Contract design and insurance fraud: an experimental investigation*

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Abstract

Deductibles are commonly used in insurance relationships to help save transaction costs or limit problems of adverse selection and/or moral hazard. In this paper we use an experimental setup to investigate the impact of deductibles on the filing of fraudulent claims. We test how fraud behavior varies for insurance contracts with full coverage, a straight deductible or claim-dependent premiums (bonus-malus contracts). In our experiment, monetary gains from claim build-up are identical for all contracts. We find that deductible contracts lead to claim build-up to a greater extent than full coverage contracts. This finding indicates that deductible contracts are seemingly perceived as unfair. In contrast, bonus-malus contracts that are payoff equivalent to deductible contracts do not increase claim build-up. Our results indicate that bonus-malus contracts may be superior because they lead to the same monetary payoffs as deductible contracts but are seemingly perceived as more fair.

July 2011

JEL Classification: G22, C91, D03

Key words: insurance fraud, experiment, fairness, contract design, deductible, bonus-malus

* Financial support from the German Insurance Science Foundation (Deutscher Verein für Versicherungs-wissenschaft e.V.) is gratefully acknowledged.

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1 Introduction

Practitioners and theorists commonly agree that fraudulent behavior by policyholders is – in addition to classical adverse selection and moral hazard problems – one of the main threats for insurance companies. Important forms of insurance fraud are claim build-up and fictitious claims. Policyholders may take advantage of private information and exaggerate the size of an actual insured loss (claim build-up) or claim losses that never occurred (fictitious claims). Because fraud can be difficult to verify ex-post, estimates of the total amount of fraud are not undisputed (Derrig, 2002). However, Caron and Dionne (1997) estimate that approximately 10% of all claims in the Quebec automobile insurance market can be attributed to some form of fraudulent behavior. These claims would add up to approximately 113.5 million Canadian dollars per year. Dionne et al. (2009) find for a large European auto insurer that approximately 8% of all claims are fraudulent (51 million €).

While the extent of fraud is hard to measure, it is even harder to examine factors that influence fraudulent behavior. However, these factors are important for insurance companies in the fight against insurance fraud. Up to now, most of the theoretical research that examines optimal ways to abate insurance fraud has been based on standard economic theory. Currently, two main models are considered: Costly State Falsification (Crocker and Morgan, 1998) and Costly State Verification (Townsend, 1979; Picard, 1996). In both models, individuals are assumed to be selfish and amoral such that they only evaluate expected monetary gains and sanctions when deciding to defraud (Becker, 1968). In fact, Dionne and Gagné (2002) provide real-world evidence that the potential gains of fraudulent activities may influence behavior. They show that in the Canadian auto insurance industry the probability of theft for contracts with generous two-year replacement coverage is significantly higher near the end of the second year, when the potential gains from fraud are highest.

In line with the standard rational-choice theory of crime (Becker, 1968), the fraud prevention activities of insurance companies currently concentrate on lowering monetary gains from fraud by efficient auditing and claim processing procedures. However, these activities are costly. Dionne et al. (2009), for instance, have analyzed optimal auditing procedures for an auto insurer. Given 500,000 claims (average claim 1,284 €) and an optimal audit probability of 9.23%, together with average costs of an audit of 280 €, the overall costs appear in the order of 12.9 million €. In addition, 33% of all fraudulent claims remain undetected, resulting in total costs of 17 million €. So even if companies adopt optimal fraud fighting strategies, the high costs of fraud remain.

Rather than tackling insurance fraud from a purely rational/monetary perspective, therefore, approaches that account for psychological considerations seem promising. In the behavioral economics literature, a great deal of evidence suggests that while some people only care about monetary payoffs, many others consider issues such as norms or fairness (Ichino and Maggi, 2000; Fehr and Schmidt, 1999). For instance, some people would never consider engaging in illegal behavior, such as insurance or tax fraud, because of norms (Falk and Fischbacher, 1999).[1] For others, their behavior depends on aspects of fairness that relate to the specific decision-making situation.[2]

[1] In fact, some theoretical models, such as Picard (1996) or Boyer (2000), consider two types of policyholders: opportunists, who consider only the costs and benefits of their actions, and honest people, who never commit any insurance fraud.

[2] For instance, Spicer and Becker (1980) provide evidence that people who believe that they are treated unfairly by the tax system are more likely to evade taxes to restore equity. See, e.g., Andreoni et al. (1998) for a review of major theoretical and empirical findings on tax evasion.

Real-world evidence indicates that fairness and norms also matter in insurance markets. As shown by Cummins and Tennyson (1996) and Tennyson (1997), claim frequencies in the US auto insurance industry are significantly related to stated attitudes towards dishonest behavior in general (norms). As insurance companies can hardly influence norms, insurance-specific factors, such as contractual arrangements, could play an important role in fighting insurance fraud.

One important contractual arrangement in insurance markets is deductibles. Deductibles specify a fixed amount of money that a policyholder herself must bear in the case of a loss. It can be shown that such a contract form is optimal from a risk allocation perspective in situations with symmetric information and transaction costs (Arrow, 1971b; Raviv, 1979). More importantly, deductible contracts have been shown to be optimal in situations with asymmetric information, such as adverse selection and moral hazard (Rothschild and Stiglitz, 1976; Shavell, 1979). Aside from the potential benefits, however, deductibles may lead to psychological side effects. Tennyson (2002) and Miyazaki (2009) find that the deductible size negatively influences perceptions of the ethicality and fairness of the insurance arrangement and, therefore, increases the acceptability of claim build-up. Dionne and Gagné (2001) estimate that in the Canadian auto insurance industry a deductible increase from \$250 to \$500 increases the average claim by 14.6%–31.8% (from \$628 to \$812). Their results indicate that higher deductibles increase fraudulent activities and, in particular, claim build-up. To summarize, based on questionnaires and estimated claiming behavior, there is some evidence to suggest that deductibles may be perceived as unfair and may trigger claim build-up.

Another common contractual arrangement (e.g., in automobile insurance) is a bonus-malus system in which the premium paid by a policyholder depends on her individual claim history. As shown by Holtan (2001), the effective indemnity function of a full-coverage bonus-malus contract is equivalent to an indemnity function of an insurance contract with a straight deductible. Hence, a bonus-malus contract entails an implicit deductible because policyholders face a future premium increase after the filing of a claim. This premium increase reduces the actual indemnity and has the same effect as a deductible. Consequently, bonus-malus contracts offer the same advantages as deductible contracts with respect to transaction costs, adverse selection and moral hazard problems (Cooper and Hayes, 1987; Lemaire, 1985; Moreno et al., 2006). To the best of our knowledge, however, there is no evidence that indicates whether these contracts are perceived as fair or not.

The aim of our paper is twofold. First, we examine the negative effects of deductible contracts in a controlled experimental environment. Second, given these negative effects, we analyze whether bonus-malus contracts that are equivalent to deductible contracts from a monetary perspective lead to the same retaliatory behavior with respect to claim build-up.

This paper reports the results of a newly developed insurance experiment that is closely related to public good (bad) experiments.[3] To the best of our knowledge, our experiment is the first to examine insurance fraud in a laboratory environment. We employ a mutual insurance framework in which participants collectively bear risk in groups. Each group member pays an insurance premium to a group account and can then claim indemnity payments from the latter. As indemnities are associated with transaction costs and both deficits and surpluses are shared equally between group members, our setup resembles a public good (bad) situation.

[3] It has been shown that social and/or internalized norms can enforce cooperation in public good situations (Arrow, 1971a; Andreoni, 1990). In addition, fairness issues play a prominent role because participants do not want to be exploited by others (Falk and Fischbacher, 1999; Fehr and Gächter, 2000).

We report results from three different treatments. In the Base Treatment, available indemnities correspond to possible losses (full coverage). In the Deductible Treatment, indemnities are kept constant in comparison to the Base Treatment, but all losses are increased by a fixed amount. In the Bonus-Malus Treatment, there is full coverage, and premiums depend on prior claiming. If a claim is made, premiums increase for all subsequent periods; otherwise, they decrease.

