INSURANCE DECISION-MAKING FOR RARE EVENTS: THE ROLE OF EMOTIONS[1]

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Abstract

This paper describes the results of a web-based multi-period insurance purchasing experiment focusing on how individuals make insurance choices for low-probability, high-consequence events. Participants were told the probability and resulting losses of a hurricane occurring and were informed that these were stable from period to period. We contrast the model of informed expected utility [E(U)] maximization with alternative behavioral models of choice as explanations for what we observe. The majority of individuals (63 percent) behaved in ways that were consistent with expected utility theory, although we do not know whether these individuals were utilizing other decision rules. A sizeable number of uninsured individuals decided to purchase insurance after learning that they had suffered a loss and revealing that they were unhappy about having been uninsured. In this sense, the study shows that a loss coupled with emotions is likely to play an important role in convincing an uninsured person to buy coverage. The paper concludes by raising questions regarding the welfare implications of this behavior.

Keywords: individual decision-making; choice under uncertainty; multi-year insurance; disasters

JEL: C90, D6, D12, D81, G22

1. Introduction

Insurance is most valuable against relatively rare and large losses. Yet there is considerable empirical evidence that consumers have difficulty deciding whether or not to buy insurance. Mistakes often occur and are most consequential when the probability of the risky event is low and the potential loss is large. For these low-probability high-consequence (LP-HC) events, consumers have little loss experience either personally or by observing first-hand the impact of these disasters on others. Should they suffer damage from an adverse event, they may overreact to the losses by overestimating the likelihood of a future loss.

In making decisions about whether to purchase insurance at a given point of time, there are three types of mistakes: (1) consumers may continue to renew a given insurance policy due to a status quo bias even when the objective circumstances (premiums, expected losses) change over time (Neipp and Zeckhauser, 1985; Madrian and Shea, 2001); (2) some consumers who are insured may be inclined to drop their coverage if the event has not occurred even when objective circumstances do not change,

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because they view insurance as an investment and feel it is not paying off (Michel Kerjan, Lemoyne de Forges and Kunreuther, 2012); (3) uninsured consumers who suffer a loss may regret not having bought coverage and then decide to buy insurance even though the occurrence of the loss does not imply any change in future loss probabilities. That is, there may either be excess or insufficient persistence, relative to what would be implied if a consumer maximized expected utility. Empirical evidence from laboratory experiments and field studies indicates that individuals often make insurance purchase decisions based on factors such as past experience and emotions. In making their choices they utilize simplified decision rules and exhibit systematic biases (Kunreuther, Pauly and McMorrow, 2013).

Some changes in consumers' purchase behavior can be understandable if recent experience signals to them that there has been a change in their probability of loss. For example, when insureds have not experienced a loss over a long period of time, they may perceive the likelihood of a future loss to be lower than they originally thought. A recent loss may lead the individual to perceive that the probability of a future loss is higher than it previously was, even though there may be no scientific evidence to support this reaction. However, if there is credible external evidence that the loss probability remained constant over time, past experience should not lead to changes in purchasing if the buyer is properly informed.

This paper focuses on how individuals make insurance choices when dealing with LP-HC events and how those decisions contrast with choices consistent with a benchmark model based on expected utility [E(U)] theory. One rationale for comparing actual behavior with a normative model of choice such as E(U) is to develop a more robust theory of behavioral welfare economics by building on the conceptual thinking of Gul and Pesendorfer (2007), Koszegi and Rabin (2007), and Bernheim and Rangel (2009). These papers all address the problem of making welfare economic judgments when consumers make choices that appear to outside observers to be "mistakes." When consumers happen to behave in ways that do not appear to be rational, are such choices a priori candidates for policy interventions?

In this paper we focus on factors that have been shown to influence consumer decision-making. The number of anecdotally plausible factors is very large, but it is an empirical question as to which ones have the most consistent and greatest influence on actual behavior. We specifically examine emotional reactions, such as how insured individuals feel after not experiencing a loss or how uninsured individuals who suffer a loss in a given period feel immediately thereafter. We then explore how these emotions may influence future insurance purchase decisions in ways not predicted by the benchmark model of choice. It will also be useful to know how consumers' insurance purchasing behavior changes as loss experience accumulates over time.

Recent work on insurance demand has emphasized the fact that there is heterogeneity in choice among those facing similar risky circumstances, potentially arising both from differences in preferences or utility functions, but also from individuals' propensity to use different kinds of decision making processes or models (Einav et al., 2012). Some individuals behave as if they followed the benchmark expected utility maximization model while others are influenced by recent and/or accumulated experience and make decisions in ways that are inconsistent with that model. We are particularly interested in how we can explain differences in behavior and what public policy interventions (if any) should be implemented that move people toward E(U) maximization.

In an effort to shed light on these questions, we designed a multi-period insurance purchasing experiment in which participants were told the loss probability and were informed that it was stable from period to period, but where participants experienced different patterns of losses. We contrast the model of informed expected utility maximization with alternative behavioral models of choice as explanations for what we observe. We focus on emotions (rather than imperfect probability updating) as an explanation for changes in insurance purchasing behavior over time. To do this we probe

consumers' emotions before and after knowing their loss experience in any time period as potential predictors of their purchasing behavior in subsequent periods.

2. Predictions based on the Benchmark Model of Choice

The benchmark model assumes that individuals are risk averse and maximize their expected utility with complete information regarding the probability of a loss and its magnitude in every time period. In this experiment, participants were told that the loss probability is identical in every period regardless of whether or not they experienced a loss in earlier periods. These consumers will presumably choose whether or not to buy coverage by comparing the premium they are offered with the likelihood of a loss and its consequences. When faced with premiums that are either favorable or actuarially fair, all risk averse consumers behaving according to the benchmark model should purchase insurance in every period regardless of their loss experience. Risk-loving consumers may choose not to be insured, but they also should be consistent across periods. When faced with an actuarially unfair premium, the decision on whether to purchase coverage depends on the individual's degree of risk aversion. In all cases, whatever decision is made in the first period should be repeated in all subsequent periods.

