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An experimental study of the effects of negative, capped and deferred bonuses on risk taking in a multi-period setting

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Abstract As a response to the financial crisis in 2008, the European bank authorities have adopted new rules for managerial remuneration. These rules are intended to mitigate managerial propensity to excessive risk taking. The purpose of this paper is to examine three prominent recommendations in these remuneration rules: the use of negative bonuses, the use of bonus caps and the use of deferred bonus payment. The paper advances the theory that cognitive frames created by compensation design affect risk-taking behaviour. We conduct a two-by-two within-subject experiment in which 153 students are set an investment task involving two periods. We find higher risk taking with the high variance bonus scheme that contains a negative bonus option. While bonus deferral appears to have no such initial effect on risk taking, it affects risk behaviour in the second period as a response to positive and negative outcomes from the first period. The findings contribute to the theory and practice of bonus system design and the application of contemporary remuneration recommendations in the financial sector.

Keywords Compensation scheme · Risky decision making · Inter-temporal choices · Negative bonus · Bonus deferral · Bonus cap · Banking

JEL Classification J33 · G32

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1 Introduction

The financial crisis has drawn the attention of practitioners and academics to the effects of pay-for-performance systems on risk inclinations of decision-makers in financial institutions and beyond. One of the specific concerns is that bonus systems may stimulate dysfunctional risk taking by decision-makers. Excessive risk taking is considered to be a logical consequence of traditional bonus schemes, which reward positive performance deviations more than they punish negative ones (Chen et al. 2006; Sanders and Hambrick 2007).

In response to this alleged dysfunction of traditional bonus systems, new pay policies have been suggested at the global level (Steward 2009) and the European level (CRD 3/2010/76/EU). These recommendations aim to regulate executive remuneration as a part of the oversight regulation of banks. Three specific types of policy measures seek to reduce dysfunctional risk taking. The first type entails a deferral of bonus payments over a period of years in order to align the incentive effect of the bonus with the periods in which outcomes of decisions become evident. A second type involves the introduction of a negative outcome such as a 'malus' or 'clawback' provision for poor performance during the vesting period. A third measure is the application of a bonus cap that limits bonus to, for example, a year's salary. These measures combined represent an important innovation in the regulation of managerial remuneration in banks. Despite the general support for the measures in the policy domain, their effects on risky decision-making are not well understood by policymakers, industry participants or researchers, and are far from trivial.

The aim of this paper is to provide experimental evidence of their effects on risk taking, using a behavioural economics framework for analysis. Little academic research has been devoted as yet to the effectiveness of these proposals (Van der Stede 2011, p. 614), despite a considerable interest in remuneration in the finance and accounting literature. We focus on three pay characteristics that are central to the current policies: the use of pay deferrals, malus and bonus caps. Remuneration arrangements such as the so-called 'bonus bank' (Byrnes 2009) include all these factors. A bonus bank makes executive pay dependent on multi-period results, averaging positive (bonus) and negative (malus) bonuses, and deferring actual payouts.

Pay deferrals have entered practice before as equity-based pay (Jensen and Murphy 2004). The various ways in which equity-based pay systems are implemented and used, however, blur their implications for risk taking. Stock options may vest subject to a holding period or be conditional upon future performance. They may also be either voluntary or mandatory. Studies that have focused on the implications of equity-based pay on risk taking have thus reported contradictory findings, showing increased risk taking (Jensen and Meckling 1976, Sanders 2001, Sanders and Hambrick 2007), no effect on risk taking (Fahlenbrach and Stultz 2010), and mitigation of risk taking (Martin et al. 2013). As pay deferral is only one aspect of equity-based pay systems, however, the general implications of bonus deferral cannot be based on the findings relating to equity-based pay.

The use of pay ‘clawback’ and ‘malus’ provisions is a novelty of the recent pay regulation policies. The explicit goal of such measures is to reduce myopic and risk-seeking tendencies (EBA 2013). A malus provision means keeping bonuses in an escrow account, which is used to reduce payment retroactively when future losses occur. Clawbacks are used to make managers repay bonuses which are found to be invalid—for example, after financial restatements or ethical misconduct. Clawback provisions have been increasingly common among Fortune 100 companies; used by less than 3 % of companies prior to 2005, they were being used by 82 % of companies in 2010 (Focus on Clawbacks, C-suite Insight 2011).

Bonus caps aim to limit the potential pay to a pre-set maximum. The use of bonus caps is motivated not only by the desire to counter excessive risk taking, but also to address public concern about pay levels in the banking industry (Guardian 2013).