We find that deductible contracts significantly increase claim build-up compared to full-coverage contracts. In the case of a loss, participants seem to find it acceptable to recoup deductibles through claim inflation. In addition to this intuitive result, there is also a spillover effect because deductible contracts also increase the filing of fictitious claims. Taken together, these results confirm that deductibles are perceived as unfair and may trigger fraudulent behavior. However, full coverage bonus-malus contracts – which entail an implicit deductible – are seemingly not perceived to be as unfair as standard deductible contracts. The probability of claim build-up is not significantly different compared with the Base Treatment.

When addressing problems of adverse selection and moral hazard, results from one-period models suggest the use of deductibles to give policyholders optimal incentives. However, these contracts may lead to serious side effects because they can significantly increase claim build-up. Our findings indicate that, due to behavioral aspects, bonus-malus contracts are superior to deductible contracts in a multi-period setting. Bonus-malus contracts can be designed to give the same incentives as deductibles without causing the same negative side effects. Hence, insurance companies can use bonus-malus contracts as an effective means to address adverse selection and moral hazard problems. In addition, as theoretical models suggest, bonus-malus contracts reduce the filing of fictitious claims in situations where auditing of claims is either too costly or impossible.

The remainder of this article is organized as follows: In Section 2, we consider the Base and Deductible Treatment. In Section 3, we analyze the Bonus-Malus Treatment. Section 4 concludes.

2 Base and Deductible Treatment

2.1 Experimental Design

In the experiment, participants are randomly and anonymously allocated into fixed groups of four.[4] All payoffs during the experiment are calculated in the experimental currency "points." After the experiment, points are converted into Euros at the rate of 1 point to 10 cents. Each group plays five periods ($t = 1,...,T = 5$) of the following insurance game: Participants get a period endowment (*W*) and are informed that they have to insure against possible losses x_j with $j = 0, L, H$ and $x_0 = 0 < x_L < x_H$. Losses in each period are identical and independently distributed, with $p_0 = 0.7$, $p_L = 0.2$ and $p_H = 0.1$. Insurance is mandatory for each participant. Thus, in every period, each group member must pay an insurance premium (*P*) to a group-specific insurance account that finances all indemnities (*I*) paid to the group members. Hence, in our experiment, we apply a mutual insurance setup.[5] All payments from and to the group members are settled via the group-specific insurance account. After the last

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[4] Small group sizes are very common in experiments in general and in public good experiments in particular. In insurance relationships there is usually a large community of policyholders. The small group size in our experiment is therefore a limitation of our study. However, externalities caused by public goods also affect large groups of people. However, due to limited lab size and resources, they are analyzed experimentally in small groups. Still, we are aware of the limitation of this research approach. Hence, future research needs to evaluate contractual fairness aspects in the field.

[5] The mutual form is very common for insurance companies. Here policyholders are, at the same time, the residual claimant of the insurance company. Mutuals are very common in life insurance. For example, in 1993 mutuals generated as much US-premium income as stock insurance companies (Mayers and Smith, 2000). In the US property-liability industry the number of mutual and stock insurers were almost equal in the period of 1981–1990. However, stock firms on average are larger than mutuals in terms of costs, input and output quantities, and invested assets (Cummins et al., 1999).

period, the insurance account is automatically and equally balanced by all group members. If the insurance account has a negative balance, all group members pay the same additional contribution. A positive balance is shared equally by all group members. The instructions (and therefore the whole experiment) were framed using insurance-specific wording.[6] All information was common knowledge. The instructions can be found in the Appendix.

With respect to indemnity claiming, we apply the strategy method.[7] Before knowing the actual loss realization in period *t*, each participant is asked which indemnity she is going to claim for each possible loss. This approach has two main advantages. First, it provides richer information about subjects' actual and potential behavior. Second, it allows for sufficient observation of a potential claim build-up that could otherwise only be observed in a case of a low loss, which occurs with a probability of 20%. In both treatments, for each potential loss x_j, participant i can only claim one of three possible indemnities, $I_{ij} \in \{0,10,15\}$. Hence, in each period, participants choose a claiming strategy $s_i^t = (I_{i0}, I_{iL}, I_{iH})$. It is common knowledge that strategies directly determine individuals' period payoffs.

In order to achieve clear-cut results with respect to the subjects' psychological costs, we consider neither monitoring activities nor fines. Indemnities are always paid as claimed, but due to transaction costs of 40% ($c = 0.4$), the insurance account is charged with an

[6] Abbink and Hennig-Schmidt (2006) find that a context-free experiment framing does not have a significant impact on a bribery game. In contrast, Schoemaker and Kunreuther (1979) find a significant impact of insurance framing on participants' behavior in their survey. We also conducted a context-free treatment and did not find any structural differences with respect to the insurance-specific wording in our Base Treatment. The respective results are available from the authors upon request.

[7] This approach goes back to Selten (1967). Participants must state contingent responses for each information set, but only one response will result in an effective action and determine the responder's and other players' payoffs. For example, Hoffmann et al. (1998), Brandts and Charness (2000), and Oxoby and MacLeish (2004) do not find any differences in behavior when using the strategy method in simple sequential games. However, e.g., Blount and Bazermann (1996), Güth et al. (2001) and Brosig et al. (2003) found significant differences between the strategy method and unconditional decision making.

amount of $1.4 \cdot I$ for each claim.[8] Therefore, the insurance account provides coverage against risk but is a costly means of reallocating the premium and the claim payments of the four group members.

All periods are identical and consist of four steps:

Step 1: Subjects confirm the payment of the insurance premium to the insurance account.

Step 2: Each player has to decide upon her claiming strategy s_i^t.

Step 3: Players are informed about their actual loss x_{ij}^t in period *t*.

Step 4: Actual indemnities I_{ij}^t are paid according to s_i^t.

After the last period, the insurance account is automatically balanced by the group members.

In the Base Treatment, the period endowment is $W = 25$ and loss sizes are $x_L = 10$ and $x_H = 15$. As participants are able to claim $I_j = \{0,10,15\}$ from the insurance account, this setup resembles a situation with a full-coverage insurance contract. The insurance premium $P = 5$ corresponds to expected losses, including transaction costs. It does not cover any fraudulent claims.

In the Deductible Treatment (Deduct), both losses, x_L and x_H, are increased by 5 points to $x_L = 15$ and $x_H = 20$. Participants are informed that there is a deductible of 5 points, and they are thus only able to claim $I_j = \{0,10,15\}$. Therefore, a player who suffers a

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[8] Transaction costs in real-world insurance markets are usually measured by the expense ratio (total premiums written divided by total expenses). From 1990 to 2000 the mean expense ratio in the U.S. property-liability insurance was 0.515 (Leverty and Grace, 2010). As reported by Leng and Meier (2006), in 1995 average expense ratios in the Swiss, German and Japanese property-liability market were 0.34, 0.27 and 0.46, respectively.

low loss of 15 points will be fully reimbursed if she reports a high loss and thus receives a high indemnity of 15 points. Compared to the Base Treatment, the premium is unchanged, but the endowment is increased to $W = 27$ to cover the higher expected loss of $0.3 \cdot 1.4 \cdot 5 = 2.1$. That is, when a loss occurs (30% of the time), this loss is 5 points higher than in the Base Treatment, and transaction costs of 40% have to be considered.

2.2 Monetary gains from fraud

The experiment is designed to test differences in the psychological costs of fraud for different contractual arrangements. In this respect, one important feature of the different treatments is that monetary incentives for fraud are identical. In the following section we outline a very simple model that captures the basic incentives to defraud. Because participants are paid after the last period, it is reasonable to assume that individuals do not discount their expected period utility $E[u_i^t]$ and maximize $U_i = \sum_t E[u_i^t]$. As the decision framework is constant over time, a subject can consider each period separately and hence, maximize her expected utility in each period *t*.

$$E[u_i^t] = \sum_j p_j u_i \left(W - P - x_j + I_{ij} + 1/4\left[4P - (1+c)(I_{ij} + 3I_{-i})\right]\right) \tag{1}$$

where I_{-i} denotes the expected indemnity payments claimed by all other group members except for individual *i*. The individual thus receives her endowment W, pays the premium P, may incur a loss x_j with probability p_j and receives the indemnity I_{ij}.

