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Is default risk acceptable when purchasing insurance? Experimental evidence for different probability representations, reasons for default, and framings

Anja Zimmer, Christian Schade *, Helmut Gründl

Humboldt-Universität zu Berlin, School of Business and Economics, Spandauer Street 1, 10178 Berlin, Germany

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ABSTRACT

We experimentally analyze consumers' reactions to insurance default risk. Consistent with earlier studies, we find that insurance with default risk is extremely unattractive to most individuals. A considerable fraction of consumers completely refuse to accept any default risk; others ask for large reductions in insurance premiums. These findings are robust against several variations of the setup: probability representations (verbal and numeric), reasons for default (insolvency and claim settlement practices), framing (positively and negatively expressed probability of default), and comparisons between the policy's level of default and that of an alternative (default free and small default risk). The major driver of willingness to pay is level of security concern and decisions are sensitive to the default probability. All other effects on willingness to pay are unsystematic.

1. Introduction

People buy insurance to protect themselves against different kinds of potential losses. However, when deciding to purchase insurance, consumers must keep in mind (or should) that the insurance contract itself might be exposed to the risk of default, i.e., the insurance policy might involve a small probability that the policyholder will not be reimbursed partially or totally by the insurer in case of a loss. Experimental research by Wakker et al. (1997) and Albrecht and Maurer (2000) shows that the awareness of default risk has an influence on consumers' insurance purchase behavior. People dislike insurance contracts that might default when indemnity payments are needed. In their study, Wakker et al. (1997) demonstrate that people demand a greater than 20% premium reduction when facing a 1% default probability. Similar results are reported

* Corresponding author. Tel.: +49 3020935904.
E-mail address: cds@wiwi.hu-berlin.de (C. Schade).

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by Albrecht and Maurer (2000), who, in addition, find that the greater the insurer's default risk, the more people will refuse to pay anything at all for such an insurance policy.

This paper tests the robustness of these findings. We analyze consumers' reactions to default risk dependent on the way an insurer's default situation is communicated. Specifically, we examine whether the way the default risk is represented influences reactions to it. Furthermore, we vary the level of default probability and the reasons for default. Finally, we check for framing effects and reference dependence. Most of these factors have not been analyzed previously with respect to their impact on reactions to default risk. We also investigate what actually drives these behaviors.

The factors we analyze are of relevance for managerial decisions and might have policy implications as well. First, we incorporate the realistic feature that policyholders do not have numeric information on the probability of default. Rating agencies usually provide only a verbal explanation of an insurer's financial situation. In principle, the insured can obtain numeric information, but doing so involves the considerable effort of working through empirical studies, e.g., annual default reports provided by financial institutions and rating agencies (see, e.g., Standard and Poor's, A.M. Best, and Moody's). A few studies suggest that being given verbal probabilities will have a very different impact on behavior than being provided with numeric probabilities. For example, Wallsten, Budescu, and Zwick (1993) show that individuals exhibit greater overconfidence when provided with verbally expressed probabilities. In Budescu, Weinberg, and Wallsten (1988) study of bidding behavior, bids made under the influence of verbal probabilities turned out to be less optimal than those based on numeric ones. Subjects would have earned about 24% less under the verbal than under the numeric condition.[1] We therefore analyze the effects of *verbal* and *numeric* probabilities on the willingness to pay for insurance with default risk.

Second, we examine the effect of *positive* and *negative framing* of default risk, i.e., whether default described in terms of *nonpayment* of claims has a different effect on purchase decisions than default described in terms of *payment* of claims. The way default risk is framed might direct consumers' attention toward the potential occurrence or nonoccurrence of default and thus might affect their decision making (see, e.g., Teigen and Brun (1999) for the effects of positive and negative phrases on decision making). Furthermore, there is wide evidence that individuals put different weights on small and high probabilities (see, e.g., Kahneman & Tversky, 1979). Thus, the choice of high positive and low negative probabilities for the description of default risk might affect policyholders' reaction to the risk.

Third, Tversky and Kahneman (1981) show that a change in reference point can lead to a reversal of individual preferences. Similarly, the choice of a reference alternative (or the status quo) can have a major impact on individuals' decisions (see Burmeister & Schade, 2007; McKenzie, Liersch, & Finkelstein, 2006; Samuelson & Zeckhauser, 1988). We analyze whether the willingness to pay for a specific insurance contract is influenced by information provided about the default risk and price of another, concurrently available contract.

Fourth, there are reasons other than the insurer's insolvency that may result in a total or partial default in paying claims (see Doherty and Schlesinger (1990, pp. 243–244), Kahneman and Tversky (1979, p. 270) and Wakker et al. (1997, pp. 7–8)). One prominent example is the recent "wind-water controversy" in respect to hurricane losses. Victims of Hurricane Katrina have been very disappointed about the unexpectedly low indemnity payments they received for repairing or rebuilding their damaged houses. They were not aware of the fact that a standard homeowner policy in the US covers losses caused by fire, hail, winter storms, tornadoes and wind damage but not from rising water due to floods and hurricanes (see Kunreuther (2006, p. 3)). Another highly relevant source of default risk is nonpayment due to the insurer's claim settlement practices, something that has not been investigated in the literature to date. Specifically, claim settlement practices[2] have to do with the insurer's *willingness* to meet its financial obligation rather than its *ability* to do so. It is unclear whether consumers will react in the same way to different reasons for default because each type of default may evoke different emotions (see Kunreuther et al. (2002)).[3] For example, individuals are likely to be more *angry* about a default based on claim settlement practices, than they are about one due to insolvency as they may believe that insolvency is something beyond the insurer's control. Affect regarding the insured object have been shown to have an impact on insurance decisions – affect regarding the reason for default might have an effect, too (Hsee & Kunreuther, 2000; Slovic, Finucane, Peters, & MacGregor, 2001).