We also inquired about emotions of two sorts. Using an indexed scale, we asked respondents how GLAD they were after they had made their insurance purchase decision but before they knew the loss outcome. After they knew whether or not they suffered a loss in a given period, we then asked participants to characterize how they FEEL on an indexed scale. Expected utility treats the emotions of GLAD and FEEL to be independent of previous experience.

3. Role of Emotions in Choice Behavior

There is a growing literature on how emotions influence individuals' decisions under risk (Loewenstein et al., 2001; Finucane et al., 2000). For low-probability, high-consequence events, those at risk may buy coverage to reduce their *anxiety* about experiencing a large financial loss, giving them peace of mind. After observing whether or not they have suffered a loss, individuals may *regret* their insurance decision (Bell, 1982; Loomes and Sugden, 1982; Braun and Muermann, 2004). Imagine you were residing in Florida and had not purchased insurance against possible damage from hurricanes and a storm occurred causing extensive losses to your property. After the disaster you likely wished you had purchased coverage and regret not having done so. If you feel very badly that you were uninsured, you may decide to purchase insurance as a way of avoiding this emotion in the future. Conversely, if you have been paying premiums for years and never collected a penny, the regret you feel over that situation may eventually prompt you to stop purchasing.

The behavioral model we will examine is one that explicitly considers emotions as part of the decision process. More specifically, we hypothesize that a person's prior loss experience will influence the value of FEEL which may then lead to a change in the person's insurance purchasing decision in the next period. We hypothesize that FEEL will be higher for people who purchased insurance and then suffered a loss relative to people who purchased insurance and whose home was unscathed. Similarly, FEEL will also be higher for people who were uninsured and did not suffer a loss relative to those who did suffer a loss. If the level of FEEL is low enough, indicating a strong negative emotional reaction, an individual is likely to change his/her insurance status in the next period.

We will also be exploring two other kinds of anomalies. One has to do with the relationship of premiums to demand for insurance: risk averse people who are uninsured every period when charged favorable or fair premiums will be behaving anomalously; these individuals are classified as *price inconsistent.* The other has to do with changing insurance purchase behavior when neither loss

probability nor experience differs; these individuals are switching for no objective reason and are classified as *time-inconsistent*.

It is important to note that behavior that can be explained by a given model may also be consistent with other models. In those cases, one cannot specify the reason for an individual's behavior. On the other hand, if behavior is consistent with one model and inconsistent with others, then this offers support for the model that is consistent with behavior.

4. Experiments to Test Hypotheses Implied by Expected Utility Theory

4.1 Experimental Design

To determine whether individuals' insurance purchasing decisions are consistent with expected utility maximization under risk aversion, and the role that emotions (GLAD and FEEL) play in their decision process, we undertook an experiment with adults in the United States. Most of the participants were over 30, so were likely to have experience purchasing insurance. The experiment consisted of a 10-period game where participants were asked to imagine that they own a house worth US$100,000.

Participants were told at the outset of the experiment that they would play a 10-period game, and that in each period there is a chance that a major hurricane will occur. If a hurricane occurs, the house will suffer a loss in value of US$50,000 unless the participant has purchased insurance for that period, in which case s/he will be fully reimbursed by the insurer for the loss. Participants were told that experts estimate the likelihood of a hurricane occurring to be 1 in 25 (i.e., 4%). After making their insurance decision, participants were asked one of the following questions depending on whether or not they had purchased coverage:

- "How glad are you with your decision to buy insurance at this premium?"
- "How glad are you with your decision not to buy insurance at this premium?"

The question had the following 5-point scale used to define the variable **GLAD**:

Very unhappy	*Unhappy*	*Neither unhappy nor glad*	*Glad*	*Very glad*
1	*2*	*3*	*4*	*5*

After making their insurance decision, participants were told whether a hurricane occurred, and then one of the following questions was posed:

- When a hurricane occurred, participants were asked: "How do you feel about [not] having bought insurance now that you know a hurricane did occur?"
- When a hurricane did not occur, participants were asked: "How do you feel about [not] having bought insurance now that you know a hurricane did not occur?"

The response scale was identical to the one noted above for the questions related to **GLAD** and is used to define the variable **FEEL**.

At the end of each period, a new round of the game was played and participants were told the conditions were the same. In other words there was no change in the insurance premium the likelihood of a hurricane was 1 in 25, and the loss if a hurricane occurred was US$50,000. To avoid income effects, there was no accumulation of wealth across periods. Repeating the same game allowed us to determine how demand for insurance evolves over time, whether it changes following the occurrence of a

hurricane, the role that **GLAD** plays in the decision on whether to buy insurance, and the impact on **FEEL** of learning whether or not a person suffered damage from a hurricane.

To analyze the impact that suffering a loss from a hurricane had on decisions in future periods, the experiment was designed so that one-third of the participants experienced a hurricane in period 2, one-third in period 8, and one-third did not experience any hurricanes at all. Any individual who experienced a hurricane in period 2 was precluded from experiencing another one in period 8.

We also examined the impact that insurance premium differentials had on participants' decisions on whether or not to purchase coverage. The expected loss from the hurricane over all 10 periods was $2,000 per period (i.e., .04 x 50,000). One-third of the participants were offered insurance at a favorable premium of $1,600; one-third were offered an actuarially fair policy at a premium of $2,000; and one-third were offered insurance at a premium of $2,400, which implies a loading factor of 20 percent.