In addition, the effect on the insurance account has to be considered. After the last period, the individual will receive one quarter of the balance of the insurance account after all the premium payments are collected and the indemnities as well as the transaction costs are paid. As all four group members pay the flat premium to the insurance account and receive one quarter of the account's balance, the insurance premium cancels out. Rearranging (1) and considering the transaction cost parameter $c = 0.4$ gives

$$E\left[u_i^t\right] = \sum_j p_j u_i \left(W - x_j - 1.05 I_{-i} + 0.65 I_{ij}\right). \quad (2)$$

The main feature of the expected utility function is that the monetary net gain of an indemnity payment is $0.65 I_{ij}$. Consequently, in the case of no loss the resulting net fraud gain of claiming $I = 15$ ($I = 10$) instead of $I = x_0 = 0$ is $0.65 \cdot 15 = 9.75$ (6.5). In the case of a low loss, the net gain of claiming $I = 15$ instead of $I = x_L - D = 10$ is $0.65 \cdot 5 = 3.25$, with $D = 0$ in the Base and $D = 5$ in the Deduct Treatment. Thus, the pure monetary incentives to either claim a fictitious loss or to engage in claim build-up are identical in both treatments and are in each treatment higher for fictitious claims than for claim build-up.

2.3 Psychological costs from fraud

In the previous section we outlined the basic reasoning for selfish participants. They only consider monetary gains from fraudulent behavior. However, experimental evidence in the field of economics indicates that many participants also consider non-monetary motivations, such as fairness or the well-being of others, when making decisions. With respect to insurance, Dionne and Gagné (2001) show that simple deductible contracts create additional incentives for filing fraudulent claims. In addition, a survey by Miyazaki (2009) reveals that the deductible amount influences perceptions of ethicality and fairness regarding insurance claim build-up. A possible reason for this finding is that policyholders want to be completely reimbursed for all losses in an insurance relationship.

One way of capturing these moral sentiments is to consider psychological costs of committing fraud. Such costs may depend on a number of institutional factors, such as the specific contractual form. Given the empirical evidence, it is reasonable to assume that the psychological costs of engaging in claim build-up are generally lower in the Deduct Treatment compared to the Base Treatment. In addition, there might be a spillover effect to the claiming of fictitious losses. Even though participants do not actually have to bear a deductible, they may have lower psychological costs of filing fictitious claims if they consider themselves to be in an unfair relationship with the insurer. Given that participants have to bear a deductible in the case of a low loss but not in the case of no loss, it seems quite plausible that the psychological costs for claim build-up are significantly lower than those for fictitious claims. However, the latter difference in psychological costs between fraud types cannot be expected in the Base Treatment. Here, subjects are fully reimbursed for all possible losses.

2.4 Predictions

In this section we combine our reasoning concerning the monetary gains and psychological costs of committing insurance fraud.

First of all, we want to compare fraud incentives in the Base and Deduct Treatment. Obviously, monetary incentives both for claim build-up and fictitious claims are identical in both treatments. Due to fairness effects, the psychological costs for claim build-up are lower in the Deduct Treatment. When comparing the psychological costs of fictitious claims, we can assume that the latter are not higher in the Deduct Treatment but may be lower due to a spillover effect.

Prediction 1: *The probability of claim build-up is significantly higher in the Deduct Treatment than in the Base Treatment.*

Prediction 2: *The probability of fictitious claims is as high as or higher in the Deduct Treatment than in the Base Treatment.*

When comparing the different fraud types within a treatment, we get different results for the treatments considered. Generally, monetary incentives are greater for fictitious losses than for build-up. In the Deduct Treatment, psychological costs are likely to be lower for claim build-up. Given the two opposite effects, then, the overall effect is indeterminate. In contrast, in the Base Treatment we have no reason to assume different psychological costs. Therefore, monetary incentives seem to play a dominant role.

Prediction 3: *In the Base treatment, the probability of fictitious claims is higher than that of claim build-up.*

2.5 Control variables

In a questionnaire after the experiment, the participants were asked several questions concerning their gender, general attitude toward risk, insurance experience (measured by the number of actual insurance contracts that they have), and their majors. These variables are controlled for in our empirical analysis. Prior studies offer some evidence on the impact of these variables on fraudulent behavior.

First of all, in economic experiments, women often behave significantly differently than men (Croson and Gneezy, 2009). Tennyson (2002) reports that women are less likely to accept fraudulent behavior. More specifically, Dean (2004) finds that women find claim build-up less ethical. Both studies indicate that women should file fewer fictitious claims and are less likely to engage in claim build-up. Additionally, Tennyson (2002) also finds that questionnaire respondents with more insurance experience (more policies and more claims) are less accepting of insurance fraud. As we only asked about the number of insurance policies held by each participant, we would expect that subjects with a higher number of contracts commit less fraud.

In line with Dohmen et al. (2011), we asked participants about their general willingness to take risks. The authors have demonstrated that this method is a good predictor of risky behavior and respondents' attitudes toward risk. Croson and Gneezy (2009) report that women are generally less willing to take risks. In addition, findings from Gosh and Crain (1995) indicate that attitudes toward risk and ethical standards are correlated such that less risk-averse people have lower ethical standards. Consequently, fraud probabilities may increase with the willingness to take risk.

Finally, students with a business or economics major have been shown to behave less pro-socially (Frey and Meier, 2004) and more corruptly in experimental settings (Frank and Schulze, 2000) than students with other majors. Consequently, we expect that economics and business students are more likely to commit insurance fraud.

2.6 Participants

All computerized experiments were conducted between March and July 2009 at the MELESSA laboratory of the Ludwig-Maximilians-University (LMU) in Munich, Germany. Recruitment was done using the ORSEE system (Greiner, 2004), and we employed the experimental software z-tree (Fischbacher, 2007). Each treatment had 72 participants (three sessions with 24 participants). A session took approximately 50–60 minutes. Subjects were predominantly students from LMU with a great variety of majors. The percentage of students with a business or economics major was 16%. All participants received a fixed show-up fee of 4 Euros. Average earnings were 8.85 € in the Base and 9.33 € in the Deduct Treatment with standard deviations of 2.13 € and 2.52 €, respectively.

2.7 Results

First, we present some general results of the experiment. Generally, we observe three different kinds of behavior. Some participants never defraud (18% Base Treatment, 14% Deduct Treatment), some defraud only sometimes (61%, 50%) and finally some always defraud (21%, 36%).

Figure 1 shows the probabilities of claim build-up per period and treatment.

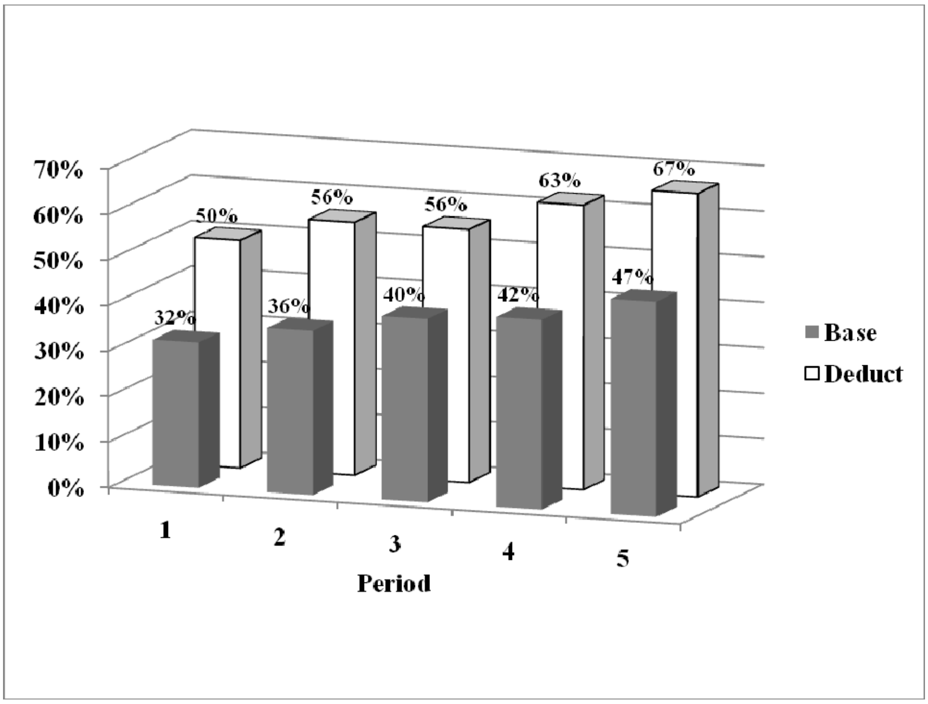

Figure 1: Claim build-up per period and treatment

Visual inspection shows that subjects commit less fraud in the Base Treatment. In order to assess the significance of these differences, we conducted a pooled random effects logit regression for panel data. Our regression results (Table A1, column 1) show that treatment differences are significant ($p < 0.042$).

