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Contract design and insurance fraud: an experimental investigation

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Abstract This paper experimentally examines the impact of contract design on insurance fraud. We test how fraud behavior varies for insurance contracts with full coverage, a straight deductible or claim-dependent premiums (bonus-malus contracts), in a setup where rational and selfish individuals have an incentive to always claim the maximum possible indemnity. We find a substantial impact of contractual arrangements: Deductible contracts lead to a greater extent to claim build-up than full coverage contracts. In contrast, bonus-malus contracts that entail the same net gains from fraud as deductible contracts do not increase claim build-up. Thus, our results indicate that bonus-malus contracts may be superior to deductible contracts for behavioral reasons.

Keywords Insurance fraud · Experiment · Contract design · Deductible · Bonus-malus

JEL Classification G22 · C91 · D03

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1 Introduction

Practitioners and theorists commonly agree that fraudulent behavior by policyholders is next 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). Still, 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. In line with the standard rational-choice theory of crime (Becker 1968), 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 and only partly effective.[1]

Thus, in addition to tackling insurance fraud from a purely rational/monetary perspective, approaches that account for psychological considerations seem promising. Our experiment is one of the first to examine insurance fraud in a laboratory environment.[2] The aim of our experiment is to analyze the effect of contractual arrangements on the decision to commit fraud. Apart from full-coverage contracts, we consider the two most common insurance-specific arrangements: deductibles and bonus-malus contracts. The experiment is closely related to public good (bad) experiments. 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 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 bad situation.

[1] Dionne et al. (2009), for instance, have analyzed optimal auditing procedures for an auto insurer. Given 500,000 claims (average claim 1284 €) 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, they estimate that a third of all fraudulent claims remain undetected, resulting in total costs of 17 million €. So even if companies adopt optimal fraud fighting strategies, high costs of fraud will remain.

[2] Gabaldón et al. (2014) conducted another experiment on insurance fraud with a very different setup and scope.

For small groups and high transaction costs, 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, there is a spillover effect because deductible contracts also increase the filing of fictitious claims. Taken together, these results are in line with existing questionnaire studies that find that deductibles are seemingly perceived as unfair and may trigger fraudulent behavior. However, full coverage bonus-malus contracts—which entail an implicit deductible—have different behavioral implications. In our experiment, the probability of claim build-up is not significantly different compared with full-coverage contracts. For large groups and low transaction costs we also find some weakly significant differences between deductible and bonus-malus contracts. In addition, according to questionnaire answers, the large majority of participants in our experiment prefer bonus-malus to deductible contracts irrespective of the contract type they were assigned to.

In many economic contexts dishonestly pays. Unethical behavior, lying in general and fraudulent behavior in different economic contexts have received substantial consideration in the experimental literature. For instance, Fischbacher and Föllmi-Heusi (2013) conducted a simple experiment where subjects privately roll a die and have an incentive to dishonestly report the result to get higher payoffs. In contrast to standard economic theory, they find that only 20% of subjects lie to the fullest extent while 39% of the subjects are fully honest. Furthermore, their results show that a high share of subjects lie, but do not report the payoff-maximizing draw. Similarly, Gneezy (2005) reports experimental evidence that a substantial share of people is not purely selfish and does not maximize their own payoffs when their lying is harmful to others. In addition, many liars are sensible to the harm they cause to others. Jones and Kavanagh (1996) find that situational and individual characteristics may affect individual's decision to engage in unethical behavior.

Tax evasion is a special form of unethical behavior which includes dishonest reporting by individuals. Here, various studies indicate that while some people would never consider engaging in illegal behavior because of norms, for others, their behavior depends on aspects of fairness that relate to the specific decision-making situation (e.g. Falk and Fischbacher 1999; Wirtz and Kum 2004; Wirtz and McColl-Kennedy 2010). Experiments on tax evasion examine different influencing factors such as the degree of uncertainty about the tax rate and the fine rate (Alm et al. 1992), the possibility to vote on public spending (Alm et al. 1993) and social interactions (Fortin et al. 2007).

From an experimental point of view, our paper is most closely related to the literature on cooperation in public goods and public bads experiments. In public goods experiments, contributions in the first period usually start around half of the endowment and deteriorate significantly towards the end of the game (Andreoni 1988). Thus, not everybody behaves in a selfish manner. In fact, a substantial share of the participants turn out to be conditional cooperators, willing to contribute to the public good if others do so, too, and ready to punish those who do not contribute even at a cost (Fehr and Gächter 2000; Fischbacher et al. 2001). In public bads experiments, often the framing of the decision problem is reversed highlighting the negative externality of not investing, while incentives may remain the same as in public goods experiments (Andreoni 1995).