To analyze consumer reactions to insurance default risk we conduct three experiments. The main aim of Experiment 1 is to examine the impact of probability representation and reasons for default on the willingness to pay for household insurance involving different levels of default risk. In this first experiment, the reference insurance is default free. Experiment 2 is designed to test whether the results of Experiment 1 hold when the reference insurance contains a small probability of default. Finally, Experiment 3 examines the effect of positive and negative framing of default risk on willingness to pay.

We find that in the presence of default risk, individuals either refuse to purchase insurance or they demand a considerable reduction in insurance premiums and are willing to pay a substantial loading on the expected claims to avoid such risk. These behaviors are observed over a variety of situations and, except for the level of default risk, the factors analyzed in

[1] See also González-Vallejo, Erev, and Wallsten (1994), Olsen and Budescu (1997), and Teigen (2001) for the different impact of verbal and numeric probabilities on individuals' behavior.

[2] Several market research studies on insurance company reputation reveal that individuals do consider claim settlement practices in their insurance purchase decisions (e.g., Eccles & Vollbracht, 2006; Schlesinger & Schulenburg, 1994). Further, rating agencies explicitly include the willingness of the "obligor to meet its financial commitments as they come due" (Standard, 2008) in some of their rating definitions.

[3] A simpler way to look at this potential effect can be derived from several experiments on decision making. Many authors have shown that "context" matters, e.g., Brun and Teigen (1988), Budescu and Wallsten (1985), Hershey and Shoemaker (1980), Johnson, Hershey, Meszaros, and Kunreuther (1993), Kahn and Sarin (1988), Kahneman and Tversky (1979), Wallsten, Fillenbaum, and Cox (1986), and Weber and Hilton (1990).

our experiments have no systematic impact. In all experiments, decisions appear to be largely driven by the individuals' degree of security concerns.

The paper is organized as follows. In the next section we present a detailed explanation of our experimental designs and the statistical analyses of the results. We continue with a discussion of our findings in relation to existing evidence. Finally, in Section 4, we draw conclusions and discuss the practical impact of our findings.

2. Experimental studies

2.1. Design characteristics

The goal of all three experiments is to elicit individuals' willingness to pay for different household insurance contracts,[4] each involving different kinds and amounts of default risk. In every experiment, each subject had to state willingness to pay for a specific household insurance contract for two different default probabilities compared to the premium offered by a reference insurer. The presentations of the insured object and sum, as well as the scope of indemnity, were identical across all scenarios (for a description of the general decision situation, see Appendix A1).[5]

Table 1 presents the general method used to measure willingness to pay for the numerically expressed insolvency risk treatment underlying Experiment 1.

In all treatments, Insurer 1 served as the reference insurer. For each combination of premiums, subjects were asked to decide with which insurer they would prefer to contract, Insurers 1 or 2 (Step 1).[6] If they decided to buy insurance from Insurer 1 for all given premium combinations, they were further asked to specify the maximum premium for which they would buy the policy from Insurer 2.[7] They were also given the option of indicating that they would never buy household insurance from Insurer 2, even for a premium of 0€ (Step 2). This elicitation method was identical for all experiments.[8] However, the level of default risk, the way default risk was presented, and the way the reference insurance contract was characterized differ between all experimental treatments. Table 2 shows a summary of the purposes of the three experiments.

Another feature common to all three experiments is the inclusion of a wide range of explanatory questions that allow us to achieve a better understanding of how people make decisions. After the insurance decision, each participant was asked several additional questions, some of which were directly related to the particular insurance purchase decision and others that were more related to qualitative variables often associated with decision-making behavior (see Appendix B for the questions and mean responses).[9] Based on the provided answers, we gain an insight into an individual's decision process. Do people actually assign subjective probabilities to possible outcomes in situations where only verbal probability descriptions are given? And, if so, how are these probabilities perceived and evaluated? Do people even perceive default risk to be relevant? (Huber, Wider, & Huber, 1997), as well as Hogarth and Kunreuther (1995), demonstrate that many individuals do not use numeric probabilities at all; instead, they look for "peace of mind" and "relief from anxiety" when deciding whether to purchase insurance or warranties.

The qualitative variables were captured by asking eight questions dealing with awareness and importance of default risk, general interest in the underlying decision object, concern, competence in choice, task complexity, and general risk and optimism–pessimism attitudes. These variables have proven to be relevant in previous studies.[10] We were particularly interested in whether and how these variables affect willingness to pay for insurance with default risk.

2.1.1. Experiment 1

In this experiment, we analyzed the impact of default risk on insurance contracts based on a 2 (probability representation) × 2 (reason for default) between-subject design. Thus, each subject randomly received one of the four treatments when accessing the online questionnaire: (1) numerically expressed insolvency risk, (2) verbally described insolvency risk, (3) numerically expressed settlement of claim risk, or (4) verbally described settlement of claim risk (the description for the

[4] We chose household insurance because it is very likely that most people either have this type of insurance or at least know about it and because there is a high probability that people have already experienced one or more losses in the household context. Further, choosing household insurance allows us to add new experimental evidence on the subject of insurance with default risk as it is a different type of property-liability insurance than that looked at in other studies. Wakker et al. (1997) studied willingness to pay for probabilistic private fire insurance and Albrecht and Maurer (2000) studied probabilistic automobile liability insurance.