Result 1: *Prediction 1 is confirmed.*

Figure 2 shows the probabilities of fictitious claims per period and treatment.

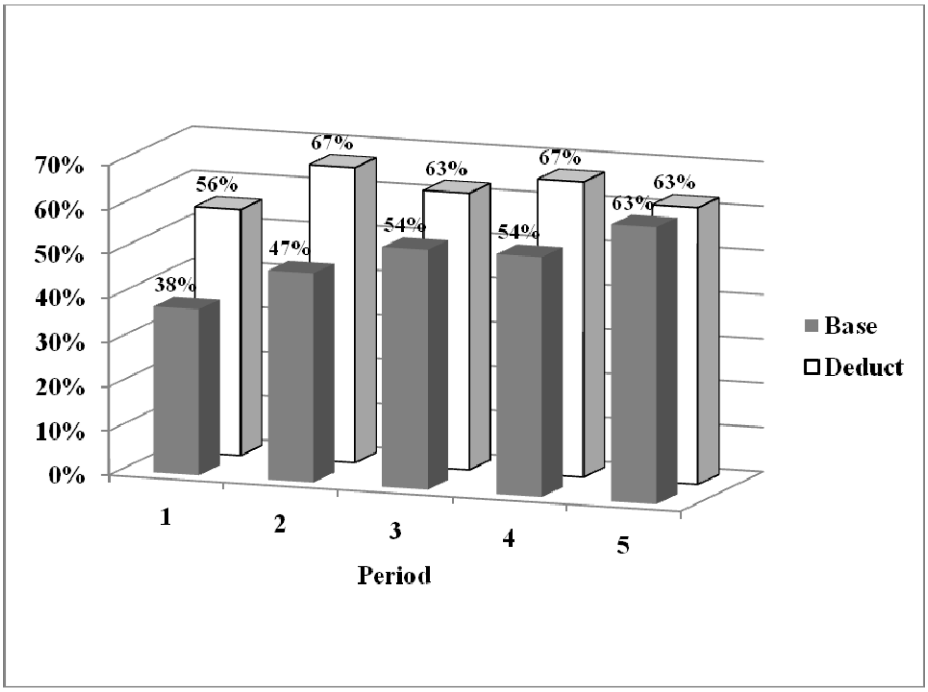

Figure 2: Fictitious claims per period and treatment

As expected, our results for the filing of fictitious claims are weaker. Figure 2 reveals that fraud probabilities in the Base Treatment are weakly lower than in the Deduct Treatment. As hypothesized, we find a small spillover effect from claims build-up to fictitious claims for early periods. The treatment dummy is significant for $t \leq 4$ (p < 0.074).

Result 2: *Prediction 2 is confirmed.*

When comparing behavior within the Base Treatment, we expected to find a higher probability of fictitious claims than of claim build-up. Comparing the average fraud probabilities for all periods of 51% (fictitious claims) and 39% (build-up) provides some evidence for a significant difference between the two. A Pearson's chi-square test shows that the difference is statistically significant, $\chi^2 = 9.888$ ($p = 0.002$, two-sided).

Result 3: *Prediction 3 is confirmed.*

Finally, visual inspection of Figures 1 and 2 reveals that both fraud probabilities are generally increasing over time. Even though participants are given no feedback, they tend to commit more fraud in later periods. This tendency is a common finding in experiments. For example, Fischbacher and Heusi (2008) find that participants who took part in their experiment a second time lied more often than they did the first time. More generally, Sonnemans et al. (1998) show in their public bad experiment that cooperative behavior declines over time.

With respect to the control variables we do not get clear-cut results (Tables A3 and A4, columns 1 and 2). No single control variable is significant across the treatments. However, wherever we find a significant effect, it does occur in the predicted direction. The willingness to take risk positively affects the probability of build-up in the Base Treatment and the probability of fictitious claims in the Deduct Treatment. Students with a business or economics major tend to engage more in claim build-up in the Deduct Treatment. Finally, the number of insurance contracts as a proxy for the familiarity with insurance products negatively affects the probability of fictitious claims in the Deduct Treatment.

2.8 Discussion

Deductibles are common in insurance contracts because they help to save transaction costs for small claims and can alleviate adverse selection and limit moral hazard. In our experiment, we abstract from the potential benefits and focus solely on the potential costs of deductibles. Our results confirm the preliminary findings in the literature that deductibles can be perceived as unfair and trigger retaliation by loss inflation (claim build-up). Furthermore, our experimental results indicate that there might be a spillover effect such that the perceived unfairness of deductibles may also result in additional filings of fictitious claims.

Given these findings, the question becomes whether other contractual arrangements can combine the advantage of deductibles while avoiding the perception of unfairness. Another common contract form in insurance relationships is the bonus-malus contract in which premiums depend on the claims history of the policyholder. As shown by Holtan (2001), the effective indemnity function of a full-coverage bonus-malus contract is equivalent to an indemnity function of an insurance contract with a straight deductible. Hence, a bonus-malus contract entails an implicit deductible because policyholders face a future premium increase after filing a claim. This premium increase reduces the actual indemnity and has the same effect as a deductible. Consequently, the potential advantage of bonus-malus contracts is that they have the same positive effect as deductible contracts with respect to transaction costs, adverse selection and moral hazard problems. In addition, Moreno et al. (2006) show that bonus-malus contracts may provide significant incentives against insurance fraud in a multi-period model. Therefore, it is interesting to examine whether these contracts with claim-dependent premiums are also perceived as unfair.

3 Bonus-Malus Treatment

3.1 Predictions

In the BoMa Treatment, losses, the endowment, and indemnities are the same as in the Base Treatment $(x_L = 10,\ x_H = 15,\ W = 25,\ I_{ij} = \{0,10,15\})$. But the insurance premium is conditioned upon past claims. If participants received a positive payment $I_i^t > 0$, their subsequent premium P_i^{t+1} is increased by 2 points; otherwise, the subsequent premium decreases by 1 point. The initial premium is $P_i^1 = 5$, and the premium in period *t+1* is

$$P_i^{t+1} = \begin{cases} P_i^t - 1 & if \quad I_i^t = 0 \\ P_i^t + 2 & otherwise \end{cases}. \tag{3}$$

In the BoMa Treatment, optimal strategies can only be derived via backwards induction. When deciding whether or not to claim an indemnity, individuals must now additionally consider the impact on future premium adjustments. Thus, the individual's utility in period *t*, including the future impact of current actions, is given by

$$E\left[u_i^t\right] = \sum_j p_j u_i \left(W - x_j^t - P_i^t - \Delta P_i^t + I_{ij}^t + 1/4\left[P_i^t + \Delta P_i^t + 3\left(P_{-i}^t + \Delta P_{-i}^t\right) - 1.4\left(I_{ij}^t + 3I_{-i}^t\right)\right]\right) \tag{4}$$

where ΔP_i^t accounts for the sum of future premium adjustments, with

$$\Delta P_i^t = \begin{cases} -(T-t) & if \quad I_{ij}^t = 0 \\ 2(T-t) & otherwise \end{cases}.$$

Rearranging (4) gives

$$E\left[u_i^t\right] = \sum_j p_j u_i \left(W - x_j^t - 3/4\left(P_i^t - P_{-i}^t\right) - 3/4\left(\Delta P_i^t - \Delta P_{-i}^t\right) + 0.65 I_{ij}^t - 1.05 I_{-i}^t\right). \tag{5}$$

Here, premiums do not cancel out. However, premium payments ($P_i^t, P_{-i}^t, \Delta P_{-i}^t$) and indemnities claimed by other group members (I_{-i}^t) are independent of the individual's claiming strategy in period *t*. As there are no future premium adjustments in period $t = 5$, clearly $\Delta P_i^5 = 0$ holds. Consequently, optimal behavior in $t = 5$ is the same as in the Base and Deduct Treatments. For all other periods, an individual has to trade off current indemnity payments and future premium adjustments.