The distinctive feature of our research with respect to the above-mentioned literature is the specific focus on the impact of contractual features. Monetary incentives in our experiments are very simple: Given the lack of auditing and resulting fines, rational and selfish individuals will always claim the maximum possible indemnity. Hence, differences in behavior between treatments can be associated to differences in the contractual features. Our results indicate that the extent of insurance fraud depends both on the contractual features as well as on the different fraud forms. In this respect our research contributes to the above-mentioned literature that institutional or contractual features play an important role when considering unethical behavior.

Real-world evidence indicates that fairness and norms 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 general norms, insurance-specific factors influencing the perceived fairness of the insurance relationship, such as contractual arrangements, could play an important role in fighting fraudulent behavior.

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 1971; 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 suggest 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. However, an open question is how to tackle this problem that might be associated with deductibles. Our approach is to test whether bonus-malus contracts might be an alternative.

Bonus-malus systems, in which the premium paid by a policyholder depends on her individual claim history, are a common contractual arrangement in automobile insurance. 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, up to now there has been no evidence on whether these contracts are perceived as fair or not and on the behavioral implications of these contracts.

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 may be superior to deductible contracts in a multi-period setting. Bonus-malus contracts can be designed to give similar 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: Sect. 2 introduces the experimental setup. In Sects. 3 and 4, the results for the different experimental setups are presented. In Sect. 5 we briefly discuss our results and Sect. 6 concludes.

2 Experimental setup

2.1 General design

In the experiment, participants are randomly and anonymously allocated into fixed groups of four.[3] 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 ($t = 1, \ldots, T = 5$) 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 to endogenize the cost of insurance fraud.[4] All payments from and to the group members are settled via the group-specific insurance account. After the last period, the insurance account is automatically and equally balanced by

[3] See Sect. 4 for a robustness check with group sizes of 24 participants.

[4] The mutual form is common for insurance companies as for instance in life insurance. Here policyholders are at the same time the residual claimant of the insurance company. 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).

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. Participants received information about the balance of the group account and thus about the claiming behavior of their fellow group members only at the end of the whole experiment, after answering the questionnaire. Thus, there was no feedback given to participants about claims and choices of other group members after each period. Feedback was only given at the end of the entire experiment. The instructions (and therefore the whole experiment) were framed using insurance-specific wording.[5] All information was common knowledge. The instructions can be found in the "Appendix".

With respect to indemnity claiming, we apply the strategy method.[6] 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 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 all 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 of committing fraud, we consider neither auditing activities nor fines.[7] Indemnities are always paid as claimed, but due to transaction costs of 40% ($c = 0.4$), the insurance account is charged with an amount of $1.4 \cdot I$ for each claim (see Sect. 4 for a robustness check with transaction costs of 20%). The resulting expense ratio (= cost/(cost + indemnities)) in the experiment is therefore 28.6%.[8] Therefore, the insurance account

[5] 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 (n = 72 as in the Base Treatment) and did not find any structural differences with respect to the insurance-specific wording in our Base Treatment. Average fraud probabilities for claim build-up were 39% with insurance specific framing and 33% with context-free framing. For fictitious claims, the corresponding fraud probabilities were 51 and 46%, respectively. Taking individual means over all periods as observations, the differences are not statistically significant (two-sided Mann–Whitney U tests, $p = 0.270$ for claim build-up and $p = 0.453$ for fictitious claims). These results are also confirmed using a random effects logit regression (results available from the authors on request).

[6] 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 a survey of the differences between the strategy method and the direct response method see Brandts and Charness (2000). Of the 29 existing studies, 16 find no difference, 4 do find differences, and 9 comparisons find mixed evidence. None of these studies finds that a treatment effect that is present with the strategy method is not observed with the direct-response method.

[7] For example, Nagin and Pogarsky (2003) experimentally evaluate the impact of auditing and fines on the extent of dishonest behavior and Grolleau et al. (2014) study the impact of monitoring activities on the self-reported performance of experimental participants in a real effort task.

[8] For large groups with 24 participants, as discussed in Sect. 4, the expense ratio is 16.7%. Transaction costs in real-world insurance markets are usually measured by the expense ratio (total expenses divided by total premiums written). 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.

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.

At the end of the experiment, the insurance account is automatically balanced by the group members.

2.2 Experimental treatments

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 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 $0.3 \cdot 5 = 1.5$.