[5] In this experiment, we were solely interested in differences in willingness to pay for specific household insurance contracts with different default probabilities. The underlying probability distribution of household losses was not explicitly given in the underlying decision situations.

[6] *Note:* We required the respondents to put themselves in the position of someone who is willing to purchase household insurance from the reference Insurer 1.

[7] So as to not waste the respondents' time, we did not provide all premium combinations from 160 to 0 Euro.

[8] *Note:* Step 2 differs when Insurer 2 had a smaller default risk than reference Insurer 1. In this case, the option of not buying insurance from Insurer 2 was not applicable.

[9] For the relevance of qualitative variables in decision making under uncertainty, see Koellinger, Minniti, and Schade (2007).

[10] See, e.g., Hogarth and Kunreuther (1995), Hsee and Kunreuther (2000), Loewenstein, Weber, Hsee, and Welch (2001), Rottenstreich and Hsee (2001), and Slovic et al. (2001) for *emotions* or *affect* in respect to protective measures; see Baron, Hershey, and H. (2000), Drottz-Sjöberg and Sjöberg (1990), Schade, Kunreuther, Kaas, and Koellinger (2008), and Sjöberg (1998) for the role of *concern*; Heath and Tversky (1991) for the relevance of *competence in choice*; Payne, Bettman, and Johnson (1988), Simonson. and Tversky (1992), and Swait and Adamowicz (2001) for the impact of *complexity* of the decision task; and Einhorn and Hogarth (1985), Hogarth and Kunreuther (1985), and Johnson et al. (1993) for the relevance of risk *attitude* and an individual's *optimism or pessimism* on decision making.

Table 1
Willingness to pay measurement for numerically expressed insolvency risk treatment

Premium of Insurer 1 default probability 0%	Premium of Insurer 2 default probability 4.9%
Step 1	
160€	160€
160€	159€
160€	158€
160€	157€
...	...
160€	138€
Step 2	
Premium of Insurer 2 should not exceed ____ Euro in order to induce me to buy the policy from Insurer 2	
I would never purchase household insurance from Insurer 2	

Table 2
Purposes of the three experiments

Does the reason for default matter? (Experiment 1)	• Claim settlement treatment (unwillingness to pay) • Insolvency treatment (financial ability to pay) (between-subject factor)
How much does the willingness to pay differ between numeric and verbal probabilities? (Experiments 1–3)	• Numeric probability treatment • Verbal probability treatment (between-subject factor)
How much does the willingness to pay differ between positive and negative phrased default risk? (Experiment 3)	• Positive phrased default risk treatment • Negative phrased default risk treatment (between-subject factor)
Does willingness to pay depend on the level of default risk? (Experiment 1)	• Two default probabilities ○ 0.3% and 4.9% (Experiment 1) ○ 4.9% and 0% (Experiment 2) ○ 8% and 0% [92% and 100%] (Experiment 3) (within-subject factor)
Does willingness to pay depend on the characteristics of a reference insurance contract available at the point of purchase? (Experiments 1 and 2)	• Reference insurance contract with no default risk (Experiment 1) • Reference insurance contract with 0.3% default risk (Experiment 2)
Can willingness to pay be explained by individual characteristics and preferences? (Experiments 1–3)	• Several explanatory variables, e.g. ○ Awareness ○ Importance ○ General interest ○ Concern ○ Competence in choice ○ Task complexity ○ Optimism–pessimism attitude ○ Risk attitude ○ Demographics issues (within-subject design)

numerically expressed insolvency risk treatment can be found in Appendix A2). In each treatment, subjects were asked to state their willingness to pay for household insurance with default risk from Insurer 2 for the default probabilities 0.3% and 4.9% compared to a premium of 160€ offered by the default-free reference Insurer 1.[11] All insurers were labeled on the basis of the insurer's rating classifications, i.e., the chosen probabilities of default represent empirically observed default rates for insurers rated *extremely strong* (0% probability of default), *good* (0.3%), and *weak* (4.9%).[12] The default probabilities were randomly presented to control for order effects.

Table 3 outlines the three rating classifications used in the numeric and verbal probability treatments.[13] The decision of which verbal and numeric expressions to use was based on a prestudy conducted with 72 respondents. In this prestudy,

[11] Although, in reality, all insurers are faced with a positive default probability, Wakker et al. (1997, p. 20) point out that insurers with the highest rating can function as "quasi" default-free insurers: "A bond with an AAA rating is considered to be essentially risk free, and a formula approved for infants is meant to be riskless, although certainty cannot be achieved in either case."

[12] See Annual 2005 Global Corporate Default Study and Rating Transitions by Standard & Poor's, p. 18.

[13] Since some authors argue that individuals process frequency formats better than they do probabilities (e.g., Cosmides & Tooby, 1996; Gigerenzer, 1996; Gigerenzer & Hoffrage, 1995), we provided both formats in the numeric probabilities scenarios to account for the individual preferences in processing probability information.