The experiment was conducted on a web-based platform (Qualtrics) with 1,834 adults in Florida–a state subject to hurricanes–whose demographics are representative of the state of Florida. About three-quarters of the participants were placed in a voluntary setting where they could determine whether or not to purchase coverage; the others were required to have insurance. Slightly more than half of the participants who could voluntarily purchase insurance and two-thirds of those required to have insurance were given tutorials with respect to how to undertake deliberative thinking in evaluating whether insurance is worth having. Midway through the game (in period 5), half of the participants in every group were shown graphic pictures of damage that could occur from a hurricane to see whether this impacted their insurance purchase decision.[2]

Before a participant began the 10-period game, s/he was asked two hypothetical questions to make sure that s/he understood the nature of the experiment and the impact of a specific insurance decision on the asset level at the end of each of the two successive periods. Individuals who answered only one of the questions correctly were directed to read the instructions again but could participate in the experiment. Those who gave wrong answers to both test questions were excluded from participating in the experiment to increase statistical power and reliability (Oppenheimer et al., 2009).

This paper examines the decision process of those who had the opportunity to purchase insurance voluntarily. Table 1 shows the number of those participants who experienced hurricanes in period 2 or 8 or did not suffer a loss in the 10-period game.

TABLE 1
Number of Subjects who Could Purchase Insurance Voluntarily Experiencing Hurricane Damage

PERIOD 2 HURRICANE	445
PERIOD 8 HURRICANE	454
NO HURRICANE	447

[2] A preliminary analysis of the data indicates that the tutorial had no significant impact on the insurance purchase decision. A graphic photo of damage from a hurricane in period 5 tended to increase insurance demand in that period. We will provide an analysis of the impact of these variables in a subsequent version of this paper.

4.2 Comparing the Models

E(U)-maximizing participants in our experiment who could choose to purchase insurance voluntarily should exhibit two kinds of behavior:

(1) If they are risk averse they should purchase coverage if faced with favorable or fair premiums, but might choose not to buy coverage under unfair premiums if their aversion to risk is low
(2) Whatever decision on coverage is made, it should be the same in every period regardless of loss experience

Hence, we can get a lower-bound estimate of participants engaged in anomalous behavior by identifying those who switch coverage status, and we can get an upper bound measure by adding those who are consistently uninsured under favorable or fair premiums.

The informed risk averse E(U) maximizer responds to an actuarially unfair price by choosing whether or not to buy insurance based on her/his degree of risk aversion, but s/he should surely purchase insurance in all 10 periods if the premium is favorable or actuarially fair (defined as STAY INSURED). In addition, those facing an actuarially unfair premium (that reflects administrative costs and profit) who decided to remain uninsured for all 10 periods (defined as STAY UNINSURED) were considered to be consistent with E(U) theory. Those inconsistent with E(U) theory would have switched insurance status at least once during the 10 periods (defined as *time-inconsistent*) or be uninsured for all 10 periods when offered a favorable or fair premium (defined as *price-inconsistent*).

Table 2 shows the proportion of respondents exhibiting time-consistent and price-consistent behaviors at the three premiums.

TABLE 2
Percent of Persons Continuously Insured and Uninsured for all 10 Periods (per Premium)

PREMIUM	N	STAY INSURED	STAY UNINSURED	SWITCH
FAVORABLE	479	64.9%	7.5%	27.6%
FAIR	437	58.6%	9.8%	31.6%
UNFAIR	430	56.7%	9.3%	34.0%
TOTAL	1346	60.1%	8.9%	31.1%

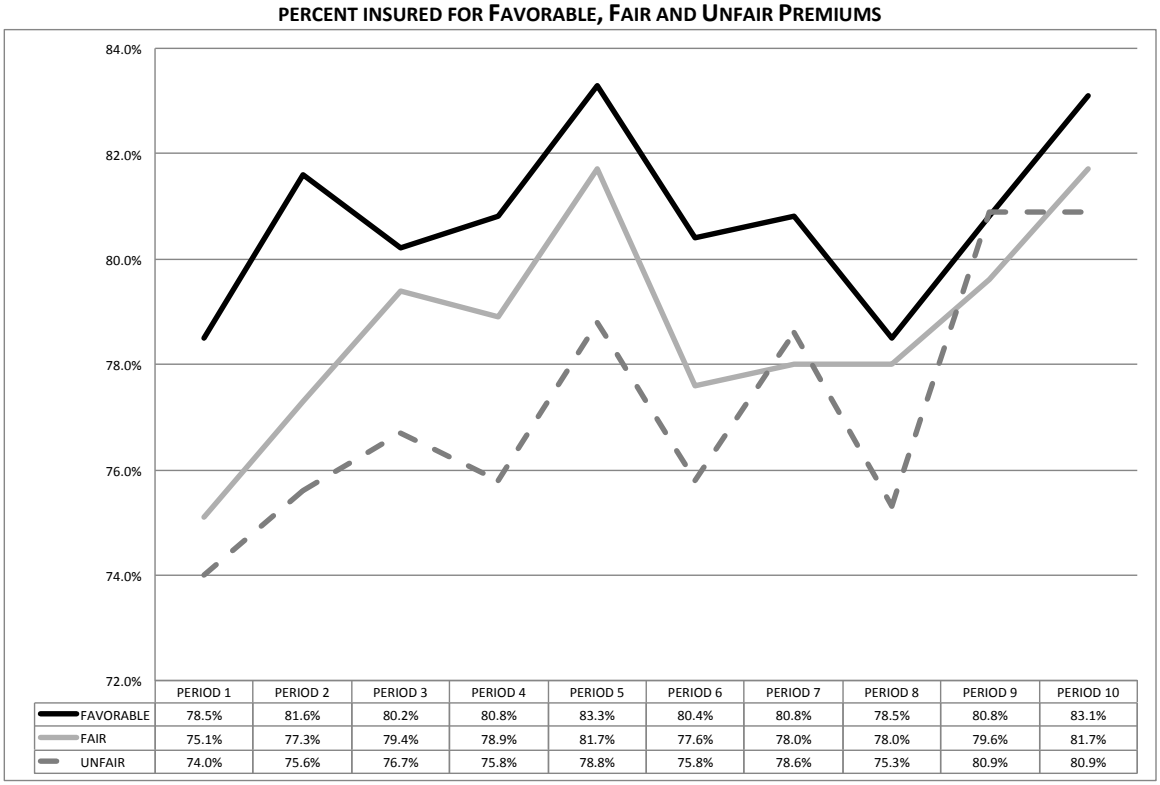
Taken together, these data indicate that 60 percent of the participants chose to STAY INSURED and an additional 3 percent chose to STAY UNINSURED if premiums were unfair.[3] The behavior of these individuals is consistent with what would be predicted by E(U) theory, although their actual decision process might have been a different one from E(U) maximization. For example, a person could decide to insure for all 10 periods to gain peace of mind, or remain uninsured because the likelihood of a hurricane was below their threshold level of concern. Another 31 percent chose to SWITCH insurance status at least once during the 10 periods. (Some of these time-inconsistent participants also failed to purchase insurance at favorable or fair premiums.) This behavior would be inconsistent with E(U) maximization regardless of risk preferences. The remaining 6 percent chose to STAY UNINSURED even though they were offered favorable or fair premiums. Their behavior would be inconsistent with E(U) maximization under the assumption of risk aversion.