The benefit – including the effect on the insurance account – of an indemnity payment in each period is still $0.65I_{ij}^{t}$. If a positive claim is made, the premium in each future period will be increased by 2 points. Otherwise, the premium in each future period will be decreased by 1 point. Given our reasoning above, the objective function for individual *i* in period *t* simplifies to

$$\max_{I_{ij}^{t}} \sum_{j} \left(0.65I_{ij}^{t} - 0.75\Delta P_{i}^{t}\right). \tag{6}$$

The following tables summarize the monetary payoffs from claiming the different indemnities $\{I_0, I_L, I_H\}$ and the resulting net gains from fraud (claiming I_H instead of the actual loss).[9]

Period	**I_0**	**I_L**	**I_H**	**I_L - I_H**
5	0	6.5	9.75	3.25
4	0.75	5	8.25	3.25
3	1.5	3.5	6.75	3.25
2	2.25	2	5.25	3.25
1	3	0.5	3.75	3.25

Table 1: Payoffs and net gains from build-up

Period	**I_0**	**I_H**	**I_0 - I_H**
5	0	9.75	9.75
4	0.75	8.25	7.5
3	1.5	6.75	5.25
2	2.25	5.25	3
1	3	3.75	0.75

Table 2: Payoffs and net gains from fictitious claims

As the perceived unfairness of deductible contracts is most pronounced for claim build-up, our main aim is to analyze the perceived fairness of bonus-malus contracts in the case of a low loss. Consequently, we designed the BoMa Treatment in order to implement

[9] Again, for the no loss situation, claiming I_H strictly dominates I_L.

identical monetary gains from claim build-up as in the Base and the Deduct Treatment. An individual without any psychological costs will always engage in claim build-up by claiming I_H in the situation of a low loss.[10] With respect to the filing of fictitious losses, however, monetary gains from fraud are strictly increasing over time due to premium increases. But in t=5, monetary fraud incentives are again identical across all treatments. Hence, in the no loss situation we will focus our analysis on the last period.

As monetary incentives are identical in the cases considered (build-up $t = 1 - 5$, fictitious claims $t = 5$), differences in behavior should be caused by differences in psychological costs. To the best of our knowledge, no evidence exists that describes the perceived fairness of bonus-malus contracts. On the one hand, one could assume that, due to the implicit deductible of bonus-malus contracts, they are perceived as equally unfair. On the other hand, in the case of a loss, participants are fully reimbursed in the first place. Only subsequently do premiums increase. These procedural arrangements, which imply the same monetary consequences as in the case of deductibles, could be perceived differently. Thus, bonus-malus contracts may be considered as less unfair, and this difference in perceived fairness should be predominant in the low loss situation. However, we maintain the conservative assumption and do not expect any differences with respect to the Deduct Treatment.

Prediction 4: *There are no significant differences between the BoMa and the Deduct Treatment for claim build-up.*

[10] In the first two periods participants with high psychological costs of fraud may prefer claiming I_0 instead of I_L. Therefore, underreporting may be relevant for the first two periods. Such a so-called “bonus hunger-strategy” in bonus-malus systems is well known in insurance markets (Nini, 2009). Here, individuals do not report (low) losses to save on future premium adjustments and get a premium bonus. But with respect to fraudulent behavior there should not be any differences between the Deductible and the BoMa Treatment, if both contractual arrangements are perceived as equally unfair.

In the Deduct Treatment we only found a small spillover effect from claim build-up to fictitious claims for early periods $t \leq 4$. Thus, there was no significant difference between the Deduct and the Base Treatment in $t = 5$. Consequently, we also do not expect any difference between the BoMa and the Deduct Treatment in the last period.

Prediction 5: *The probability for fictitious claims is not significantly different in the BoMa and the Deduct Treatment.*

3.2 Results

The BoMa Treatment was also conducted with 72 participants. Average earnings were 9.50 € with a standard deviation of 2.71 €. Again, we observe three different kinds of behavior. Some participants never defraud (14%), some defraud only sometimes (69%) and, finally, some always defraud (7%).

Figures 3 and 4 depict the probabilities of claim build-up and fictitious losses per period and treatment.

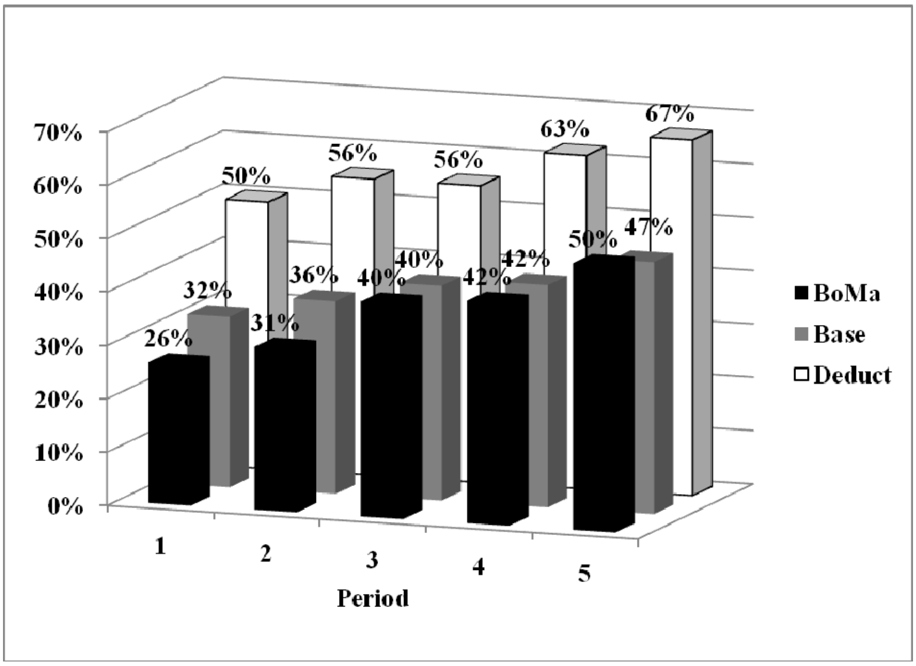

Figure 3: Claim build-up per period and treatment

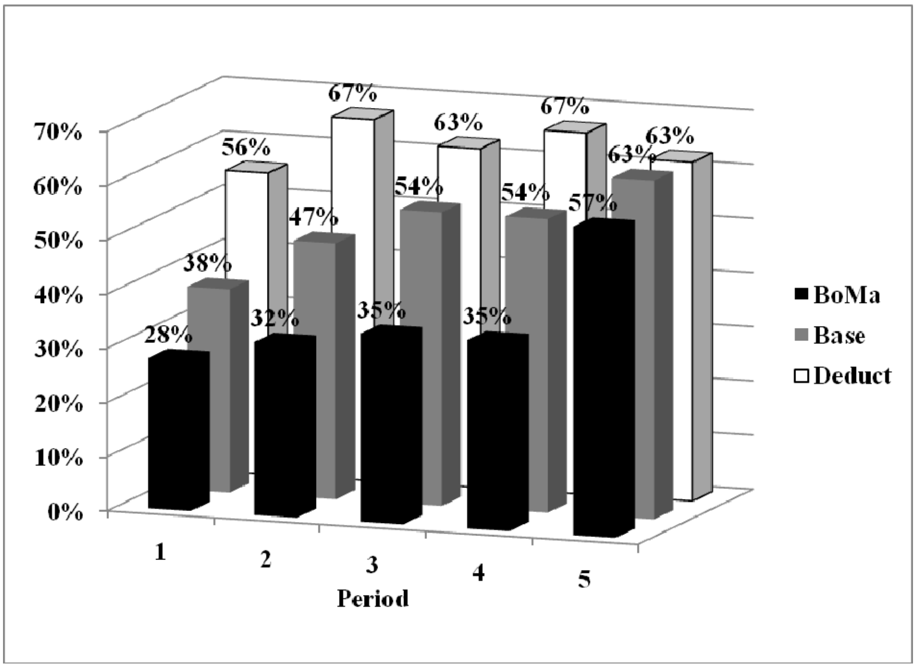

Figure 4: Fictitious claims per period and treatment

The probability for build-up is obviously lower in the BoMa Treatment than in the Deduct Treatment (Figure 3). A pooled random effects logit regression confirms this finding (Table A2, column 1). The treatment dummy is highly significant ($p < 0.013$).