Table 3
Rating classifications with corresponding numeric and verbal probabilities for both insolvency and claim settlement treatments (Experiments 1 and 2)

Rating	Numeric probability	Verbal probability expression
Extremely strong[a]	0%	Insurer *always* pays
Good[b]	0.3%, i.e., 30 out of 10,000 policyholders would not be reimbursed by the insurer.	It *almost never* happens that policyholders would not be reimbursed by the insurer
Weak	4.9%, i.e., 490 out of 10,000 policyholders would not be reimbursed by the insurer.	It is *unlikely* that the policyholders would not be reimbursed by the insurer. On *very seldom* occasions it could still happen

[a] Reference insurer in Experiment 1 with an insurance premium offer of 160€.
[b] Reference insurer in Experiment 2 with an insurance premium offer of 145€.

participants provided numeric frequencies for 24 verbal probability and frequency expressions. Specifically, participants had to answer the question: "imagine a group of 10,000 people. How many individuals must experience a certain event so that you would state that this happens *occasionally*?" We used 10,000 as the basis for the frequency statements to simplify answers reporting very small probabilities.[14] The analysis of standard deviations (SD) reveals that quantitative meanings of verbal probability expressions vary across individuals. Further, some expressions seem to be perceived as more precise than others. For instance, probability phrases such as *never*, *almost never*, or *unlikely* have a much smaller standard deviation (1%, 4%, and 8%) than phrases such as *quite likely*, *very likely*, or *quite frequently* (19%, 20%, and 21%).

Given the large spread of individuals' responses, we used median values to better match numeric and verbal expressions (the statistics for each verbal expression can be found in Appendix C). Note that we were primarily interested in finding out whether general reactions to default risk are affected or unaffected by verbal or numeric descriptions of probabilities. This required having realistic and understandable descriptions of default risk that are matched to some numeric values. Our study is not designed to derive any general results on verbal and numeric probabilities. To control for a uniform perception of verbal probabilities, the default risk was expressed with the same wording in both the settlement of claim and insolvency treatments.

Via email, we invited 6120 individuals[15] to take part in an online questionnaire experiment. As an incentive to participate, 20 randomly determined individuals received 100€ each. The questionnaire was fully completed by 943 individuals. Out of this group, 719 (i.e., 76%) provided usable responses. Specifically, we eliminated the following participants from the dataset: (1) subjects who stated ludicrously high default probabilities (above 50%) were removed. (2) Subjects who took less than one minute to answer the first question were also removed from the data set. Our pretest participants needed a minimum of 80 seconds. We assumed that respondents using less than one minute did not carefully read the instructions. (3) Finally, individuals exhibiting larger willingness to pay for larger default probabilities were eliminated, too. The data set included individuals between the ages of 18 and 63 (M = 29.7; SD = 9.3) with various educational backgrounds. Fifty-three percent subjects were female.

2.1.2. Experiment 2

Experiment 2 was conducted to test whether the results of Experiment 1 hold when the reference Insurer 1 has a nonzero probability of default. We reduced the design of Experiment 1, though, to a 2 (probability representation) × 1 (default) between-subject design and only differentiated between verbally and numerically expressed probabilities. In Experiment 2, we did not specify reason for default because the results of Experiment 1 showed no significant differences in purchase behavior between default due to insolvency and default due to settlement of claim practices. For both treatments of this experiment, participants had to specify willingness to pay, first, for household insurance with a 4.9% risk of default compared to a reference insurance contract with 0.3% default risk offered for a premium of 145€.[16] Next, participants were asked how much more they were willing to pay for a default-free insurance contract (see Table 3 for the respective insurers' rating classifications).

The second experiment was also conducted via an online questionnaire. Since Experiments 2 and 3 were carried out at the same time, we invited 2000 individuals via email for both experiments.[17] As an incentive to participate, 20 randomly determined individuals received 50€ each. The questionnaire was fully completed by 149 individuals. Out of this group, 118 (i.e., 79%) provided usable responses.[18] The participants were aged between 18 and 74 (M = 33.7; SD = 12.3) and, again, from various educational backgrounds. Forty-nine percent subjects were female.

2.1.3. Experiment 3

Experiment 3 was designed to study the effect of positive or negative framing of the insurer's default risk on consumer reaction. In the negative condition, the default risk is framed in terms of probability of *nonpayment* of claims, whereas in the positive condition, it is described as the probability of *payment* of claims. We, again, differentiate between verbally and

[14] The study was conducted at Humboldt-Universität zu Berlin in Germany. All expressions used in the questionnaire have been translated into English.
[15] One part of this group (1120 people) was invited through the subject pool of Humboldt-Universität zu Berlin in Germany. The other 5000 were invited through the subject pool of sozioland.de, a German online portal for surveys. Our research project was selected for support by this portal, leading to a very large number of potential respondents.
[16] The premium corresponds to the median willingness to pay for insurance with 0.3% default risk elicited in Experiment 1.
[17] We thank sozioland.de for providing us with an additional 2000 subjects from its subject pool.
[18] See Experiment 1 for details on the exclusion of participants.

Table 4
Insurer classifications with corresponding numeric and verbal probabilities for both positively and negatively phrased default risk treatments (Experiment 3)

Insurer default risk			
Positively phrased		Negatively phrased	
Numeric probability	Verbal probability expression	Numeric probability	Verbal probability expression
100%	Insurer always pays.	0%	It *never* happens that the policyholders would not be reimbursed by the insurer.
95%, i.e., 9500 out of 10,000 policyholders will be reimbursed by the insurer.[a]	Insurer practical always pays.	5%, i.e., 500 out of 10,000 policyholders would not be reimbursed by the insurer.	It is *unlikely* that the policyholders would not be reimbursed by the insurer.
92%, i.e., 9200 out of 10,000 policyholders will be reimbursed by the insurer.	Insurer almost always pays.	8%, i.e., 800 out of 10,000 policyholders would not be reimbursed by the insurer.	It is *quite unlikely* that the policyholders would not be reimbursed by the insurer.

[a] Reference insurer with an insurance premium offer of 150€.

numerically expressed probabilities in both conditions. Hence, Experiment 3 consists of a 2 (probability representation) × 2 (framing of default) between-subject design. Participants were, again, randomly allocated between these four conditions.