The true combined effects of introducing deferred, capped and negative bonuses are not straightforward. Beside their direct and intended effects on managerial decision-making behaviour, they are also likely to have effects that are indirect and unintended. The main and direct effect of these policies is caused by limited incentives. The decrease in the expected value of bonuses is expected to reduce dysfunctional risk-taking. The behavioural economics literature, however, suggests that important indirect effects may occur as changes in pay structure will alter decision-makers’ cognitive framing of their investment opportunities. In particular, if pay systems result in negative framing, the risk-taking propensity of managers may indeed be enhanced, rather than reduced (Thaler 1981; Kahneman and Lovallo 1993; Barberis et al. 2006).

This framing effect is the explicit object of our study. Our analysis aims to show how decision-makers’ risk inclinations are affected by a negatively framed bonus scheme and by bonus deferrals, keeping the expected value of bonuses constant. To analyse this relationship, we conducted a between-participants randomized choice experiment, using a two (bonus scheme: high- vs. low-variance bonus) by two (payment: immediate vs. deferred bonus) factorial design with gain and loss as a within-subject factor. A total of 153 finance and accounting students participated in a classroom experiment, in which they were asked to invest in a risky or a risk-free asset in two consecutive investment periods.

Our results indicate that the capped (i.e. low variance) bonus scheme mitigates risk taking. Under the high variance bonus scheme, which contains a negative bonus but compensates for higher risk taking, subjects were more inclined to take risks in both periods, regardless of whether they received an immediate or a deferred bonus. In the first period, deferred payout did not significantly decrease risk taking. In the second period, deferred payment accentuated the effects of prior outcomes; subjects on a deferred bonus payment scheme who had incurred a gain in the first period were more inclined to take risks in the second period, and vice versa.

These findings contribute to our knowledge of the relationship between pay-system design and risk taking in a number of ways. First, we show separate and combined effects of recently proposed regulatory measures on risk taking which have not been directly explored in the literature as yet. Second, our findings support the concern that the measures we are studying influence risk taking because they have an indirect, cognitive, effect above and beyond their economic effect based on incentive reduction. We demonstrate that bonus schemes may systematically influence cognitive frames of people taking risky decisions. Finally, we show that the effects of the policy measures are less straightforward and likely to be less functional than financial regulators hope. Contrary to their expectations, our results suggest that deferred bonus system may contain a risk of pro-cyclicality. Performance in good times, and the associated accumulation of positive bonuses, may encourage managers to take more risks, while accumulation of negative bonuses may discourage them from pursuing risky opportunities. Overall, our paper adds to the relatively scarce compensation literature that seeks to explain the effects of bonus schemes from a behavioural economics perspective.

2 Literature overview and hypotheses

The role of any monetary incentive scheme is to direct managerial behaviour towards maximizing firm value (Jensen and Murphy 2004). Traditional performance-related pay schemes have been criticized for not achieving such alignment. As displayed in Fig. 1a, traditional systems in fact resemble option contracts that reward positive outcomes more than they punish negative ones. This provides managers with an incentive to increase dysfunctional risk-seeking behaviour (Chen et al. 2006; Sanders and Hambrick 2007; Carolillo et al. 2013).

We do not know, however, the decision effects of a remuneration scheme that symmetrically rewards and punishes managers for performance. Such effects are not straightforward. In part, they depend on the perceived utility that decision-makers attach to prospective outcomes. Prospect theory argues that the utility of a reward depends on the recipients framing the reward as a gain or a loss, which requires a reference point (Kahneman and Tversky 1979). People are more risk-averse when perceiving themselves to be in a gain domain, and more risk-seeking when they feel themselves to be in a loss domain. There has been some empirical evidence of this in the accounting literature. Chow et al. (2007) find that higher performance standards lead to a preference for riskier projects. Drake and Kohlmeyer (2010) find that negative past performance leads to greater risk taking. Therefore, understanding how incentive systems can reframe the prospects by changing the recipient's reference point is crucial to curb risky decision-making (Tversky and Kahneman 1992).

We first discuss the introduction of a bonus cap. Holding constant the expected value of the compensation under any arrangement, we compare the effects of a scheme that includes an upper cap (maximum bonus) and a lower cap (minimum bonus) with a linear system.[1] In the linear system, the bonus could reach higher positive values, but also negative values. We call such a scheme a *high variance* bonus scheme as opposed to a *low variance* bonus scheme which is capped. Figure 1b, displays these two compensation arrangements. A bonus scheme that contains the potential of both a loss and a gain represents a mixed domain in the

[1] Our assumption is realistic, as there is little evidence that bonus caps actually lead to overall pay reductions. Reduction in bonus potential is compensated for through increased fixed pay (EBA 2013; Guardian 2013).