[3] There were 40 participants who chose to STAY UINSURED when premiums were unfair, which is 3 percent of the 1,346 participants.

Figure 1 shows how participants' purchasing behavior in the experiment varied with the premium. As can be seen, the proportion purchasing insurance over all periods was highest at the favorable premium, slightly lower at the fair premium and lowest at the actuarially unfair premium. This suggests that individuals took premiums into account when making their decisions in a manner that is consistent with E(U) theory.

FIGURE 1

PERCENT INSURED FOR FAVORABLE, FAIR AND UNFAIR PREMIUMS



	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	PERIOD 5	PERIOD 6	PERIOD 7	PERIOD 8	PERIOD 9	PERIOD 10
FAVORABLE	78.5%	81.6%	80.2%	80.8%	83.3%	80.4%	80.8%	78.5%	80.8%	83.1%
FAIR	75.1%	77.3%	79.4%	78.9%	81.7%	77.6%	78.0%	78.0%	79.6%	81.7%
UNFAIR	74.0%	75.6%	76.7%	75.8%	78.8%	75.8%	78.6%	75.3%	80.9%	80.9%

5. Switching Behavior and FEEL

We hypothesize that individuals respond to their loss experience in a two-stage process. In stage 1, a bad experience–such as being worse off than if a different purchase decision had been made–will likely affect a person's emotions, as measured by the score on the question about FEEL. More specifically, a person who chose to be uninsured will likely have a lower level of FEEL if a loss occurs than if it does not, whereas someone who chose to be insured will likely have a lower level of FEEL if a loss does not occur than if one does. However, because the financial consequences of an uninsured loss are larger than the consequences of a premium payment with no benefit, we expect the size of the difference in FEEL to be larger for the uninsured individual than for the insured one.

Stage 2 relates to a possible switch in subsequent insurance purchasing behavior as a function of the level of FEEL in the current period. We hypothesize that the lower the level of FEEL associated with current behavior and current-period loss experience, the more likely the person's behavior will change in the next period. Again, we expect this reaction to be stronger for those who suffer uninsured losses than for individuals who pay a premium but do not collect on their policy because they do **not** suffer a loss. One difficult question we will examine is whether switching behavior, for the uninsured, is primarily determined by the effect of loss on FEEL (compared to no loss) or whether those uninsureds who suffer a loss switch their insurance status independent of their level of FEEL.

Our most interesting empirical results are associated with changes in insurance purchasing behavior for the uninsured, depending on whether they do or do not experience an uninsured loss. We examine how the emotion FEEL impacts these individuals' decisions on whether or not to purchase coverage as a function of their hurricane loss experience. To do this we define the variable LOSS, which takes on the value 1 if a person suffers damage and 0 if she does not. We find that both FEEL and LOSS are significantly associated with some uninsured individuals' decision to switch to being insured. This is most likely to occur when an uninsured individual suffers a loss and also feels very badly about the situation relative to her feelings if she didn't suffer a loss. The following section examines the role of FEEL on next-period purchasing decisions by uninsured individuals after they learn whether or not they have suffered a loss. We then turn to the insured individuals and indicate why emotions such as FEEL are unlikely to explain their decision to switch to being uninsured even when they have not suffered a loss for a number of periods.

6. Behavior of Uninsured Individuals

6.1 The Role of LOSS on FEEL

A low level of FEEL by an uninsured individual who experiences a loss may reflect regret at not having purchased coverage. Conversely, if the uninsured individual did not suffer damage from a hurricane, the average level of FEEL is likely to be much higher than for those who did suffer a loss, although some persons who chose to be uninsured may still display low levels of FEEL even without a loss. That is, FEEL is likely to be affected by the loss experience but not wholly determined by it. Table 3 shows that the average level of FEEL among the uninsureds who experienced a hurricane loss is much lower than for uninsureds who did not suffer a loss and is highly significant using a Wilcoxon-Mann-Whitney test.[4] The median values of FEEL were 2 and 5 in both periods 2 and 8 for LOSS and NO LOSS respectively.