Table 4 shows the six insurer classifications used in the numeric and verbal probability treatments for both the positively and negatively framed default risk.

Note that in Experiment 3, we used different levels of default risk than were used in the other experiments because our prestudy did not provide matching positive and negative verbal probability or frequency expressions for the default risk of 0.3% utilized in Experiments 1 and 2. Additionally, in this experiment, insurers are not labeled by financial rating classification so as to avoid additional framing effects; instead, they are solely described via their level of default risk.

Therefore, in Experiment 3, subjects were asked to state their willingness to pay for a household insurance contract with an 8% default risk, compared to a reference insurance contract with a 5% probability of default, with default being negatively framed. Furthermore, they were asked how much they were willing to pay for a default-free insurance contract as opposed to one with a default risk of 5%. In the positive treatment, we utilized corresponding probabilities of payment of claims, i.e., 92%, 95%, and 100%, respectively. The insurance premium for the reference insurance was specified to be 150€.

A total of 324 individuals of various educational background participated in Experiment 3. Fifty-nine had to be excluded because of nonsensical responses.[19] The remaining 265 (81%) were aged between 18 and 76 (M = 30.8; SD = 15.9). Sixty percent participants were female.

2.2. Results

2.2.1. General patterns of behavior

Our respondents fall into two distinct groups: those who would never purchase insurance with default risk and those who would buy such insurance if the premium was low enough. Furthermore, all individuals are willing to pay a substantial loading to avoid default risk. All reactions are independent of the characteristics of the concurrently available reference insurance contract. Tables 5.1–5.4 present the descriptive results for all experimental treatments. For example, the results of Experiment 1 show that 10% of the subjects would not buy insurance with a default probability of 0.3% and 38% would not buy it when it has a default probability of 4.9% when default-free insurance is available. Those who are willing to buy insurance with default risk require a premium reduction of 14% (26%) on average for a default risk of 0.3% (4.9%) compared to the premium of 160€ offered by the default-free insurer.

In the presence of a reference insurer with 0.3% default risk and a premium offer of 145€ (Experiment 2), we observe that the percentage of subjects who would not purchase insurance with the higher default probability of 4.9% is quite similar to the percentage observed under the default-free reference insurer condition. That is, about 40% of the subjects refused to buy. On the other hand, the amount individuals are willing to pay should they consider purchasing differs significantly between both experiments ($p < 0.001$). However, all subjects were willing to purchase the reference insurance contract with a default probability of 0.3%, although for a lower average premium of 135€.[20]

The findings of Experiment 1 further reveal that reactions are very sensitive to the level of default probability. That is, significantly more people refuse to purchase insurance with default risk when the default probability is high (4.9%) than when it is low (0.3%) ($p < 0.001$). Furthermore, willingness to pay for insurance with the lower default probability of 0.3% is significantly higher than willingness to pay for insurance with the higher default probability of 4.9% ($p < 0.001$).

[19] See Experiment 1 for details on the exclusion of participants.

[20] To discover this, we included a control question asking whether individuals would have purchased insurance from the reference Insurer 1 and, if not, at what price they would be willing to purchase it.

Table 5.1
Descriptive statistics for purchase decision and willingness to pay for all three experiments over all treatments

		Experiment 1 ($N = 718$)		Experiment 2 ($N = 118$)		Experiment 3 ($N = 265$)	
		0.3%	4.9%	0%	4.9%	100%/0%	92%/8%
Yes-no-purchase	Yes	646 (90%)	449 (62%)		71 (60%)		201 (76%)
	No	73 (10%)	270 (38%)		47 (40%)		64 (24%)
Positive-WTP	Mean	138€	118€	160€	113€	172€	128€
	Median	145€	138€	155€	124€	164€	135€
	SD	22€	31€	16€	22€	32€	20€

Table 5.2
Descriptive statistics for purchase decision and willingness to pay for Experiment 1, separately for all treatments ($N = 719$)

		Default probability: 0.3 %				Default probability: 4.9 %			
		Settlement of claim		Insolvency		Settlement of claim		Insolvency	
		Verbal	Numeric	Verbal	Numeric	Verbal	Numeric	Verbal	Numeric
Yes-no-purchase	Yes	159 (90%)	174 (88%)	154 (93%)	159 (89%)	108 (61%)	119 (60%)	114 (69%)	108 (61%)
	No	18 (10%)	24 (12%)	12 (7%)	19 (11%)	69 (39%)	79 (40%)	52 (31%)	70 (39%)
Positive-WTP	Mean	137€	136€	141€	138€	116€	118€	123€	116€
	Median	144€	145€	149€	145€	122€	138€	139€	139€
	SD	21€	25€	21€	21€	31€	33€	27€	34€

Table 5.3
Descriptive statistics for purchase decision and willingness to pay for Experiment 2, separately for all treatments ($N = 118$)

		No default probability: 0%		Default probability: 4.9%	
		Verbal	Numeric	Verbal	Numeric
Yes-no-purchase	Yes			36 (77%)	35 (49%)
	No			11 (23%)	36 (51%)
Positive-WTP	Mean	157€	162€	118€	107€
	Median	155€	155€	125€	115€
	SD	10€	19€	20€	23€

Table 5.4
Descriptive statistics for purchase decision and willingness to pay for Experiment 3, separately for all treatments ($N = 265$)

		No default probability: 100% or 0%				Default probability: 92% or 8%			
		Positive		Negative		Positive		Negative	
		Verbal	Numeric	Verbal	Numeric	Verbal	Numeric	Verbal	Numeric
Yes-no-purchase	Yes					48 (71%)	64 (85%)	45 (78%)	44 (69%)
	No					20 (29%)	11 (15%)	13 (22%)	20 (31%)
Positive-WTP	Mean	174€	169€	167€	180€	128€	129€	128€	124€
	Median	160€	162€	160€	170€	134€	135€	135€	130€
	SD	50€	21€	18€	27€	19€	17€	23€	22€

2.2.2. Impact of treatment variables

Since we observed a two-stage decision process, i.e., first the decision whether or not to buy insurance with default risk and, second, the decision on amount willing to pay if such a risk is, in principle, accepted, all following analyses deal with – *yes-no-purchase* and *positive-WTP* (i.e., positive willingness to pay for insurance with default risk) – separately.