In the Bonus-Malus Treatment (*BoMa*), 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

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

2.3 Monetary gains from fraud

The experiment does neither entail any auditing nor any fines for detected fraudulent behavior. Therefore, rational and purely selfish individuals should always claim the maximum possible indemnities. The purpose of the experimental setup is to identify differences in behavior and consequently the psychological costs of fraud for different contractual arrangements. In the spirit of Mazar et al. (2008), we hypothesize that people face a tradeoff between monetary benefits from behaving dishonestly and psychological costs from being dishonest. In the following section, we outline a very simple model that captures the basic incentives (payoffs) to defraud for rational and purely selfish participants. Because participants are paid at the end of the experiment, it is reasonable to assume that individuals do not discount their expected period utility $E[u_i^t]$ and maximize $U_i = \sum_t E[u_i^t]$.

First, we consider the Base and Deductible Treatment. 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:

$$E[u_i^t] = \sum_j p_j u_i\left(W - P - x_j + I_{ij} + 1/4\left[4P - (1+c)\left(I_{ij} + 3I_{-i}\right)\right]\right) \quad (2)$$

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 (2) and considering the transaction cost parameter $c = 0.4$ gives

$$E[u_i^t] = \sum_j p_j u_i\left(W - x_j - 1.05I_{-i} + 0.65I_{ij}\right). \quad (3)$$

The main feature of the expected utility function is that the monetary net gain of an indemnity payment is $0.65I_{ij}$. 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 $I = 10$ is $0.65 \cdot 5 = 3.25$. 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.

In the BoMa treatment, monetary gains from fraud can only be derived via backwards induction. When deciding whether 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

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

where ΔP_i^t accounts for the sum of future premium adjustments, with $\Delta P_i^t = \begin{cases} -(T-t) & \text{if } I_{ij}^t = 0 \\ 2(T-t) & \text{otherwise} \end{cases}$.

Table 1 Payoffs and net gains from fraud in the BoMa Treatment

Period	I_0	I_L	I_H	I_H–I_L	I_H–I_0
5	0.00	6.50	9.75	3.25	9.75
4	0.75	5.00	8.25	3.25	7.50
3	1.50	3.50	6.75	3.25	5.25
2	2.25	2.00	5.25	3.25	3.00
1	3.00	0.50	3.75	3.25	0.75

Rearranging (4) and introducing the transaction cost parameter $c = 0.4$ gives

$$E\left[u_i^t\right] = \sum_j p_j u_i\left(W - x_j^t - 0.75\left(P_i^t - P_{-i}^t\right) - 0.75\left(\Delta P_i^t - \Delta P_{-i}^t\right) + 0.65 I_{ij}^t - 1.05 I_{-i}^t\right). \tag{5}$$

Here, premiums do not cancel out. However, premium payments (P_i^t, P_{-i}^t, ΔP_{-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 $0.65 I_{ij}^t$. 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 and considering only the parameters that individual i can influence in period t, the objective function for individual i in period t simplifies to

$$\max_{I_{ij}^t} \sum_j \left(0.65 I_{ij}^t - 0.75 \Delta P_i^t\right). \tag{6}$$

Table 1 summarizes 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) that individual i can influence by his choice in period t. Thus, $I_H - I_L$ gives the net gain from claim build-up and $I_H - I_0$ the net gain from fictitious claims. As the net gains are always positive, rational and purely selfish individuals should also in the BoMa treatment always claim the maximum possible indemnities.

In questionnaire studies, the perceived unfairness of deductible contracts seems to be most pronounced for claim build-up (Tennyson 2002; Miyazaki 2009). Our main aim is thus to analyze the impact of bonus-malus contracts on fraudulent behavior in the case of a low loss. Consequently, we designed the BoMa treatment to implement identical monetary gains from claim build-up as in the base and the Deduct Treatment.[9] The monetary gain from claim build-up $I_H - I_L = 3.25$ is

[9] Recall that the net gain from claim build-up in the Base and Deduct Treatment is given by $5 \cdot 0.65 = 3.25$.

constant across periods in this situation because the premium increase is the same no matter if the true low loss or an inflated high loss is reported. A purely selfish individual will thus always engage in claim build-up by claiming I_H in the situation of a low loss. With respect to the filing of fictitious losses, however, monetary gains from fraud are strictly increasing over time due to premium increases. But in the final period $t = 5$, monetary fraud incentives are again identical across all treatments because there are no future premium adjustments in the BoMa treatment.