TABLE 3

Relationship of LOSS to FEEL Score among Uninsured by Prior Period Behavior

PERIOD 2 LOSS

	N	AVE FEEL SCORE LOSS	AVE FEEL SCORE NO LOSS	WILCOXON-MANN-WHITNEY TEST
ALL UNINSURED	207	1.79	4.35	(p < .0001)
ALWAYS UNINSURED	171	1.79	4.31	(p < .0001)
EVER INSURED	36	1.80	4.50	(p < .0001)
WILCOXON-MANN-WHITNEY TEST		(p = .94) (N = 72) z = .07	(p = .44) (N =135) z = .77	

PERIOD 8 LOSS

	N	AVE FEEL SCORE LOSS	AVE FEEL SCORE NO LOSS	WILCOXON-MANN-WHITNEY TEST
ALL UNINSURED	217	2.16	4.30	(p < .0001)
ALWAYS UNINSURED	99	2.76	4.21	(p < .0001)
EVER INSURED	118	1.68	4.37	(p < .0001)
WILCOXON-MANN-WHITNEY TEST		(p < .0001) (N = 73) z = -3.87	(p = .50) (N = 144) z = .68	

[4] The Wilcoxon-Mann-Whitney test is used in place of an independent samples t-test when the dependent variable is not assumed to be a normally distributed interval variable.

Period 8 provides a much more revealing picture of the role that consistency of behavior plays with respect to FEEL since we are able to compare those who were uninsured for the first 7 periods and remained uninsured in period 8 with those who had switched some time during the first 7 periods and also were uninsured in period 8. As detailed in Table 3, those who were consistently uninsured and suffered a loss late in the game (ALWAYS UNINSURED) had a much higher and statistically significant post-loss level of FEEL (2.76) than those who had been inconsistent non-purchasers (EVER INSURED) (1.68). The medians also were different between these two groups of uninsured when individuals suffered a loss: 3 for the ALWAYS UNINSURED and 1 for the EVER INSURED.[5] We attribute this higher value of FEEL by the ALWAYS UNINSURED group as their being more prepared to suffer a loss compared to those who had switched at least once. As expected, individuals who did not suffer a loss had a much higher level of FEEL at the end of period 8 and there was almost no difference in the value of FEEL between the two groups. This implies that insurance status in periods 1 through 7 had no significant impact on how the subject felt if s/he did not suffer a loss in period 8 and was uninsured.

6.2 The Impact of LOSS and FEEL on Switching from Uninsured to Insured

We next turn to the relationship between suffering a loss and switching. Table 4 shows that a slightly larger percentage of all uninsured individuals who suffered a loss in period 2 switched to being insured in period 3 than those who did not suffer a loss (29.2% vs. 22.2%) but the difference is not statistically significant. However, turning to period 8, we see that there is a statistically significant difference in next-period switching behavior between those suffering and not suffering a loss (37.0% vs. 22.2%; p=.02).[6]

It is understandable that if a person is uninsured and suffers a loss, s/he will feel badly about not having insurance, but this does not necessarily mean that one should decide to purchase coverage the next period. If an individual behaves in a way that is consistent with expected utility theory, then he makes a decision not to purchase insurance knowing that he will want to remain uninsured the next period unless there is a decrease in the premium and/or an increase in the risk of a future hurricane. Given that these parameters are constant across all 10 periods, an E(U) maximizer should be consistent over time in his decision on whether or not to purchase insurance.

TABLE 4

Relationship of LOSS to Next Period Switching among Uninsured

	PERIOD 2 LOSS						
	NUMBER			% SWITCHING			
	N	LOSSES	NO LOSSES	TOTAL	AFTER LOSS	AFTER NO LOSS	CHI-SQUARE TEST
PERIOD 2	207	72	135	24.6	29.2	22.2	(p = .27)
PERIOD 8	217	73	144	27.2	37.0	22.2	(p = .02)
			CHI-SQUARE TEST	(p = .55) (1, N = 424) = .36	(p = .32) (1, N = 145) = 1.00	(p = 1.0) (1, N = 279) = .00	

To examine whether consistency over time affects either the relationship of LOSS to FEEL or switching in response to a loss, we also compare those individuals who have always been uninsured prior to the time that a hurricane occurred (periods 2 or 8) with those who may have previously switched insurance status. We want to see if this prior behavior makes a difference as to how they FEEL after a loss and whether or not they switch to being insured in the next period.

[5] The median was 5 for both groups when they did not suffer a loss.

[6] In examining switching behavior between periods 2 and 8 for those who did and did not suffer a loss, we see from Table 4 that there is no statistically significant difference.

Table 5 shows that there is a difference in switching percentages, regardless of loss experience, between those who had purchased insurance in one of the earlier periods and those who were consistently uninsured. Compared to those who were EVER INSURED, a much smaller percentage of those who were ALWAYS UNINSURED switched to being insured in the next period, whether or not they suffered a loss in period 2 or 8.

TABLE 5

Relationship of LOSS to Next-Period Switching among Uninsured by Prior Period Behavior

PERIOD 2 LOSS

	NUMBER			% SWITCHING			
	TOTAL	LOSSES	NO LOSSES	TOTAL	AFTER LOSS	AFTER NO LOSS	CHI-SQUARE TEST
ALWAYS UNINSURED	171	62	109	33	25.8	15.6	(p = .10)
EVER INSURED	36	10	26	18	50.0	50.0	(p = 1.0)
CHI-SQUARE TEST				(p < .001) (1, N = 207) = 15.10	(p = .12) (1, N = 72) = 2.44	(p < .001) (1, N = 135) = 14.38	

PERIOD 8 LOSS

	NUMBER			% SWITCHING			
	TOTAL	LOSSES	NO LOSSES	TOTAL	AFTER LOSS	AFTER NO LOSS	CHI-SQUARE TEST
ALWAYS UNINSURED	99	33	66	7	12.1	4.5	(p = .17)
EVER INSURED	118	40	78	52	57.5	37.2	(p = .035)
CHI-SQUARE TEST				(p < .001) (1, N = 217) = 37.22	(p < .001) (1, N = 73) = 15.95	(p < .001) (1, N = 144) = 22.03	

The difference in switching behavior between the two groups is particularly noticeable and highly statistically significant following a loss in period 8 where only 4 individuals heretofore in the ALWAYS UNINSURED group (12.1%) decided to buy insurance in period 9, while 23 of the 40 individuals (57.5%) of the EVER INSURED group switched their status by purchasing insurance.