Table 6
Correlations of qualitative variables with the elicited factors

Qualitative variables	Factor loadings		
	1 Security concern	2 Decision-making ability	3 Individual characteristics
(1) Awareness	.555	.393	-.023
(2) Importance	.735	-.121	-.063
(3) General interest	.578	.149	-.027
(4) Competence in choice	.272	.721	-.096
(5) Task complexity	.108	-.704	.021
(6) Concern	.565	-.445	-.203
(7) Optimism-pessimism attitude	.041	.013	.843
(8) Risk attitude	-.129	.059	.777

Extraction method, principal component analysis; rotation method, varimax with Kaiser normalization (shaded cells are used for the interpretation of the factors).

Table 7.1
ANCOVA results of positive-WTP decision, separately for each experiment; *F*-statistics and significance levels (in brackets) for the main effects, interaction effects, and covariates

		Experiment 1 Positive-WTP		Experiment 2 Positive-WTP		Experiment 3 Positive-WTP	
		4.9%	0.3%	4.9%	0%	92%/8%	100%/0%
Main effects	Probability representation (verbal vs. numeric)	0.26 (0.61)	0.98 (0.32)	*6.13* (*0.02*)	2.29 (0.13)	0.34 (0.56)	0.69 (0.41)
	Reason for default (insolvency vs. claim settlement)	0.85 (0.36)	0.12 (0.73)	–	–	–	–
	(Order)	0.14 (0.71)	9.77 (*0.00*)	–	–	–	–
	Framing of default risk (positive vs. negative)	–	–	–	–	1.50 (0.22)	0.50 (0.48)
Interaction	Probability representation by reason for default	1.76 (0.19)	0.50 (0.48)	–	–	–	–
	Probability representation by framing of default risk	–	–	–	–	0.94 (0.33)	*4.59* (*0.03*)
Covariates	Security concern	*25.18* (*0.00*)	*21.99* (*0.00*)	0.23 (0.63)	*3.82* (*0.05*)	2.61 (0.11)	*3.54* (*0.06*)
	Decision-making ability	0.00 (0.96)	2.70 (0.10)	*10.21* (*0.00*)	0.16 (0.69)	0.26 (0.61)	0.00 (0.97)
	Individual characteristics	0.19 (0.66)	0.48 (0.49)	0.13 (0.77)	0.45 (0.51)	0.15 (0.70)	0.06 (0.81)
	Age	*3.21* (*0.07*)	0.99 (0.32)	0.21 (0.65)	0.05 (0.83)	0.19 (0.66)	0.39 (0.53)
R^2		0.08	0.06	0.07	0.24	0.04	0.03

To analyze the impact of the treatment variables, i.e., reason for default (insolvency and claim settlement practices), probability representation (verbal and numeric probabilities), and framing of default risk (positive and negative framed default risk), we conducted analyses of covariance (ANCOVA) for the positive-WTP decisions, and binary logistic regression analyses for the yes-no-purchase decisions. Note that a direct comparison between verbal and numeric probability treatments is not based on an exact theoretical equivalence. The dependent variables were either the willingness to pay for insurance for each default probability or the binomial responses of yes-no-purchase, respectively. All analyses include the experiment-specific main effects (probability representation, reason for default, and framing of probabilities) and interaction of those as independent variables. Furthermore, we include explanatory variables, such as individual's *security concern*, *decision-making ability*, *individual characteristics*, and *age*, as covariates in our analyses to control for the effect of those variables on the dependent variables. The factors security concern, decision-making ability, and individual characteristics were derived by a principal component analysis with varimax rotation on the interval-scaled qualitative variables over all three experiments. Together

Table 7.2
Results of binary logistic regression for yes-no-purchase decision – separately for each experiment; exponential coefficients and significance levels (in brackets) for the main effects, interaction effects, and covariates

		Experiment 1		Experiment 2	Experiment 3
		Yes-no-purchase 4.9%	Yes-no-purchase 0.3%	Yes-no-purchase 4.9%	Yes-no-purchase 8%
Main effects	Probability representation (verbal vs. numeric)	1.64 (0.12)	1.45 (0.59)	*0.28* (*0.01*)	*2.35* (*0.05*)
	Reason for default (insolvency vs. claim settlement)	1.50 (0.23)	0.77 (0.70)	–	–
	(Order)	1.37 (0.33)	0.36 (0.07)	–	–
	Framing of default risk (positive vs. negative)	–	–	–	1.20 (0.68)
Interaction	Probability representation by reason for default	0.50 (0.13)	0.64 (0.64)	–	–
	Probability representation by framing of default risk	–	–	–	*0.29* (*0.05*)
Covariates	Security concern	*0.58* (*0.00*)	*0.59* (*0.00*)	*0.52* (*0.02*)	*0.55* (*0.00*)
	Decision-making ability	0.92 (0.32)	*0.76* (*0.05*)	*1.80* (*0.02*)	0.81 (0.15)
	Individual characteristics	1.02 (0.80)	1.05 (0.71)	0.83 (0.45)	1.05 (0.75)
	Age	*0.98* (*0.03*)	0.98 (0.13)	*0.95* (*0.01*)	1.00 (0.78)

The reference category of the dependent variable is equal to not buy insurance.

they explain 55% of the cumulative variance of the variables under analysis. Table 6 shows these three factors, together with their partial factor loadings.[21] Highlighted cells represent the variables used for the interpretation of these factors.