2.4 Psychological costs and predictions

In the previous section we outlined the basic reasoning for rational and purely selfish participants. They only consider monetary gains from fraudulent behavior and therefore always claim the maximum possible indemnity. However, a vast amount of experimental evidence indicates that many participants also consider non-monetary motivations, such as fairness, norms, cost of lying 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 the diverse moral sentiments is to consider psychological costs of committing fraud. Such costs may depend on several institutional factors, such as the specific contractual form. Individuals who consider themselves to be treated unfairly may have lower psychological costs of committing fraud. For example, Grolleau et al. (2014) find in their experimental study that participants cheat more to avoid a loss than to realize a gain. As deductibles can be perceived as a loss, deductible contracts may increase the general extent of fraudulent behavior of participants. Given the empirical evidence, it is thus 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.

Prediction 1 The probability of claim build-up is significantly higher in the Deduct Treatment than in 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. Furthermore, prior literature has shown that behaving unethically in one dimension (wearing fake sunglasses) has positive spillover effects to cheating in other dimensions (Gino et al. 2010). Thus, we can assume that the psychological costs of filing fictitious claims are not higher in the Deduct Treatment but may be lower due to a spillover effect.

Prediction 2 The probability of fictitious claims is as high 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.[10] 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.

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 in the case of claim build-up the same net gains from fraud 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.

The same reasoning applies to fictitious losses for the comparison of the final period, where monetary gains from fraud are identical.

Prediction 5 In the final period, the probability for fictitious claims is not significantly different in the BoMa and the Deduct Treatment.

2.5 Control variables

In a questionnaire after the experiment, 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.

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) finds that questionnaire respondents with more insurance experience (more policies and more claims) are less accepting of

[10] If psychological costs depend on the amount defrauded, this reasoning may no longer hold.

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. Respondents indicated their risk preferences on an eleven-point Likert-type scale with zero indicating total unwillingness to take risks and ten indicating total willingness to take risks. The authors have demonstrated that this method is a good predictor of risky behavior and respondents' attitudes toward risk. Several studies (Ghosh and Crain 1995; Bosco and Mittone 1997; Trivedi et al. 2003) 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

The experiment was 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 2015), and we employed the experimental software z-tree (Fischbacher 2007). Each treatment had 72 participants (three sessions with 24 participants each), thus overall 216 individuals participated. A session took approximately 50–60 min. 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, 9.33 € in the Deductible, and 9.50 € in the Bonus-Malus Treatment.

3 Results

First, we present some descriptive results. Generally, we observe three different kinds of behavior. Some participants never defraud (18% Base Treatment, 14% Deduct Treatment, 14% BoMa Treatment), some defraud only sometimes (61, 50, 69%) and some always defraud (21, 36, 7%). Obviously, payoff maximization (selfish optimization) does not do a very good job in explaining the data, since there is a significant share for each treatment that never defraud. However, financial incentives seem to significantly affect participants' behavior, as the fraction of participants who always defraud is significantly lower in the BoMa (7%) than in the Base Treatment (21%). Our results are in the same range as that of Fischbacher and Föllmi-Heusi (2013). They find in their simple lying experiment that about 20% of their subjects act in line with the assumption of payoff maximization and lie to the fullest extent, while about 39% of their subjects resist monetary incentives and remain honest.

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

First, we compare the Base and Deduct Treatment. Visual inspection shows that subjects commit less claim build-up in the Base Treatment. We find that the difference in the mean claim build-up over all periods is statistically significant (individual means as observations, two-sided Mann–Whitney U test, $p = 0.011$). A random effects logit regression for panel data shows a weekly significant treatment effect (see Table 2, column 1, $p = 0.073$).

Result 1 Prediction 1 cannot be rejected.

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

As expected, our results for the filing of fictitious claims when comparing Base and Deduct are weaker. Figure 2 reveals that fraud probabilities in the Base Treatment are equal or lower than in the Deduct Treatment. The difference in the mean fictitious claims over all periods is weakly significant (individual means as observations, two-sided Mann–Whitney U test, $p = 0.073$). Considering behavior in each period separately, we find a significant difference for the first two periods but not for later periods (two-sided Mann–Whitney U tests, $p = 0.030$ in period 1 and $p = 0.019$ in period 2; $p > 0.1$ in periods 3–5). Thus, we find a small spillover effect from claims build-up to fictitious claims for early periods. This is confirmed by a random effects logit regression for panel data where we find a weakly significant treatment effect for $t \leq 4$ (see Table 2, column 3, $p = 0.074$).

Result 2 Prediction 2 cannot be rejected.