We also see higher switching rates among those with a loss (compared to those without a loss) for the ALWAYS UNINSURED (25.8% vs. 15.6 % in period 2, and 12.1 % vs. 4.5% in period 8). The one statistically significant difference in switching rates as a function of loss was among those who had been insured at least once prior to period 8; they switched at a rate of 57.5% after a loss, which is high relative to those with no loss (37.2%). These data provide additional evidence that those who were EVER INSURED were much more likely to switch to being insured after suffering a loss than if they had not suffered a loss, compared to those who were ALWAYS UNINSURED during the first 7 periods.

6.3 Two Stage Model of Switching Behavior: Results

We now explore the two-stage model described earlier that highlights the relative roles that FEEL and LOSS might play in the behavior of the uninsured to change behavior (SWITCH). We have already shown that, among the uninsured, LOSS affects both FEEL and SWITCH. We now explore whether FEEL can explain switching behavior. The model also highlights the potential importance of emotions in influencing behavior of those individuals who are not consistent with the standard expected utility model by purchasing insurance in an earlier period.

We approach this question in two different ways. First, using logistic regression, we ask whether the observed level of FEEL predicts switching, both in isolation and along with the binary measure of LOSS. In effect, we ask whether a loss helps to explain switching after we have controlled for the level of FEEL. Second, we analyze the relationship between FEEL and SWITCH, treating FEEL as an endogenous variable with LOSS used as the instrument. We use two-stage least-squares (2SLS) for this analysis and therefore estimate a linear probability model as the second stage.

Because FEEL is a continuous variable, we present results using logit regressions where SWITCH is the dependent variable and FEEL and LOSS are independent variables. The adjusted odds ratio coefficients reported in Table 6 show the estimated change in the odds ratios on switching for a one-unit change in the right side variable. Hence a coefficient significantly less than 1 indicates that increasing the magnitude of the explanatory variable reduces the likelihood of switching.

Rows 1 and 3 in Table 6 show that high values of FEEL are related to lower odds of switching from uninsured to insured, with the effect significant in period 8. In addition, rows 2 and 4 show that, when FEEL is included in the regression, adding a binary variable for LOSS is not statistically significant. In period 8, even though LOSS significantly predicted switching, it no longer does so when FEEL is included, but higher FEEL still predicts lower odds of switching, and is statistically significant. This implies that, although both FEEL and LOSS taken alone are related to switching, the variable measuring emotion is more strongly predictive. With respect to period 2, the odds ratios are in the expected direction but are not statistically significant.

TABLE 6
Relationship of FEEL and FEEL & LOSS to SWITCH for All Uninsured

Adjusted Odds Ratios and (Significance Levels)

PERIOD 2

	N	FEEL	LOSS	MODEL SIGNIFICANCE
ROW 1	207	0.90 (p = .31)	–	(p = .31)
ROW 2	207	0.96 (p = .84)	1.30 (p = .65)	(p = .54)

PERIOD 8

	N	FEEL	LOSS	MODEL SIGNIFICANCE
ROW 3	217	0.71 (p < .001)	–	(p = .001)
ROW 4	217	0.70 (p = .023)	0.96 (p = .93)	(p = .005)

Table 7 presents the results of the 2SLS linear probability models for the uninsured. As before, the level of FEEL is statistically significant in period 8. The fact that switching is related to a value of FEEL predicted from the relationship of LOSS to FEEL supports the hypothesis that the chain of causation runs from LOSS to a lower level of FEEL to SWITCH.

The finding that uninsured behavior in period 8 provides much stronger evidence for the 2-stage model than uninsured behavior in period 2 is consistent with findings from trust behavior in multi-period experiments conducted by Bottom et al. (2002) and Lount et al. (2008). They find that negative emotional responses (FEEL in our experiment) and reduced cooperation (SWITCH in our experiment) were much more pronounced in a late trust breach (LOSS in our experiment).

TABLE 7

Relationship of LOSS and FEEL to SWITCH for all Uninsured in Loss Periods

TWO-STAGE LEAST-SQUARES LINEAR PROBABILITY REGRESSION

	NUMBER	LOSS (STAGE 1)	FEEL (STAGE 2)	MODEL SIGNIFICANCE
PERIOD 2	207	-2.56 (p < .001)	-0.03 (p = .27)	p = .27
PERIOD 8	217	-2.13 (p < .001)	-0.07 (p = .02)	P = .02

Finally, we look for a possible relationship between FEEL and switching among the subset of uninsureds who did suffer a loss, and then separately for the subset who did not. We see from the adjusted odds ratios in the top half of Table 8 that an uninsured individual with a low level of FEEL who also had a loss in period 8 is more likely to switch to being insured than an uninsured participant with a high level of FEEL who also suffered a loss. In other words, the coefficient of FEEL among uninsured with a loss is less than 1 and significant in relation to the dependent variable (SWITCH). This implies that those who suffered a loss from a hurricane that translated into a low level of FEEL are the individuals most likely to switch. With respect to period 2, the odds ratio is also less than 1 but not statistically significant. The lower half of Table 8 repeats the analysis for those uninsured who did not suffer a loss, and here the level of FEEL is greater than 1 as would be expected but it is not a statistically significant predictor of switching. This implies that an uninsured person who does not suffer a loss will want to remain uninsured, independent of her level of FEEL.