Tables 7.1 and 7.2 summarize the most important findings of our analyses. We find no systematic main effect of our treatment variables. The results indicate that the reason for default – insolvency or claim settlement practices – does not have an effect on consumer reaction to default risk. Similarly, the choice of probability representation does not significantly influence willingness to pay in most insurance purchase decisions. An exception to this is found for willingness to pay for insurance with a 4.9% default probability compared to a reference insurer with a 0.3% default risk (Experiment 2). Here, choice of probability representation has a significant influence on the yes-no-purchase decision (see Table 7.1: Exp(B) = 0.280, $p < 0.01$) and the positive-WTP decision (see Table 7.1: $F = 6.134$, $p < 0.05$) decision. There is a higher rejection rate (51% vs. 23% of subjects) and a lower average willingness to pay in absolute terms (adjusted means: 106€ vs. 119€) when default risk is presented by numeric probabilities.

The results of Experiment 3 reveal a significant interaction effect between framing of default risk and choice of probability representation for the yes-no-purchase decision for a insurance contract with an 8% default risk (see Table 7.2: Exp(B) = 0.292, $p < 0.05$) and for the positive-WTP decision for a default-free insurance contract (see Table 7.1: $F = 4.587$, $p < 0.05$). This interaction effect implies that both decisions are affected, but to different extents, by how default risk is framed in the verbal and numeric probability conditions. For example, the results indicate that mean willingness to pay for default-free insurance is lower in the positive than in the negative condition (adjusted mean: 169€ vs. 180€) for numerically presented default probabilities, whereas in the verbal condition we find the opposite (adjusted means: 174€ vs. 168€). Furthermore, more individuals seem to refuse to purchase insurance with an 8% default risk when the default risk is framed negatively than when it is framed positively and probabilities are presented numerically (31% vs. 15% of subjects). Again, for verbal probabilities the interaction effect implies the opposite, i.e., fewer people refuse to buy insurance when the default is framed negatively than when it is framed positively (22% vs. 29%).

2.2.3. Impact of control variables

As reported in Tables 7.1 and 7.2, the results further indicate that the control variables *decision-making ability* and *age* have only a small effect on insurance purchase decisions, whereas *security concern* significantly influences reaction to default risk. This variable explains nearly all insurance purchase decisions. Thus, the greater an individual's concern with security, the less likely it is that the individual will ever purchase insurance with default risk. If they are willing to buy such insurance, individuals with a high security concern factor will demand a much greater reduction in insurance premium than will individuals who are less concerned with security. Furthermore, individuals who are more concerned about security are willing to pay a much higher loading to avoid default risk. For example, results of Experiment 1 show that individuals who are concerned about security issues are willing to pay 7% (4%) less on average for an insurance contract with a default risk of

[21] The requirements for a factor analysis were met. The Kaier-Meyer-Olkin measure of sampling adequacy, as well as the Bartlett's test of sphericity, sufficiently indicate that our data are suitable for such a factor analysis (KMO: .571, Bartelett: $p < 0.001$).

4.9% (0.3%) than are individuals who are not concerned. Further, 48% (14%) of concerned individuals were not willing to purchase insurance having a default probability of 4.9% (0.3%), whereas only 27% (6%) of unconcerned individuals refuse to purchase an insurance contract with that default probability.[22]

3. Discussion

The results of this study confirm previous results that individuals either will not accept insurance with default risk or they will ask for a higher than expected reduction in insurance premiums. But why do people refuse to accept insurance with default risk – even as a gift? This cannot be explained by any rational model of choice. Instead, this behavior looks like an extreme certainty effect (Allais, 1953): Willingness to pay is not only heavily reduced but the entire risky prospect is refused. From a more psychological perspective one could argue that people buy warranties and insurance to achieve "peace of mind" (Hogarth & Kunreuther, 1995) or to reduce concern about the occurrence of a potential loss (Schade et al., 2008), a need that cannot be fulfilled in the presence of default risk. Thus, the idea of buying insurance and *still* being subject to some of the risk one wanted to get rid of, no matter how small, appears to be unacceptable for many people. Our findings on the impact of the individual's security concern factor on the percentage of those rejecting a policy support this interpretation. Nearly half the individuals who are concerned about the fact that the insurer would not pay its valid claims refuse to purchase an insurance contract with a default probability of 4.9%, whereas in the group of unconcerned individuals, only one-quarter refused to purchase. A similar reasoning applies to the very strong reactions of those willing to purchase insurance with default risk.

The factors analyzed in our experiments: verbal and numeric probabilities, insolvency and settlement of claim practices, positive and negative framing, have no systematic impact on these general findings. That is, the observed reactions to insurance with default risk are in principle identical over the entire spectrum of situations analyzed in our experiments. Apart from subtle differences in magnitude, the main result of our paper is clear: no matter how default is communicated, people strongly dislike it and react accordingly.