Result 4: *Prediction 4 is not confirmed.*

Figure 4 reveals that there are significantly fewer fictitious claims in the first four periods of the BoMa Treatment compared both to the Base and the Deduct Treatment. The respective treatment dummies are both highly significant ($p < 0.014$ Base Treatment and $p < 0.000$ Deduct Treatment).[11] This result is not surprising because the monetary fraud gains are much lower in the BoMa Treatment compared to the other two treatments (see Table 2). More importantly, Figure 4 also shows that the probability of fictitious claims in $t = 5$ is smaller compared to the Base and the Deduct Treatment (57% to 63% respectively). But the difference is not significant, as a pooled logit regression shows (Table A2, column 2, $p < 0.667$).

Result 5: *Prediction 5 is confirmed.*

With respect to the control variables (Tables A3 and A4, columns 3) we find for the BoMa Treatment that students with a business or economics major tend to engage significantly more in claim build-up.

3.3 Discussion

In insurance markets, deductible as well as bonus-malus contracts are commonly used. Both contract types lead to a cost sharing between the policyholder and the insurer. Therefore, small losses are not reported (saving on transaction costs), risk types can be screened (adverse selection) and incentives for prevention can be implemented (moral hazard). To the best of our knowledge, we are the first to analyze the perceived fairness of bonus-malus contracts.

[11] The regressions are available from the authors upon request.

Our experiment indicates that deductible and bonus-malus contracts are perceived differently. Although the monetary fraud incentives are exactly the same in each, the Deduct Treatment features much more claim build-up. Apparently, the implicit deductible of a bonus-malus contract does not trigger any retaliatory behavior. The fact that we do not find any significant differences between the Base and the BoMa Treatment (treatment dummy $p < 0.704$) further supports this finding.[12]

An interesting question resulting from our findings is how these results can be incorporated into existing behavioral theories. One possible explanation can be derived from mental accounting (Thaler, 1999). Policyholders may have different accounts for indemnities and losses on the one hand and (future) premium payments on the other. Deductibles only affect the loss-indemnity-account, whereas bonus-malus contracts only affect the premium-account. An important difference with respect to the two accounts may arise from frequency of payments (Kahneman and Tversky, 1984). Money given up on regular basis, such as insurance premiums, is not perceived as a loss and changes in premiums do not seem to matter that much. In contrast, bearing a part of a loss in an infrequent event leads to a significant deficit in the loss-indemnity-account. The latter may subsequently reduce the psychological cost of committing fraud.

4 Conclusions

The goal of our experimental study was to evaluate the impact of contractual arrangements and the resulting psychological costs on insurance fraud. Our experiment indicates that the design of insurance contracts may affect claiming behavior considerably. A first important

[12] The regressions are available from the authors upon request.

result that confirms the preliminary findings is that deductible insurance contracts are perceived as unfair. Second, our results indicate that bonus-malus contracts with a variable claim-dependent premium seem not to be perceived as unfair. The fraud-reducing effect of bonus-malus contracts with full coverage is surprising from a theoretical point of view because these contracts are payoff-equivalent to deductible contracts. Our analysis implies that bonus-malus contracts are a good means of reducing the extent of claim build-up compared to deductible contracts. A crucial feature of both contracts is that policyholders bear parts of their loss, but in different ways. As real-world insurance arrangements predominantly entail some kind of cost sharing, our findings are highly relevant to the insurance industry. Based on our results, it seems to be preferable – whenever possible – to implement cost sharing by future premium adjustments rather than deductibles.

Clearly, our results have to be viewed with caution. In our experiment, buying insurance coverage was mandatory, and participants could not choose between different contracts. Finally, the community of policyholders was (with a group size of four participants) extremely small compared to real-world situations. It is up to future research to determine whether or not these limitations significantly affect the findings. In addition, it seems promising to further examine the specific behavioral differences between deductible and bonus-malus contracts.

Acknowledgements

We thank Ole von Häfen and Achim Wambach for their very valuable comments.

References

Abbink, K., Hennig-Schmidt, H., 2006. Neutral versus loaded instructions in a bribery game. Experimental Economics 9, 103-121.

Andreoni, J., 1990. Impure altruism and donations to public goods: a theory of warm-glow giving. Economic Journal 100, 464-477.

Andreoni, J., Erard, B., Feinstein, J., 1998 Tax Compliance. Journal of Economic Literature 36, 818-860.

Arrow, K.J., 1971a. Political and economic evaluation of social effects and externalities. In: Intrilligator, M. (Ed.), Frontiers of Quantitative Economics, Amsterdam.

Arrow, K.J., 1971b. Essays in the Theory of Risk Bearing, Chicago.

Becker, G.S.S., 1968. Crime and Punishment: An Economic Approach. Journal of Political Economy 76, 169-217.

Blount, S., Bazerman, M., 1996. The inconsistent evaluation of absolute versus comparative payoffs in labor supply and bargaining. Journal of Economic Behavior and Organization 30, 227-240.

Boyer, M.M., 2000. Centralizing Insurance Fraud Investigation. Geneva Papers on Risk and Insurance Theory 25, 159-178.

Brandts, J., Charness, G., 2000. Hot vs. Cold: Sequential Responses and Preference Stability in Experimental Games. Experimental Economics 2, 227-238.

Brosig, J., Weimann, J., Yang, C.-L., 2003. The hot versus cold effect in a simple bargaining experiment. Experimental Economics 6, 75-90.

Caron, L., Dionne, G., 1997. Insurance Fraud Estimation: More Evidence from the Quebec Automobile insurance industry. Assurances 64, 567-578.

Cooper, R., Hayes, B., 1987. Multi-period Insurance Contracts. International Journal of Industrial Organization 5, 211-222.

Crocker, K.J., Morgan, J., 1998. Is Honesty the Best Policy? Curtailing Insurance Fraud Through Optimal Incentive Contracts. Journal of Political Economy 106, 355-375.

Croson, R., Gneezy, U., 2009. Gender Differences in Preferences. Journal of Economic Literature 47, 1-27.

Cummins, J.D., Tennyson, S., 1996. Moral hazard in Insurance Claiming: Evidence from Automobile Insurance. Journal of Risk and Uncertainty 12, 29-50.

Cummins, J.D., Weiss, M.A., Zi, H., 1999. Organizational Form and Efficiency: The Coexistence of Stock and Mutual Property-Liability Insurers. Management Science 45, 1254-1269.

Dean, D.H., 2004. Perceptions of the Ethicality of Consumer Insurance Claim Fraud. Journal of Business Ethics 54, 67-79.

Derrig, R.A., 2002. Insurance Fraud. Journal of Risk and Insurance, 69, 271-287.

Dionne, G., Gagné, R., 2001. Deductible Contracts against Fraudulent Claims: Evidence from Automobile Insurance. Review of Economics and Statistics 83, 290-301.

Dionne, G., Gagné, R., 2002, Replacement Cost Endorsement and Opportunistic Fraud in Automobile Insurance. Journal of Risk and Uncertainty 24, 213-230.