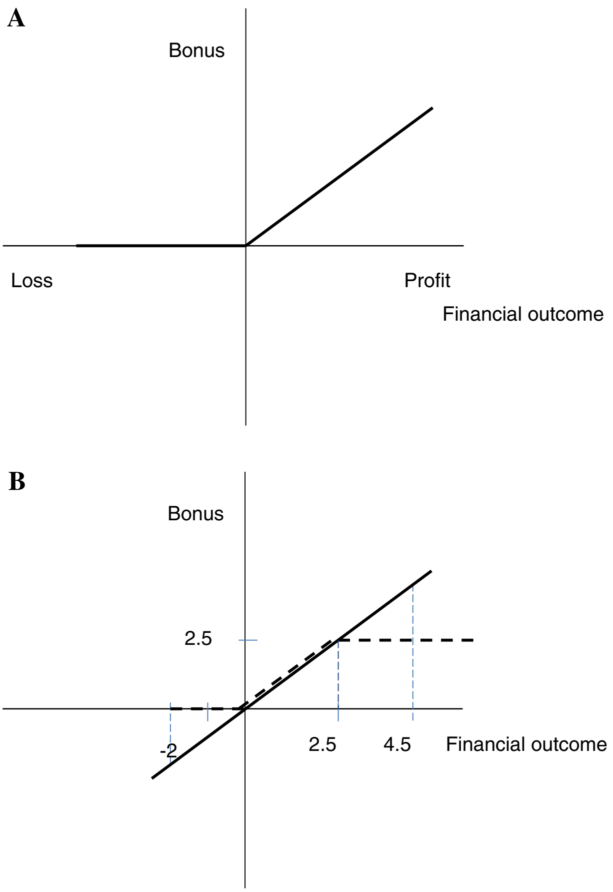


Fig. 1 **a** A traditional bonus scheme. **b** The high versus the low variance bonus scheme. *Note*: the *solid line* represents the high variance scheme and the *dashed line* represents the low variance scheme

prospect theory framework. Tversky and Kahneman (1992) predict that a mixed domain leads to even stronger risk aversion as an individual's value function is the steepest around the reference point: a risky alternative will only be accepted if the gain is considerably larger than the loss. Whether such a bonus scheme increases risk taking depends on the size of the gain it offers. If a potential gain more than offsets disutility of a potential loss, the *high variance* bonus scheme will not decrease risk taking, despite the penalty for losses. In line with these predictions we propose to test the following hypothesis:

H1 A high variance bonus scheme leads to lower risk taking than a low variance bonus scheme.

The practical enforcement of a bonus scheme that contains a negative bonus is therefore expected to be closely linked to a *deferred bonus* scheme under which losses may be reconciled with past gains. Deferred payout differs from immediate payout not only in the timing of the bonus, but also in its probability. The chances that a positive bonus earned in one period will be paid out in subsequent periods depend on performance in these later periods. Testing of the deferred bonus effect involves several periods and extends beyond the predictions of prospect theory, which is limited to static choices of risk. Introducing time into the decision framework creates new frames (Benartzi and Thaler 1999). With respect to time, framing refers to the time span that people take into account when evaluating financial outcomes: a narrow frame is taken when the financial outcome of each period is evaluated separately, and a broad frame is adopted when the cumulative financial outcomes of several periods are considered (Kahneman and Lovallo 1993; Thaler et al. 1997; Barberis and Huang 2001; Barberis et al. 2006). The behavioural finance literature suggests that short-term evaluations of investment outcomes, or so-called narrow framing, causes excessive risk aversion. This literature implies that an extended evaluation period would mitigate the effects of loss aversion on risk taking. It is claimed that less frequent evaluations help adopt a broader frame and elicit risk taking. According to this logic, the deferred bonus scheme may bring about reduced sensitivity to short-term losses and may lead to greater risk taking.

However, the deferred bonus system is less about the frequency of performance evaluation and more about differences in the timing of the bonus and its probability. We assume that agents who are subject to a deferred bonus scheme actively influence the probability of payout by choosing a less risky strategy. According to this reasoning, the deferred payment scheme may increase risk aversion. Such a strategy would mitigate future losses in order not to jeopardize deferred bonuses from earlier periods. This latter assumption seems to underlie the regulatory adoption of a deferred bonus requirement. We therefore propose to test the following hypothesis:

H2 A deferred bonus scheme leads to lower risk taking than an immediate bonus scheme.