4. Conclusions, implications, and limitations

We carried out three experiments on insurance with default risk that varied the characteristics of the decision situation. We find that irrespective of the choice of default probability representation, the reason for default, the framing of the default risk, and the default-proneness of the reference insurance, default risk is a very unattractive feature of insurance contracts for most individuals. When purchasing insurance, individuals seem to be in search of peace of mind and this desire is not satisfied when the insurance contract "is not safe".

What are the practical implications for insurers? Few theoretical models dealing with risk management of insurance companies such as Froot (2007) and Gründl, Post, and Schulze (2006) incorporate policyholder reactions. However, in these approaches, the reactions are not quantified on an empirical basis. Our results demonstrate that consumers' reactions to default risk might be more extreme than assumed. This may or may not require making people sensitive to the problem of default risk. Given the nature of our study, we are not able to answer the question how well informed people actually are about insurance companies' default situation.

However, based on the extreme behavior we observed in our studies, deriving an optimal level of financial solvency for insurance companies might often lead to a unique solution, and that solution is a corner optimum: Be as safe as possible within reasonable limits. Additionally, according to our findings, controlling the settlement of claims practices is just as important as controlling the solvency level. Practitioners should also note that there appears to be no good way of informing potential policyholders of a nonzero default risk; basically, to consumers, no matter how it is described, this is bad news.

Our decision situations are hypothetical. However, we saw no way of making our experiments incentive-compatible while keeping our scenarios realistic. To avoid the major problem associated with non-incentive-compatible experimentation – low interest and respondent carelessness – we controlled for individual effort via a measurement of the time needed for each task. We also required the respondents to put themselves in the position of someone who is willing to purchase the reference insurance contract. Not everybody would have bought it. We adopted this design feature because of its relative simplicity, but believe that the comparison between treatments and observed general behavioral tendencies nevertheless remain valid.

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[22] Separate results for concerned and unconcerned individuals for all experimental treatments are available from the authors upon request.

Appendix A1. Description of general decision situation, which is the same across all treatments

Imagine that you just moved into a new apartment and you *decide on purchasing* insurance against damages and theft occurring to your belongings that would cover losses up to 60,000€, the value of your furniture, and other belongings in the apartment. You have gathered information on household insurance and received quotes from two insurers, which are identical in the scope of indemnity. Insurer 1 offers its household insurance for a premium of 160€ [145€ (Experiment 2); 150€ (Experiment 3)] per year, whereas Insurer 2 has not yet specified the amount of its premium.

Appendix A2. Specific description for numerically expressed insolvency risk treatment (Experiment 1)

Furthermore, you have read an article in a journal about the financial stability of various insurers, i.e., the insurer's ability to meet its financial commitment to its policyholders at any time. Specifically, you have read that the financial stability of Insurer 1 is rated *extremely strong* and the financial stability of Insurer 2 is rated *weak*.

The insurers' rating classification ranges from extremely strong, to very strong, to strong, to marginal, and finally to weak. The probability that insurers with a rating of *extremely strong* would not pay their claims in case of a loss due to their inability to pay (insolvency) equals *zero*. The probability that insurers with rating of *weak* would not pay their claims [...] equals *4.9%*. This number can be interpreted so that 490 out of 10,000 insurees who reported a claim would not be reimbursed by the insurer. You now have to decide with which insurer you would prefer to contract, Insurers 1 or 2.

Appendix B

Table B1.

Table B1
Qualitative variable definition and mean values

Qualitative variable with corresponding survey question	Scale values[a]	Mean
Awareness		
(1) Have you ever thought about the risk of default with insurance purchase before you have done this experiment?	Rather no thoughts Rather many thoughts	3.02
Importance		
(2) How important do you find the quality of claim settlement practices/financial situation of the insurer when purchasing household insurance?	Not important at all Very important	5.85
General interest		
(3) How important is the ownership of household insurance for you?	Not important at all Very important	5.31
Competence in choice		
(4) How competent do you judge yourself in respect to purchasing insurance policies?	Not competent at all Very competent	4.07
Task complexity		
(5) Was it difficult to choose an insurer based on the set of premiums, to begin with?	Not difficult at all Very difficult	3.23
Concern		
(6) How concerned are you that the insurer would not pay its valid claims?	Not concerned at all Very concerned	4.00
Optimism–pessimism attitude		
(7) If someone asked you whether you are an optimistic or a pessimistic person, how would you evaluate yourself?	Very pessimistic Very optimistic	4.89
Risk attitude		
(8) If someone asked you whether you are risk seeking or risk avoiding, how would you evaluate yourself?	Very risk avoiding Very risk seeking	3.62

[a] Subjects provided responses on a seven-point scale for all these variables.

Appendix C

Table C1.

Table C1
Probability estimates for 24 verbal probability and frequency expressions

Verbal expression	Mean	Median	SD
Never	.004	.00	.01
Almost never	.03	.01	.04
Very seldom	.06	.03	.13
Unlikely	.07	.05	.08
Seldom	.10	.10	.12
Quite unlikely	.10	.08	.10
It happens	.17	.12	.15
Slightly likely	.18	.16	.13
Sometimes	.20	.20	.14
Occasionally	.20	.20	.12
Now and then	.20	.20	.13
Less likely	.23	.20	.16
Not frequently	.23	.20	.17
Possible	.26	.20	.20
Perhaps	.26	.23	.20
Partly	.29	.30	.16
Quite likely	.57	.60	.19
Quite frequently	.62	.70	.21
Often	.66	.70	.17
Frequently	.67	.70	.18
Very likely	.77	.80	.20
Almost always	.91	.95	.11
Practically always	.93	.95	.11
Always	.95	1.00	.18

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