TABLE 8

Relationship of FEEL to SWITCH for All Uninsured

Adjusted Odds Ratios and (Significance Levels)

WITH LOSS

	NUMBER	FEEL	MODEL SIGNIFICANCE
PERIOD 2	72	0.73 (p = .38)	(p = .37)
PERIOD 8	73	0.32 (p < .001)	(p < .0001)

NO LOSS

	NUMBER	FEEL	MODEL SIGNIFICANCE
PERIOD 2	135	1.09 (p = .72)	(p = .71)
PERIOD 8	144	1.22 (p = .43)	(p = .42)

7. Behavior of Insured Subjects

Those who bought insurance should not respond to whether or not there was a loss in a given period when making their decisions on purchasing coverage in the future if they are E(U) maximizers and if the probability of a loss and the consequences remain constant over time (as in our experiment). In many real-world insurance situations with low-probability events, however, people have a tendency to drop coverage if there is no loss after several years. This behavior is consistent with the hypothesis that consumers treat insurance as a short-term investment and feel that they have wasted their premium because they have not received any return in the form of a claims payment (Kunreuther et al. 1978). It is difficult to convince them that insurance should be treated as a protective measure and that they should celebrate not having a loss. In other words, while individuals should recognize that the best return on an insurance policy is no return at all, not all do so.

In our experiment we observe insured people who did and did not suffer losses in period 2 and in period 8. In line with the analysis of the uninsured in the previous section, we expect that insured individuals who suffer a loss and hence collect on their policy have a higher level of FEEL than those who are unscathed. Table 9 indicates that there is a statistically significant relationship between LOSS and FEEL in both periods. However, the difference in FEEL between the loss and no-loss groups in each period is much smaller than the difference in FEEL for the uninsured that do and do not suffer hurricane losses (see Table 3). This is not surprising since the perceived loss experienced by the insured that did not have damage from a hurricane (in the form of a perceived unnecessary premium paid) is much less than the loss to an uninsured individual who suffered property damage from the hurricane.

TABLE 9

Relationship of LOSS to FEEL Score among Insureds by Prior Period Behavior

PERIOD 2 LOSS

	N	LOSS	NO LOSS	WILCOXON-MANN-WHITNEY TEST
ALL INSURED	817	4.40	3.50	(p < .0001)
ALWAYS INSURED	751	4.39	3.60	(p < .0001)
EVER UNINSURED	66	4.43	3.04	(p < .0001)
WILCOXON-MANN-WHITNEY TEST		(p = .35) (N =262) z = -.94	(p = .001) (N = 555) z = -3.26	

PERIOD 8 LOSS

	N	LOSS	NO LOSS	WILCOXON-MANN-WHITNEY TEST
ALL INSURED	807	4.52	3.48	(p < .0001)
ALWAYS INSURED	647	4.50	3.56	(p < .0001)
EVER UNINSURED	160	4.60	3.18	(p < .0001)
WILCOXON-MANN-WHITNEY TEST		(p = .32) (N = 272) z = .99	(p = .003) (N = 535) z = -2.94	

Table 9 also reveals that, among those with NO LOSS, the level of FEEL is significantly lower for those who were EVER UNINSURED than for those who were ALWAYS INSURED up to the time of the loss. This implies that previously uninsured individuals who did not suffer a loss were more likely to feel worse than those who bought insurance in all previous periods about learning that they would not be able to make a claim.

Table 10 examines whether the switching rate for an insured individual without a loss is higher than the switching rate for those with a loss. The first thing to note in Table 10 is that the ALL INSURED switching rate (regardless of loss experience) is only 5% in period 2 and less than 4% in period 8, much lower in both periods than it was for the uninsured (see Table 4). This means that it will be hard to detect differences as a function of whether or not an individual suffered a loss. Table 10 shows that there is no significant difference in switching between these two groups.

When we examine the ALWAYS INSURED subgroup we find even lower switching rates than for the full sample of insured individuals, especially in period 8 where only 7 out of the 647 individuals insured in periods 1 through 8 switched to being uninsured in period 9. As in the full sample, in the ALWAYS INSURED and EVER UNINSURED groups there is no significant effect of LOSS on switching in either period.

TABLE 10

Relationship of LOSS to Next-Period Switching among Insureds by Prior Period Behavior

PERIOD 2 LOSS

	NUMBER			% SWITCHING			
	TOTAL	LOSSES	NO LOSSES	TOTAL	AFTER LOSS	AFTER NO LOSS	CHI-SQUARE TEST
ALL INSURED	817	262	555	42	4.2	5.6	(p = .40)
ALWAYS INSURED	751	241	510	32	2.5	5.1	(p = .10)
EVER UNINSURED	66	21	45	10	23.8	11.1	(p = .18)
			CHI-SQUARE TEST	(p < .001) (1, N = 817) = 14.76	(p < .001) (1, N = 262) = 21.83	(p < .09) (1, N = 555) = 2.84	

PERIOD 8 LOSS

	NUMBER			% SWITCHING			
	TOTAL	LOSSES	NO LOSSES	TOTAL	AFTER LOSS	AFTER NO LOSS	CHI-SQUARE TEST
ALL INSURED	807	272	535	31	4.0	3.7	(p = .83)
ALWAYS INSURED	647	218	429	7	1.2	0.92	(p = .77)
EVER UNINSURED	160	54	106	24	16.7	14.2	(p = .67)
			CHI-SQUARE TEST	(p < .001) (1, N = 807) = 67.27	(p < .001) (1, N = 272) = 27.66	(p < .001) (1, N = 535) = 39.83	

Because Table 10 reveals no statistically significant effect of loss experience on switching, we did not further examine whether changes in FEEL predicts switching for the full sample of insureds.[7] However, we do explore whether FEEL is related to SWITCH for each of the subsamples of insureds split by whether or not they experienced a loss. Table 11 does find that the insureds with no loss and a lower level of FEEL have higher odds of switching, notably in period 2 (statistically significant) and also in period 8. So although those insured persons whose property is not damaged by a hurricane in period 2 or 8 do not consistently drop coverage, those who feel badly about having purchased insurance are likely to cancel their policy. These individuals may have felt that they made a poor decision in purchasing coverage because they wasted their money on a premium. This would imply that they viewed insurance as an investment rather than as a protective mechanism. For those who had a loss, the impact of FEEL was not statistically significant in either period 2 or 8.