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 evidence in this direction. We find that the difference in individual

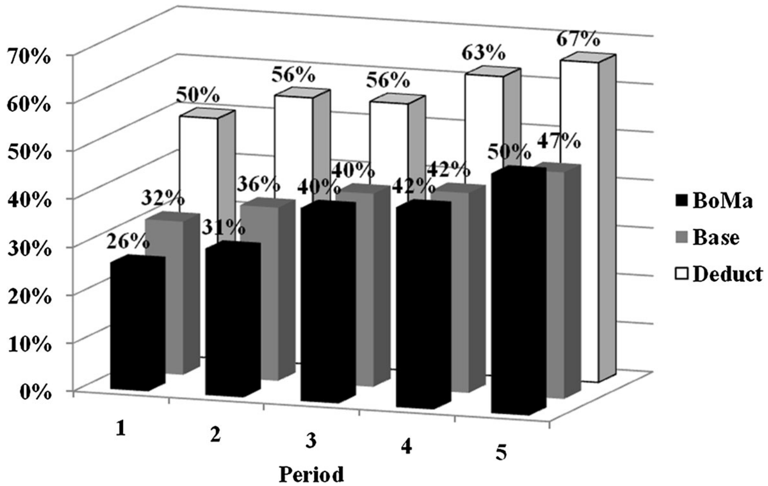

Fig. 1 Claim build-up per period and treatment

Table 2 Logit estimates for the Base and Deduct Treatments

	Dep. variable: claim build-up, periods 1–5 (1)	Dep. variable: fictitious claims, periods 1–5 (2)	Dep. variable: fictitious claims, periods 1–4 (3)
Treatment (Deduct = 1)	2.068*	0.754	1.169*
	(1.154)	(0.584)	(0.655)
Period	0.531***	0.337***	0.434***
	(0.129)	(0.098)	(0.124)
Gender (female = 1)	−0.201	−1.256*	−1.467**
	(1.137)	(0.641)	(0.714)
Risk	0.963**	0.602 ***	0.633***
	(0.452)	(0.204)	(0.229)
Econ or business major	2.501*	0.759	0.843
	(1.352)	(0.787)	(0.887)
Insurance contracts	−0.169	−0.631***	−0.734***
	(0.443)	(0.238)	(0.271)
Constant	−5.387***	−1.004	−1.277
	(1.935)	(0.864)	(0.953)
Number of observations	720	720	576
Log-likelihood	−289	−342	−277
Wald χ^2	23.96***	32.45***	31.05***

Random effects logit regression. Robust standard errors clustered at the individual level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

behavior is highly significant (individual means of fictitious claims and claim build-up as observations, two-sided Wilcoxon signed-rank test, $p < 0.001$).

Result 3 Prediction 3 cannot be rejected.

When comparing BoMa and Deduct, the probability for build-up is obviously lower in the BoMa Treatment than in the Deduct Treatment (Fig. 1). The difference is statistically significant (individual means as observations, two-sided Mann–Whitney U test, $p = 0.002$). A random effects logit regression for panel data confirms this finding (see Table 3, column 1, $p = 0.023$).

Result 4 Prediction 4 must be rejected.

Figure 2 reveals that there are 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 in the regressions are both highly significant ($p = 0.013$ when comparing with the Base Treatment and $p < 0.001$ when comparing with the Deduct Treatment).[11] This result is not surprising given that monetary fraud gains for fictitious claims are much lower in the BoMa Treatment compared to the other two treatments (see Table 1). More importantly, Fig. 2 also

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

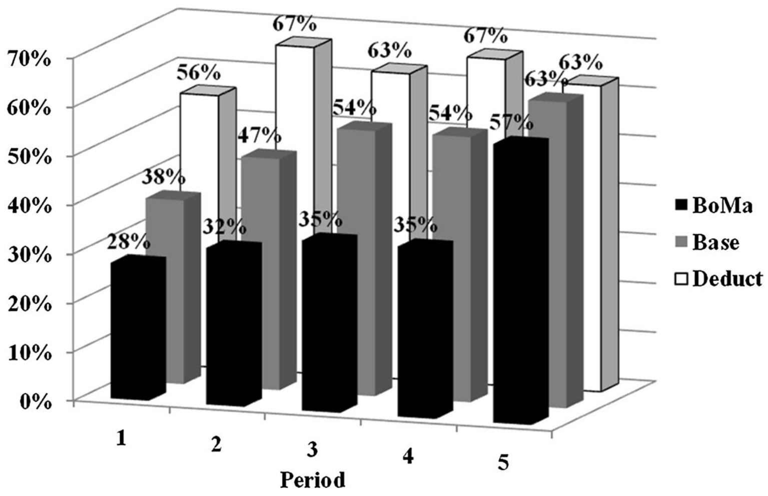

Fig. 2 Fictitious claims per period and treatment

shows that the probability of fictitious claims in $t = 5$ is smaller compared to the Deduct Treatment (57–63%, respectively). But the difference is not significant (two-sided Mann–Whitney U test, $p = 0.498$; similar results for a logit regression, Table 3, column 2, $p = 0.671$).

