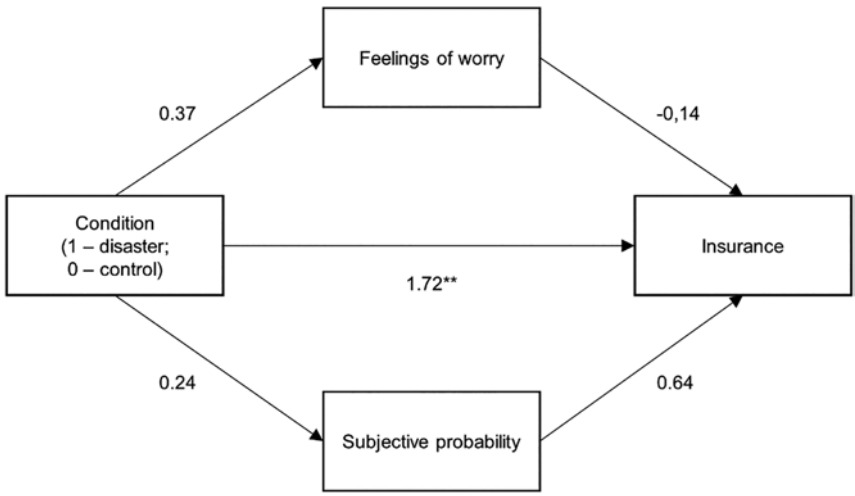

Figure 7.6 Unstandardized beta regression coefficients for the mediation model linking personal experience of a disaster (X) and amount paid to buy insurance (Y) via feelings of worry and subjective probability. The correlation coefficient between feelings of worry and subjective probability was $r = 0.734$, $p < 0.001$.

7.3.3 Discussion

Experiment 2 demonstrated that personal experience of a disaster led to purchasing more expensive insurance even when controlling the final number of tokens in the control condition. This replicated findings from Experiment 1 and other research showing the crucial role of personal experience in insurance buying and self-protective behavior (Weinstein, 1989; Zaleskiewicz *et al*. 2002; Papon, 2008; Tyszka & Konieczny, 2016). However, contrary to Experiment 1, feelings of worry did not mediate the relationship between personal experience and insurance buying behavior. It is noteworthy that in Experiment 2 there was no difference in feelings of worry between the experimental and control conditions. The reasons for these differences between the two experiments are unclear. One explanation may be differences in participants' characteristics. Compared to Experiment 1, in Experiment 2 there were far fewer women and very few psychology students.

One remaining methodological problem was addressed in Experiment 3. In this experiment we used a between-subjects experimental design to separate the influences of worry and subjective probability on insurance buying behavior.

7.4 EXPERIMENT 3

7.4.1 Method

7.4.1.1 Subjects

Seventy undergraduate students (67% females, ages ranging from 18 to 45 years) participated in the study in exchange for course credits or 30 PLN compensation. None of the participants was excluded from data analysis. Each participant gave their informed consent before the experiment.

7.4.1.2 Design and procedure

Similarly to the previous experiments, participants played a game in which they had to protect a cardboard house from being destroyed by a windstorm (the EIT). Only the experimental condition was used, in which a disaster always occurred on a fixed date. To separate the influence of feelings of worry from subjective probabilities on insurance buying decisions, participants were randomly assigned to one of two conditions. In the first condition, participants rated their feelings of worry (using a 10-point scale as in the previous experiments) and declared the extent of their worries every three months using a 100-point open-ended question. In the second condition, every three months, participants rated the subjective probability (using a 10-point scale as in the previous experiments) and the chances (as a percentage, using an open-ended question) that a disaster would happen. To measure changes in current affective states, all participants completed the Positive and Negative Affect Schedule (PANAS; Watson *et al.* 1988) twice: at the beginning and at the end of the experiment.

7.4.2 Results

To capture changes in feelings of worry, subjective probabilities and insurance buying decisions, mean ratings for these measures before the disaster were subtracted from mean ratings after the disaster. Similarly to the previous experiments, higher scores indicated that participants were more worried, rated the subjective probability of disaster as higher, and paid more for insurance. Since responses for scale ratings and open-ended questions were highly correlated ($r = 0.905$, $p < 0.001$ and $r = 0.871$, $p < 0.001$, for the subjective probability and worry conditions respectively), these measures were averaged.