[7] The only group approaching statistical significance was the ALWAYS INSURED in period 2. Those who did not experience a loss in periods 1 and 2 were more likely to switch to being uninsured than those did suffer a loss, behavior that is consistent with individuals treating insurance as an investment rather than a form of protection.

TABLE 11

Relationship of FEEL to SWITCHING for All Insureds

Adjusted Odds Ratios and (Significance Levels)

WITH LOSS

	NUMBER	FEEL	MODEL SIGNIFICANCE
PERIOD 2	262	2.23 (p = .21)	(p = .10)
PERIOD 8	272	2.46 (p = .19)	(p = .12)

NO LOSS

	NUMBER	FEEL	MODEL SIGNIFICANCE
PERIOD 2	555	0.69 (p = .04)	(p = .04)
PERIOD 8	535	0.73 (p = .14)	(p = .15)

8. Conclusions

Sixty percent of the 1,346 individuals who participated in our experiment purchased insurance in all 10 periods and nine percent were uninsured for all periods. Since the probability of a loss, the magnitude of the damage from a hurricane, and the insurance premium were identical in all periods, an individual should want to maintain her insurance status over time if her sole focus is the risk of damage from a hurricane and the price of protection. The individuals who purchased insurance in every period behaved in ways that were consistent with the benchmark model of choice: expected utility maximization. Of course, we cannot know whether their decisions were based on comparing the insurance premium with the expected benefits from having coverage or whether participants in the experiment were utilizing other decision rules that do not involve these comparisons. For example, a person could have decided that insurance was an attractive option by comparing the premium with anticipated claims should they suffer a loss without factoring in the probability of a hurricane occurring. The 79 individuals (6 percent of the sample) who were uninsured for all 10 periods and faced either fair or favorable premiums were inconsistent with expected utility theory if they were risk averse.

The 420 individuals (31 percent of sample) who changed their insurance status at least once during the ten periods were impacted by factors normally not incorporated in an E(U) model. By inquiring as to how subjects felt about their insurance decision after they learned whether or not they had suffered a loss, we gained insight into the role that their emotions played in influencing their purchase decision in the next period. A sizeable number of uninsureds decided to purchase insurance after learning that they had suffered a loss and revealing that their FEEL level was very low. In this sense, the study shows that a loss coupled with emotions is likely to play an important role in convincing an uninsured person to buy coverage. This behavior is consistent with findings by Gilovich and Medvec (1995) that indicate that decisions made today that produce great regret in the short term will lead individuals to take steps immediately to reduce the pain of their actions. This may partially explain why the uninsured with low levels of FEEL switched their insurance status in the next period rather than delaying taking action.

On the other hand, those who were insured and didn't suffer a loss had a much higher level of FEEL than uninsured persons with a loss, because they had foregone only a relatively small premium compared with uninsured victims of a hurricane who had to use their own resources to cover the loss. The data indicate that the small decrease in the FEEL level of insured individuals who did not suffer a loss was unlikely to change their decisions to buy insurance again next period.

While our findings about the roles of preferences and emotions in insurance purchasing behavior are reasonably clear, the welfare implications are of this behavior are not obvious for the participants in our sample who were inconsistent in their insurance purchasing behavior. Sometimes they bought coverage and sometimes they were uninsured even though the observable external conditions were the same so they do not show what Bernheim and Rangel (2009) call an "unambiguous choice relation". Their inconsistency raises challenging questions for behavioral welfare economics, especially for the uninsured who switched to being insured, apparently because of a loss and its impact on their emotions.

If one takes the position that individuals should be consistent in their behavior over time given that the parameters influencing the decision have not changed, then one might recommend providing individuals with information as to why they should not be influenced by the outcome of an uncertain event, or even structuring choice settings in ways that deter switching. On the other hand, if one believes that emotions play an important role in a person's well-being, then one should not discourage someone from switching to coverage who is disappointed after experiencing an uninsured loss. How they feel is how they feel, and there is no obvious reason to over-ride someone's choice of what they consider to be best for themselves. An argument could be made that the strong negative feeling generated by having to pay for the loss forces the individual to reflect on the advantages of having insurance and was a positive learning experience. Further research is needed to understand more fully why emotional reactions to an outcome may lead to a change in behavior as our experiment revealed.

The findings from our experiment raise the broader question as to the appropriate role of insurance and public policy in dealing with low-probability high-consequence events. Do individuals utilize simple heuristics in making their insurance decision that are influenced by past experience and are guided by emotional reactions and other attributes, such as reduction of worry and gaining peace of mind in the spirit of intuitive thinking as documented by Kahneman (2011)? When is it appropriate to require individuals to purchase insurance rather than making coverage voluntary? In the spirit of recommendations by Thaler and Sunstein (2008) and others, would the default option of providing insurance unless one opts out serve as an appropriate nudge for individuals to maintain coverage when they are likely to feel regret if they are not insured and suffer a loss? Can one design new insurance products to deal with people's emotional reactions to adverse events, such as home equity insurance, that would protect against losses in the value of homes from causes other than fire and natural disasters as advocated by Shiller (2003)? Additional controlled experiments and field studies are needed to shed light on these questions to be able to provide guidance on the welfare implications of taking steps prior to a disaster to encourage people to undertake protective measures rather than waiting for the catastrophe to occur.

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