Dionne, G., Giuliano, F., Picard, P., 2009. Optimal Auditing with Scoring: Theory and Application to Insurance Fraud. Management Science 55, 58-70.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., Wagner, G.G., 2011. Individual Risk Attitudes: Measurement, Determinants and Behavioral Consequences. Journal of the European Economic Association 9, 522-550.

Falk, A., Fischbacher, U., 1999. "Crime" in the Lab – Detecting Social Interaction. European Economic Review 46, 859-869.

Fehr, E., Gächter, S., 2000. Cooperation and Punishment in Public Goods Experiments. American Economic Review 90, 980-994.

Fehr, E., Schmidt, K., 1999. A theory of fairness, competition and cooperation. Quarterly Journal of Economics 114, 817-851.

Fischbacher, U., 2007. Zurich Toolbox for Ready-made Economic Experiments. Experimental Economics 10, 171-178.

Fischbacher, U., Heusi, F., 2008. Lies in Disguise - An Experimental Study on Cheating, mimeo. University of Konstanz.

Frank, B., Schulze, G.G., 2000. Does economics make citizens corrupt? Journal of Economic Behavior and Organization 43, 101-113.

Frey, B.S., Meier, S., 2004. Pro-Social behavior in a natural setting. Journal of Economic Behavior and Organization 54, 65-88.

Gosh, D., Crain, T.L., 1995. Ethical standards, attitudes toward risk, and intentional noncompliance: an experimental investigation. Journal of Business Ethics 14, 353-365.

Greiner, B., 2004. An Online Recruitment System for Economic Experiments. In: Kremer, K. and V. Macho (Eds.), Forschung und wissenschaftliches Rechnen. GWDG Bericht 63, Gesellschaft für wissenschaftliche Datenverarbeitung, Göttingen, 79-93.

Güth, W., Huck, S., Müller, W., 2001. The relevance of equal splits in ultimatum games. Games and Economic Behavior 37, 161-169.

Hoffman, E., McCabe, K.A., Smith, V.L., 1998. Behavioral foundations of reciprocity: experimental economics and evolutionary psychology. Economic Inquiry 36, 335-352.

Holtan, J., 2001. Optimal Loss Financing under Bonus-Malus Contracts. Astin Bulletin 31, 161-173.

Ichino, A., Maggi, G., 2000. Work Environment and Individual Background: Explaining Regional Shirking Differentials in a Large Italian Firm. Quarterly Journal of Economics 115, 1057-1090.

Kahneman, D., Tversky, A., 1984. Choices, values, and frames. American Psychologist 39, 341-350.

Lemaire, J., 1985. Automobile Insurance: Actuarial Models. Boston.

Leng, C.-C., Meier, U.B., 2006. Analysis of multinational underwriting cycles in property-liability insurance. Journal of Risk Finance 7, 146-159.

Leverty, J.T., Grace, M.F., 2010. The robustness of output measures in property-liability insurance efficiency studies. Journal of Banking and Finance 34, 1510-1524.

Mayers, D., Smith, C.W. , 2000. Organizational Forms within the Insurance Industry: Theory and Evidence. In: Dionne, G. (ed.): Handbook of Insurance. Boston et al.

Miyazaki, A.D., 2009. Perceived Ethicality of Insurance Claim Fraud: Do Higher Deductibles Lead to Lower Ethical Standards? Journal of Business Ethics 87, 589-598.

Moreno, I., Vázquez, F.J., Watt, R., 2006. Can Bonus-Malus Allieviate Insurance Fraud? Journal of Risk and Insurance 73, 123-151.

Nini, G., 1999. Ex-post Behavior in Insurance Markets, mimeo. University of Pennsylvania.

Oxoby, R.J., McLeish, K.N., 2004. Sequential decision and strategy vector methods in ultimatum bargaining: evidence on the strength of other-regarding behavior. Economics Letters 84, 399-405.

Picard, P., 1996. Auditing Claims in insurance Markets with Fraud: The Credibility Issue. Journal of Public Economics 63, 27-56.

Raviv, A., 1979. The Design of an Optimal Insurance Policy. American Economic Review 69, 84-96.

Rothschild, M., Stiglitz, J., 1976. Equilibrium in Competitive Insurance Markets: An Essay on the Economics of Imperfect Information. Quarterly Journal of Economics 90, 629-649.

Schoemaker, P.J.H., Kunreuther, H.C., 1979. An Experimental Study of Insurance Decisions. Journal of Risk and Insurance 46, 603-618.

Selten, R., 1967. Die Strategiemethode zur Erforschung des eingeschränkt rationalen Verhaltens im Rahmen eines Oligopolexperiments. In: Sauermann, H. (Ed.), Beiträge zur Experimentellen Wirtschaftsforschung, 136-168.

Shavell, S., 1979. On Moral Hazard and Insurance. Quarterly Journal of Economics 93, 541-562.

Sonnemans, J., Schram, A., Offerman, T., 1998. Public Good Provision and Public Bad Prevention: The Effect of Framing. Journal of Economic Behavior and Organization 34, 143-161.

Spicer M., Becker, L.A., 1980. Fiscal Inequity and Tax Evasion: An Experimental Approach. National Tax Journal 33, 171-175.

Tennyson, S., 1997. Economic Institutions and Individual Ethics: A Study of Consumer Attitudes toward Insurance Fraud. Journal of Economic Behavior and Organization 32, 247-265.

Tennyson, S., 2002. Insurance Experience and Consumers' Attitude Towards Insurance Fraud. Journal of Insurance Regulation 21, 35-55.

Thaler, R.H., 1999. Mental Accounting Matters. Journal of Behavioral Decision Making 12, 183-206.

Townsend, R.M., 1979. Optimal Contracts and Competitive Markets with Costly State Verification. Journal of Economic Theory 21, 265-293.

Appendix

The probabilities of filing a fictitious claim (in the state of no loss) or engaging in claim build-up (in the state of a low loss) are the dependent variables. Both variables equal 1 if that specific kind of fraud is committed and 0 otherwise.

	Dep. variable: claim build-up, periods 1-5 (1)			**Dep. variable: fictitious claim, periods 1-5** (2)			**Dep. variable: fictitious claim, periods 1-4** (3)		
Treatment (Deduct = 1)	2.068	**	(1.015)	0.754		(0.593)	1.169	*	(0.653)
Period	0.531	***	(0.111)	0.337	***	(0.085)	0.434	***	(0.124)
Gender (Female = 1)	-0.201		(1.070)	-1.256	*	(0.641)	-1.467	**	(0.703)
Risk	0.963	***	(0.347)	0.602	***	(0.209)	0.633	***	(0.230)
Econ or business major	2.501	*	(1.332)	0.759		(0.863)	0.843		(0.945)
Insurance contracts	-0.169		(0.387)	-0.631	***	(0.230)	-0.734	***	(0.258)
Constant	-5.387	***	(1.521)	-1.004		(0.867)	-1.277		(0.960)
Number of observations	720			720			576		
Log-likelihood	-289			-342			-277		
Wald chi-squared	37.79	***		36.49	***		33.28	***	

Notes: Pooled random effects logit regression.

Table A1: Logit Estimates for the Base and Deduct Treatments

	Dep. variable: claim build-up, periods 1-5 (1)			Dep. variable: fictitious claim, periods 5 (2)		
Treatment (BoMa = 1)	-1.812	**	(0.731)	-0.155		(0.361)
Period	0.554	***	(0.099)			
Gender (Female = 1)	-1.358	*	(0.774)	-0.570		(0.394)
Risk	0.091		(0.238)	0.190		(0.121)
Econ or business major	2.916	***	(1.037)	0.158		(0.527)
Insurance contracts	0.007		(0.288)	-0.205		(0.143)
Constant	-0.772		(1.179)	0.526		(0.575)
Number of observations	576			144		
Log-likelihood	-254			-92		
LR chi-squared				9.40	*	
Wald chi-squared	36.14	***				

Notes: (1) Pooled logit regression, (2) Pooled random effects logit regression.