Result 5 Prediction 5 cannot be rejected.

Finally, visual inspection of Figs. 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 public goods/bads experiments, even without feedback (see, e.g., Sonnemans et al. 1998; Weber 2003).

With respect to the control variables we do not get clear-cut results (Tables 2, 3, columns 1 and 2). No single control variable is significant across all treatments. However, wherever we find a significant effect, it does go 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 and BoMa 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.

4 Robustness of the results (large groups with low transaction costs)

To test for the robustness of our results, we ran two more treatments (Deduct and BoMa) where we increased the attractiveness of committing fraud by changing two components of the experiment. In both treatments, we changed the group size to 24. Thus, all people in one session played together in one insurance group. In addition,

Table 3 Logit estimates for the Deduct and BoMa Treatments

	Dep. variable: claim build-up, periods 1–5 (1)	Dep. variable: fictitious claims, period 5 (2)
Treatment (BoMa = 1)	−1.812**	−0.155
	(0.794)	(0.366)
Period	0.554***	
	(0.119)	
Gender (female = 1)	−1.358*	−0.570
	(0.786)	(0.395)
Risk	0.091	0.190
	(0.251)	(0.121)
Econ or business major	2.916***	0.158
	(1.104)	(0.518)
Insurance contracts	0.007	−0.205
	(0.354)	(0.164)
Constant	−0.772	0.526
	(1.296)	(0.567)
Number of observations	720	144
Log-likelihood	−319	−92
Wald χ^2	33.50***	8.00

(1) Random effects logit regression, (2) logit regression. Robust standard errors clustered at the individual level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

we lowered the transaction costs to 20%.[12] Apart from these changes, everything else in the main insurance experiment stayed as before.

Following the main experiment, we introduced a new sequence of questions and decision tasks to better understand participants' behavior. First, participants were asked to give a personal assessment about how many of the 24 group members had claimed no indemnity, a low indemnity, or a high indemnity on average per round. In addition, we asked participants about how fair they considered the offered insurance contract (*Fairness own contract*). Respondents indicated their fairness rating on a seven-point Likert-type scale with zero indicating completely unfair and six indicating completely fair. Next, we presented participants with four different alternatives for insurance: a deductible contract, a bonus-malus contract, a full-coverage contract and no insurance. We asked participants to rank these four alternatives from their preferred to their least preferred alternative. *Preference for BoMa* indicates that a participant prefers the bonus-malus over the deductible contract. Following Murphy et al. (2011), we measured social value orientation (SVO), i.e., the magnitude of the concern people have for others. Participants had to

[12] Of course, this simultaneous change of two experimental components is not ideal, but it was due to financial limitations. Given that the aim of the robustness check was to strongly increase the attractiveness of committing fraud and not to disentangle the influence of group size and transaction costs, respectively, we believe this twofold change can offer valuable insights.

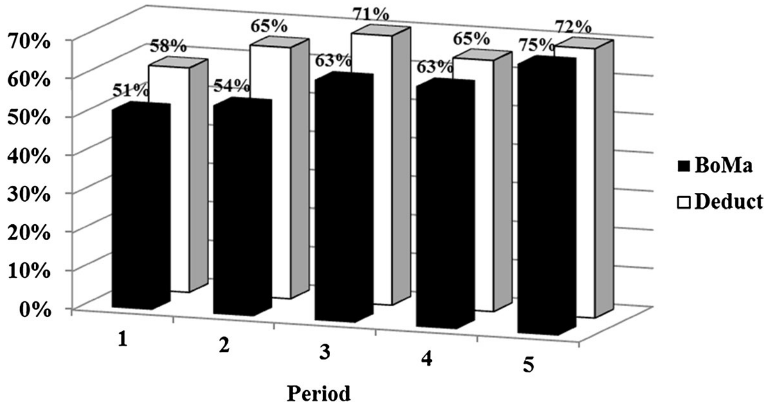

Fig. 3 Claim build-up per period and treatment

make six choices. In each choice, a participant has to decide on an allocation of money for himself and another participant. Whereas some choices correspond to a distribution of a fixed amount of money, others make it more or less costly to be generous to the other person (see Murphy et al. 2011, for details). One of the choices was randomly selected for payment. According to their choices participants can be grouped into one of four different social orientations: altruistic (maximize other peoples' payoffs), prosocial (maximize joint payoff), individualistic (maximize own payoff), and competitive (maximize payoff differences).