There was a positive correlation between increasing Negative Affect (NA) and ratings of worry, $r = 0.293$, $p = 0.044$, whereas the relationship between subjective probability ratings and NA was non-significant, $r = 0.137$, $p = 0.216$. No associations with changes in Positive Affect (PA) were observed ($r = -0.204$, $p = 0.120$ for subjective probability and $r = -0.185$, $p = 0.144$ for worry).

Next, we performed two separate regression analyses to test whether feelings of worry or subjective probability better predicted changes in the number of tokens spent on purchasing insurance. Measures of NA and PA were introduced

in the first step of hierarchical regression analyses, and either feelings of worry or subjective probabilities were entered into models in the second step (Table 7.1). In the group of participants who were asked to rate feelings of worry, this measure significantly predicted insurance buying decisions, $b = 0.229$, $p < 0.001$. There was no effect of subjective probability on insurance buying decisions in the second condition, $b = 0.096$, $p = 0.175$. Importantly, introducing feelings of worry into a regression model substantially increased the explained variance in amount paid for insurance, $\Delta R^2 = 0.294$, $p < 0.001$, whereas no similar result was found in the case of subjective probabilities, $\Delta R^2 = 0.054$, $p = 0.175$.

Table 7.1 Two hierarchical linear regression models in which insurance purchasing decisions were predicted by changes in Positive Affect (PA) and Negative Affect (NA) from the PANAS, feelings of worry, and subjective probabilities.

		Feelings of Worry				R^2	ΔR^2
		B	***SE***	***t***	***p***		
Step 1	Intercept	1.472	0.382	3.854	0.001		
	NA	0.027	0.079	0.336	0.739		
	PA	–0.043	0.089	–0.479	0.635	0.015	
Step 2	Feelings of worry	0.229	0.063	3.633	<0.001	0.309	0.294***
		Subjective Probability					
		B	***SE***	***t***	***p***	R^2	ΔR^2
Step 1	Intercept	0.671	0.439	1.530	0.136		
	NA	0.040	0.079	0.508	0.615		
	PA	–0.134	0.088	–1.520	0.138	0.083	
Step 2	Subjective probability	0.096	0.069	1.389	0.175	0.137	0.054

Note: *** $p < 0.001$.

Similarly to Experiment 2, we found no significant differences between the groups in the number of tokens possessed at the end of the game, $t(68) = 0.327$, $p = 0.745$. Participants providing subjective probabilities finished the game with $M = 51.51$ ($SD = 7.73$) tokens, and those rating their feelings of worry finished with $M = 50.94$ ($SD = 6.86$) tokens.

7.4.3 Discussion

In Experiment 3 we demonstrated that our scales of worry and subjective probability measured separate constructs. First, only feelings of worry correlated

with a standardized measure of current negative affective state (i.e., the Negative Affect scale of the PANAS). Second, we replicated findings from Experiment 1 showing that emotional factors related to feelings of worry, but not cognitive evaluations of subjective probabilities, predicted insurance buying decisions. Taken together, our findings imply that personal experience of a low-probability disaster leads to a propensity to spend more on insurance. Crucially, this effect can be explained by changes in feelings of worry that are related to the financial loss caused by the disaster.

7.5 CONCLUSIONS

The focus of this study was to explore why personal experience is a key factor in decisions regarding insurance purchases. Introducing a novel experimental task, we were able to show that emotional rather than cognitive factors led to a propensity to spend more on insurance against natural hazards. This means that insuring oneself against natural disasters is determined not so much by cognitive evaluations of risk, but rather by emotions which usually accompany personal experience of a disaster. This result is in close agreement with findings of Siegrist and Gutscher (2008) showing that non-material consequences and feelings (e.g., evacuation, effort of cleaning up, shock, and helplessness) were most commonly mentioned as the worst aspects of flooding by people experiencing such a disaster. Similarly, in our series of three laboratory experiments, we showed that decisions about how much to spend on purchasing insurance are driven by personal experience of low-probability disasters with serious consequences, operating indirectly through changes in emotional feelings of worry, rather than through cognitive evaluations of subjective probability. Thus, we can say that the prominent role of emotional factors in dealing with natural disasters has been confirmed both when interviewing people living in flood-prone areas (in naturalistic settings) and in controlled laboratory experiments.