Table A2: Logit Estimates for the Deduct and BoMa Treatments

	Dep. variable: claim build-up, Base (1)			Dep. variable: claim build-up, Deduct (2)			Dep. variable: claim build-up, BoMa (3)		
Period	0.518	***	(0.159)	0.544	***	(0.155)	0.561	***	(0.130)
Gender (Female = 1)	0.965		(1.551)	-1.408		(1.436)	-1.301		(0.890)
Risk	1.374	***	(0.530)	0.653		(0.440)	-0.153		(0.274)
Econ or business major	-0.121		(2.437)	3.006	**	(1.488)	3.570	**	(1.616)
Insurance contracts	-0.097		(0.573)	-0.138		(0.501)	0.121		(0.354)
Constant	-7.059	***	(2.154)	-1.710		(2.014)	-1.961		(1.260)
Number of observations	360			360			360		
Log-likelihood	-142			-145			-170		
Wald chi-squared	15.27	***		19.65	***		23.15	***	

Notes: Pooled random effects logit regression.

Table A3: Logit Estimates for claim build-up (individual treatments)

	Dep. variable: fictitious claim, Base (1)			Dep. variable: fictitious claim, Deduct (2)			Dep. variable: fictitious claim, BoMa (3)		
Period	0.491	***	(0.120)	0.151		(0.124)	0.399	***	(0.101)
Gender (Female = 1)	-0.696		(0.845)	-1.918	*	(1.007)	-0.611		(0.499)
Risk	0.377		(0.284)	0.820	***	(0.318)	0.205		(0.154)
Econ or business major	-0.098		(1.474)	1.075		(1.115)	1.971	**	(0.882)
Insurance contracts	-0.368		(0.314)	-0.824	**	(0.347)	0.086		(0.202)
Constant	-1.458		(1.140)	0.280		(1.338)	-2.374	***	(0.756)
Number of observations	360			360			360		
Log-likelihood	-185			-153			-202		
Wald chi-squared	19.26	***		19.02	***		22.73	***	

Notes: Pooled random effects logit regression.

Table A4: Logit Estimates for fictitious claims (individual treatments)

General instructions (all instructions translated from German)

Welcome to the experiment. Please read through the instructions carefully. They are identical for all participants. In this experiment, you and the other participants will have to make decisions. At the end of the experiment, you will receive a payment depending on your own decisions and the decisions of the other participants. In addition, you will receive a fixed show-up fee of 4 Euro.

During the entire experiment, you may not talk to other participants, use your mobile phone, or start any programs on the computer. Should you break this rule, we will have to exclude you from the experiment and from receiving any payment. Whenever you have a question, please raise your hand. The experimenter will come to your seat to answer your question. If the question is relevant to all participants, the experimenter will repeat the question and answer it aloud.

During the experiment, we calculate payments in points instead of Euros. At the end of the experiment, the total number of points will be converted into Euros at the rate of 10 points = 1 Euro. Before we start the experiment, you will have to answer six written questions regarding the experiment to make sure that you have correctly understood the instructions.

The experiment is confidential; no other participant will receive any information regarding your answers, decisions, or final payment.

The experiment consists of two parts: In the first part, you will have to make decisions that will determine your success in the experiment and, consequently, your final payment. In the second part, you will have to answer several questions that have no influence on your success in the experiment. Your answers to these questions will be treated as strictly confidential.

Specific instructions [D: Deduct Treatment; B: Bonus-Malus Treatment]

The experiment consists of five periods. Before period 1, you will be randomly and anonymously allocated into fixed groups of four. The group composition will remain unchanged during the entire experiment.

At the beginning of each period, each participant will receive an endowment of 25 [Deduct: 27] points, thus totaling 125 [D: 135] points over the five periods. In each period, each participant runs the risk of losing a part of his or her endowment. The following losses can occur with the following probabilities in each period:

Loss	**Probability**
0 points (no loss)	70 %
10 [D: 15] points (low loss)	20 %
15 [D: 20] points (high loss)	10 %

In each period, given the above probabilities, a computer randomly determines for each participant independently if any of the above losses occur. The amounts of the potential losses and the probabilities remain constant over all periods. Your decisions or losses in earlier periods, therefore, have no influence on the probability or the amount of future losses.

In order to compensate for potential losses, the four group members together build a mutual insurance group. This setup ensures that each group member automatically pays an insurance premium of 5 points [BoMa: no points mentioned here] on a joint group account ("insurance account") at the beginning of each period.

In order to receive payment from the insurance account, group members can retrieve indemnities from the insurance account. [D: There is a deductible of 5 points.] Each group member only has the possibility to retrieve 0 points, 10 points or 15 points from the insurance account. If a group member retrieves an indemnity, he or she receives the corresponding amount from the insurance account. The other group members have no influence on this payment; it will be made automatically.

[BoMa: The insurance premium of each participant is 5 points in the first period. The insurance premium in periods 2–5 is dependent on whether indemnities have been retrieved in earlier periods. If, in a given period, an indemnity is retrieved from the insurance account, then the insurance premium in the next period increases by 2 points. If no indemnity is retrieved, the insurance premium in the next period decreases by 1 point. The following table summarizes this relation for the first three periods:

<table>
<tr><th colspan="2">Period 1</th><th colspan="2">Period 2</th><th colspan="2">Period 3</th><th>…</th></tr>
<tr><th>Premium</th><th>Indemnity</th><th>Premium</th><th>Indemnity</th><th>Premium</th><th>…</th><th>…</th></tr>
<tr><td rowspan="4">5 points</td><td rowspan="2">yes</td><td rowspan="2">7 points</td><td>yes</td><td>9 points</td><td>…</td><td>…</td></tr>
<tr><td>no</td><td>6 points</td><td>…</td><td>…</td></tr>
<tr><td rowspan="2">no</td><td rowspan="2">4 points</td><td>yes</td><td>6 points</td><td>…</td><td>…</td></tr>
<tr><td>no</td><td>3 points</td><td>…</td><td>…</td></tr>
</table>

end of insertion for BoMa]

Any indemnity payment from the insurance account results in additional transaction costs of 40 percent. Therefore, if a group member retrieves an indemnity of 10 points, the insurance account will be debited with 4 additional points (14 points overall). If 15 points are retrieved, the insurance account will be debited with 6 additional points. The following table summarizes this relation:

Retrieved indemnity	Transaction costs	Total debit to the insurance account
0 points	0 points	0 points
10 points	4 points	14 points
15 points	6 points	21 points

Potential credit and debit balances of the insurance account are summed up over all five periods. During the experiment, you will receive no information regarding the balance of the insurance account. After the last period, the insurance account is automatically and equally balanced by all group members. If the insurance account has a negative balance, each group member has to pay one fourth of the balance from his or her winnings up to that point. On the other hand, if the insurance account has a positive balance, each group member receives one fourth of the balance in addition to his or her winnings up to this point.

The timing of your decisions in each period is as follows:

Step 1: At the beginning of each period, you receive your period endowment of 25 [D: 27] points.

Step 2: You must acknowledge the payment of the insurance premium of 5 points [B: no points mentioned] to the insurance account.

Step 3: You will make three decisions in each period: For each potential loss situation, you must decide how many points you will retrieve from the insurance account. Thus, for a situation in which you have not incurred a loss, you have to decide whether you want to retrieve 0 points, 10 points, or 15 points from the insurance account. You must make the same decision twice more for the situations in which you have incurred a low loss or a high loss, respectively.

Step 4: Only after you have made all three decisions will you find out whether you have indeed incurred a loss in this period. If you have incurred a loss, you will also learn whether it was a low or a high loss. You will then automatically receive the indemnity from the insurance account that you requested in step 3 for this particular situation. [B: If an indemnity is retrieved from the insurance account in this period, then the insurance premium in the next period increases by 2 points. If no indemnity is retrieved, the insurance premium in the next period decreases by 1 point.]

After the last period, the second part of the experiment will start, and you will have to answer several questions. After you have filled in the questionnaire on the computer, you will receive detailed information regarding the balance of the insurance account, your earned points, and your payment in Euros.

Please pack up your personal belongings after the experiment and sit quietly in your seat. We will call you in a random order to collect your payment outside the lab room. Thank you for your participation.