The additional experiments were conducted in July 2012 at the MELESSA laboratory of the Ludwig-Maximilians-University (LMU) in Munich, Germany. Each treatment had again 72 participants (three sessions with 24 participants). A session took approximately 60 min. All participants received a fixed show-up fee of 4 Euros. Average earnings excluding the show-up fee were 11.01 € in the Deductible and 10.93 € in the Bonus-Malus Treatment.

First, we consider the new variables. The mean fairness rating of the given contract is similar across treatments (3.5 for Deduct, 3.4 for BoMa). However, when given the choice, the large majority of all participants (78%) prefer the bonus-malus contract over the deductible contract. The difference is statistically significant (Binomial test, $p < 0.001$).[13] For the participants who took part in the Deduct (BoMa) treatment, the corresponding percentage is 85% (72%). Next, we check the SVO categorization. We find that in the Deduct (BoMa) treatment, 35% (24%) of participants are categorized as altruistic, 29% (29%) as prosocial and 36% (47%) as individualists. No participant in our experiment was categorized as competitive. Third, in the Deduct (BoMa) treatment, participants expect in each period 41% (45%) of group members to claim no indemnity, 26% (23%) to claim a low

[13] Of all participants, 8% very strongly prefer the bonus-malus contract (highest preference compared to deductible as lowest preference), 26% strongly prefer bonus-malus (another alternative is rated lower than bonus-malus but higher than deductible), 45% just prefer bonus-malus, 17% just prefer deductible and 4% strongly prefer the deductible.

Table 4 Logit estimates claim build-up for large groups with low transaction costs

	Dep. variable: claim build-up, periods 1–5 (1)	Dep. variable: claim build-up, periods 1–5 (2)
Treatment (BoMa = 1)	−0.910	−1.521*
	(1.055)	(0.870)
Period	0.674***	0.677***
	(0.145)	(0.146)
Gender (female = 1)	−1.674	−1.293
	(1.161)	(0.982)
Risk	0.014	0.014
	(0.360)	(0.298)
Econ or business major	4.669***	3.203***
	(1.105)	(1.191)
Insurance contracts	0.479	0.502
	(0.580)	(0.462)
Fairness own contract		−0.584**
		(0.264)
Preference for BoMa		−1.448
		(1.080)
SVO altruistic		−4.783***
		(1.279)
SVO prosocial		−4.291***
		(1.187)
Constant	0.484	6.436***
	(1.892)	(2.178)
Number of observations	720	720
Log-likelihood	−261	−250
Wald χ^2	37.64***	39.89***

Random effects logit regression. Robust standard errors clustered at the individual level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

indemnity and 33% (32%) to claim a high indemnity. None of the described differences is statistically significant unless otherwise mentioned.[14]

Figure 3 shows the probabilities of claim build-up for the new treatments.

As expected, fraud probabilities increased for claim build-up compared to the previous treatments and differences between both treatments are less pronounced. We find that the difference in the mean claim build-up over all periods is not statistically significant (individual means as observations, two-sided Mann–Whitney

[14] For the SVO categorization: Pearson's Chi square test ($\chi^2 = 2.590$, $p = 0.274$). For the fairness of the given contract: Mann–Whitney U test ($p = 0.782$). For the no/low/high indemnity expectations: Mann–Whitney U tests ($p = 0.238$; $p = 0.147$; $p = 0.682$, respectively). All tests are two-sided.

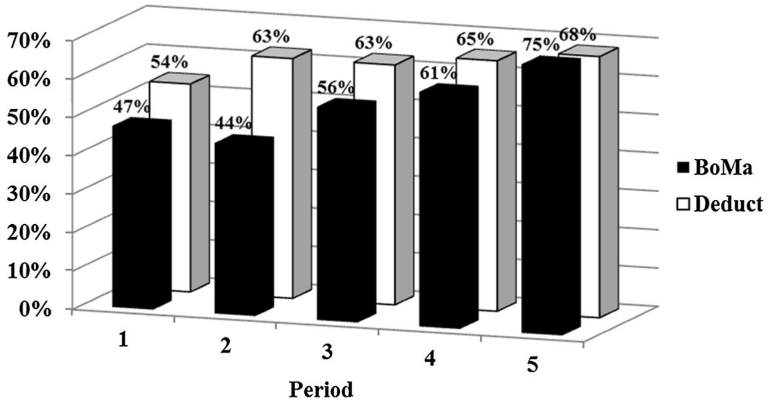

Fig. 4 Fictitious claims per period and treatment

Table 5 Logit estimates fictitious claims for large groups with low transaction costs