The results of the present study may explain why people often fail to purchase insurance against high-loss disasters (Schade *et al.* 2012) and experience severe financial and psychological consequences, even if premiums are at fair prices (Kunreuther & Pauly, 2004). Our research suggests that such individuals are likely to be people who have not experienced disasters before, and who are therefore untroubled by the negative emotions which accompany personal experience of a disaster. There are at least two possible psychological mechanisms that may underlie our findings. First, personal experience of a disaster is likely to make the consequences of disaster more available (e.g., it would be easy to recall that water had flooded into one's cellar) and this higher availability will lead to intense negative emotions. Alternatively, personal experience of a disaster resulting in severe material and financial losses may influence the imaginableness of consequences, this, in turn, leading to more vivid mental images of disaster and evoking more intense negative emotions (without better recall). Given that availability and affect

are closely connected (Keller *et al.* 2006), future studies ought to focus on testing these two hypotheses directly.

However, there is some initial evidence favoring the crucial role of affect-laden imagery in risk perception and risk taking. Specifically, previous research by Traczyk *et al.* (2015) demonstrated that even imagining the consequences of risk (but not directly experiencing them) exerts an influence on risk perception and willingness to take risk. Moreover, these relationships were mediated by emotional factors (i.e., negative affect and feelings of stress; Sobkow *et al.* [2016]; (Traczyk *et al.* [2015]). Based on these findings, one can speculate that researchers could influence people's decisions to purchase insurance against disasters by evoking intense affect-laden imagery. Indeed, previous research has documented that even the simple instruction to visualize the consequences of risks (Traczyk *et al.* 2015) or asking specific questions regarding risky scenarios (e.g., 'Can you see smoke from the fire when you get to the exit?'; Holmes & Mathews [2005]) produces vivid mental images of risks and elicits intense emotional responses. However, the prospects of using such procedures in the real world are unclear since recent neuroscientific findings have revealed that simple behavioral training is not sufficient to generate long-term changes in behavior (Santarnecchi *et al.* 2015). More promising techniques might involve the use of transcranial direct current stimulation to stimulate areas of the brain responsible for vivid mental images, or using neurofeedback (Johnston *et al.* 2010) to teach people how to create more vivid images of risk. It would also be very interesting and challenging to combine neural stimulation with behavioral procedures designed to simulate personal experience of a disaster using virtual reality (Tarr & Warren, 2002; Diemer *et al.* 2015) and test whether such quasi-experience has an impact on real-life insurance decisions.

Our finding that emotional feelings of worry, rather than cognitive evaluations of subjective probability, are a main determinant of the amount one will pay to insure oneself against natural hazards, fits well with previous findings that people discount the experiences of other decision-makers compared to experiencing a loss themselves (Viscusi & Zeckhauser, 2015). Indeed, from a cognitive perspective, others' loss experiences should be equally as informative as our own loss experiences. The observation that disasters affecting other people have a reduced impact on our own insurance-related behavior, provide strong support for the idea that emotional feelings are crucial in decisions to insure oneself against natural hazards.

Finally, we attach great importance to our novel Experimental Insurance Task (the EIT). Participants found the task highly engaging and it seems to effectively mimic real-life situations and evoke similar psychological processes. Also, good experimental design, rigorous procedures, and a laboratory setting permit the control of confounding variables and the drawing of causal inferences. So, the task provides vast possibilities to researchers interested in studying the role of personal experience in protective behavior. In the reported experiments we focused on a low-probability

disaster with serious consequences, and we did not manipulate probability levels or the role of self-engagement in building a property. However, one could study these issues using our EIT technique. In addition to studying insurance purchasing decisions, the technique could also be used to study the taking of actions to prevent the negative consequences of natural hazards and disasters.