	Dep. variable: fictitious claims, period 5 (1)	Dep. variable: fictitious claims, period 5 (2)
Treatment (BoMa = 1)	0.316 (0.385)	0.127 (0.418)
Gender (female = 1)	0.046 (0.409)	0.177 (0.442)
Risk	0.108 (0.120)	0.133 (0.139)
Econ or business major	1.518** (0.694)	1.161 (0.795)
Insurance contracts	−0.306* (0.159)	−0.396** (0.166)
Fairness own contract		−0.424*** (0.125)
Preference for BoMa		−0.560 (0.558)
SVO altruistic		−1.751*** (0.524)
SVO prosocial		−0.845 (0.552)
Constant	0.605 (0.557)	3.581*** (0.981)
Number of observations	144	144
Log-likelihood	−81	−71
Wald χ^2	8.29	28.28***

Logit regression. Robust standard errors clustered at the individual level in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

U test, $p = 0.336$). A random effects logit regressions with the same covariates as before also finds no significant differences between treatments (see Table 4, column 1, $p = 0.389$). However, when also considering the new covariates, we find a weakly significant difference between both treatments on a 10%-level (Table 4, column 2, $p = 0.081$).

Figure 4 shows the probabilities of fictitious claims for the new treatments.

For fictitious losses average fraud probabilities across all periods remain at 63% in the Deduct treatment and increase from 37 to 57% in the BoMa treatment. As before, only the final period can be meaningfully compared. In contrast to the previous results, with 75% more people commit fraud in the BoMa treatment compared to 68% in the Deduct treatment. The difference is not significant (two-sided Mann–Whitney U test, $p = 0.358$; similar results for a logit regression, Table 5, column 1, $p = 0.413$ and column 2, $p = 0.760$).

5 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.

Our experiments find some evidence that deductible and bonus-malus contracts may have different behavioral implications. Although the monetary net gains from fraud are the same with respect to claim build-up, this behavior is more often observed in the Deduct Treatment. Apparently, the implicit deductible of a bonus-malus contract does not trigger any retaliatory behavior. The fact that for claim build-up we do not find any significant differences between the Base and the BoMa Treatment (treatment dummy $p < 0.706$) further supports this finding.[15]

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-

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

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 a 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.

6 Conclusions

The goal of our experimental study was to evaluate the impact of contractual arrangements and the resulting psychological costs on insurance fraud. In the considered experiments, rational and purely selfish participants are expected to always claim the highest possible indemnity. However, the experimental results indicate that the design of insurance contracts and different fraud forms may affect claiming behavior considerably. A first important result is that deductible insurance contracts increase the probability for claim build-up. Second, our results indicate that bonus-malus contracts with a variable claim-dependent premium do not have the same behavioral implications as they entail less fraudulent behavior. The fraud-reducing effect of bonus-malus contracts with full coverage with respect to claim build-up is surprising from a theoretical point of view because these contracts entail with respect to this fraud form the same net gains from fraud as deductible contracts. Our analysis implies that bonus-malus contracts may be a promising 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. First, the experiment is of course unrealistic in the sense that an experimenter cannot incorporate all relevant aspects of real-world insurance transactions. For example, one may argue that our mutual insurance setup is unrealistic. This is true, but we still believe that this setup is the best way to cope with the problem that real-world premiums entail a loading for fraudulent claims. We did not want to charge this loading upfront, as any fraud-specific loading may be interpreted as an expectation of the experimenters and may consequently mislead subjects. In our experiment, the fraud loading (cost of fraud) is completely endogenous. Insurance coverage was mandatory in the experiment, and participants could not choose between different contracts. Giving participants a free choice of different contracts (or even no insurance) is of course preferable, but this would further complicate the data analysis due to selection effects. In addition, we did not consider any monitoring activities by the insurer. Finally, when increasing the group size and lowering the transaction costs, we only find a weakly significant difference for claim build-up under both contractual forms. 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.

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Appendix

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:

Period 1		Period 2		Period 3		–
Premium	Indemnity	Premium	Indemnity	Premium	–	–
5 points	Yes	7 points	Yes	9 points	–	–
			No	6 points	–	–
	No	4 points	Yes	6 points	–	–
			No	3 points	–	–

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.

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