Two clear conclusions may be drawn from our research:

Using experimental settings, we demonstrated that personal experience of a disaster caused people to pay more for insurance against natural hazards.

Emotional feelings of worry, rather than cognitive evaluations of subjective probability, mediated the relationship between personal experience of a disaster and insurance buying decisions.

ACKNOWLEDGEMENTS

The research was supported by The National Science Centre, Poland under Grant number DEC-2012/04/A/HS6/00614.

We would like to thank Przemyslaw Korotusz for his help in data collection for Experiment 3.

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APPENDIX

Table 7.A.1 Descriptive statistics for number of tokens allocated for purchasing insurance.

Experiment	Group	Insurance			
		Year 1	Year 2	Year 3	Year 4
1	control	3.00 (2.53)	3.43 (2.79)	3.26 (2.78)	3.57 (3.22)
	experimental	3.06 (2.73)	3.37 (2.43)	4.89 (3.26)	5.31 (3.15)
2	control	2.91 (3.08)	2.17 (2.47)	2.74 (2.23)	2.11 (1.86)
	experimental	2.69 (2.70)	3.2 (2.46)	4.60 (3.17)	4.91 (3.17)
3	only worry	2.97 (2.93)	3.31 (2.54)	4.51 (2.79)	4.83 (2.77)
	only subjective probability	3.43 (3.36)	3.23 (2.87)	3.77 (2.27)	4.2 (3.13)

Table 7.A.2 Descriptive statistics for ratings of worry.

Experiment	Group	Worry			
		Year 1	Year 2	Year 3	Year 4
1	control	3.29 (1.59)	3.27 (1.59)	3.37 (1.81)	3.66 (2.09)
	experimental	3.52 (2.04)	3.44 (2.30)	4.28 (2.34)	4.51 (2.57)
2	control	3.12 (1.74)	2.92 (1.61)	2.96 (1.62)	3.03 (1.90)
	experimental	3.61 (1.43)	3.44 (1.63)	3.63 (1.58)	4.00 (1.86)
3	only worry	2.96 (1.68)	2.69 (1.51)	3.38 (1.92)	3.74 (2.41)

Note: for years 1–3 ratings of four respective quarters were averaged (i.e. for year 1 ratings from quarter 1, 2, 3 and 4 were averaged etc.). In year 4 participants rated worry only once. Worry was rated on 10-point scale (*1* – not at all, *10* – extremely).

Table 7.A.3 Descriptive statistics for ratings of subjective probability.

Experiment	Group	Subjective Probability			
		Year 1	Year 2	Year 3	Year 4
1	control	2.86 (1.12)	2.89 (1.24)	2.87 (1.45)	2.89 (1.61)
	experimental	3.41 (1.88)	3.59 (2.01)	4.12 (1.78)	4.11 (2.36)
2	control	3.00 (1.560)	2.44 (1.40)	2.4 (1.25)	2.31 (1.47)
	experimental	3.09 (1.63)	2.83 (1.71)	2.89 (1.63)	3.43 (2.09)
3	only subjective probability	3.96 (2.23)	3.49 (2.12)	4.22 (2.26)	4.14 (2.78)

Note: for years 1–3 ratings of four respective quarters were averaged (i.e. for year 1 ratings from quarter 1, 2, 3 and 4 were averaged etc.). In year 4 participants rated subjective probability only once.
'How do you assess the CHANCES that your building will be destroyed the next three months?' (*1* – low*, 10* – high).

Table 7.A.4 Descriptive statistics for open-ended questions from Experiment 3.

	Year 1	Year 2	Year 3	Year 4
worry	21.4 (18.06)	20.86 (17.09)	28.80 (22.24)	31.00 (24.72)
subjective probability	34.48 (28.63)	28.21 (24.28)	37.41 (26.66)	38.49 (29.39)

Note: for years 1–3 ratings of four respective quarters were averaged (i.e. for year 1 ratings from quarter 1, 2, 3 and 4 were averaged etc.).