So far, we have predicted the effect of bonus scheme characteristics in the first period. Deferral of bonuses may, however, impact not only decision-making in the first period, but also the decisions that follow later. A manager with a deferred bonus scheme has to assess the prospects in the current period, but also needs to consider that current decisions might jeopardize prior outcomes. Risk taking in an inter-temporal setting may be influenced by at least two factors: discounting of deferred gains and losses and a prior bonus balance.

Regarding the discounting of deferred outcomes, prior studies agree only that people are inconsistent when discounting deferred gains and losses (gain-loss asymmetry, Thaler 1981; Shelley 1994; Ahlbrecht and Weber 1997) and when gains and losses are evaluated in delayed and "speed-up" time frames (delay-speed-up asymmetry, Shelley 1993). This leads Green and Myerson (2004) to suggest that different cognitive processes underlie the discounting of different outcomes. Discrepancies in discount rates lead to preference reversals. It is therefore not surprising that different studies report conflicting results, and this may to some extent be attributed to specific experimental conditions.

With respect to gains and losses, Thaler (1981), Ahlbrecht and Weber (1997) and Murphy et al. (2001) find that positive outcomes are discounted more steeply than negative ones, but Shelley (1994) reports the reverse. As Green and Myerson (2004) report, there is no evidence as to whether negative outcomes are discounted less steeply than positive outcomes when both are present in the same choice situation. In other words, identifying discount rates for deferred outcomes would mean knowing the weights that are applied to deferred gains and losses in the next decision period. If losses are discounted less than gains, for example, integrating a deferred loss into the decision in the next period would result in higher disutility in comparison to the utility from the deferred gain. Understanding the valuation of deferred gains and losses at specific points in time is further complicated by the fact that discount rates are not constant over time (Musau 2009) and that they change with increasing amounts (Thaler 1981) or uncertainty (Benzion et al. 1989; Stevenson 1986; Ahlbrecht and Weber 1997).

With respect to the sign of the effects of prior outcomes on subsequent decisions, Thaler and Johnson (1990) suggest that a particular type of framing facilitates the integration of prior outcomes by shifting individuals' reference points and thus changing their risk preferences. Framing is controlled by the manner in which the decision problem is presented. As far as prior losses are concerned, Thaler and Johnson (1990) suggest that in inter-temporal gambles prior losses are not automatically integrated into decision problems, especially if the second choice does not offer the opportunity to break even. They provide evidence that a prior loss causes an increase in risk aversion. Conversely, after a gain, subsequent losses that are smaller than the original gain seem to be integrated with the prior gain, mitigating the influence of loss aversion and facilitating risk seeking. Losses that come after gains are coded as reductions in gains and do not hurt as much until prior gains are exhausted (Thaler and Johnson 1990, p. 657).

As far as integration of prior periods' outcomes is concerned, we suggest that the deferred bonus scheme should assist such integration, while for the immediate payment scheme no such effect is likely. We expect that the integration of prior outcomes into decision-making will be affected by the deferral of bonuses, such that the prior outcome effect will be more pronounced under the deferred payment scheme. On the other hand, paying bonuses immediately is more likely to create a 'cognitive cut' between periods. Deferred payment is designed to merge several payout periods and induce managers to adapt behaviour based on the cues from past evaluation reports more strongly than is the case with an immediate payment scheme in which the periods may be seen as independent. Contrary to the expectations of regulators that a deferred scheme would unequivocally decrease risk taking, we predict that in an inter-temporal setting a deferred bonus scheme will accentuate the 'prior outcome effect' such that, in line with the reasoning of Thaler and Johnson (1990) and Barberis et al. (2006), a prior gain will increase risk taking and a prior loss will decrease it. We thus formulate the following two hypotheses:

H3 Prior outcome positively affects risk taking.

H4 Prior outcome more strongly affects risk taking under a deferred bonus scheme than under an immediate bonus scheme, such that a prior unfavourable outcome decreases risk taking and a prior favourable outcome increases it.

3 Experimental setting

We used a two-by-two between-subjects experiment that involves a choice task with gain and loss as a within-subject factor. In the experiment, subjects were presented with a task in which they had to allocate assets between two alternative investments, one risky, the other risk-free. The task was repeated in a subsequent round for four possible combinations of bonus schemes. The subjects were 160 third-year undergraduate students from the University of Ljubljana, majoring in finance and accounting. Their average age was 21.5 years, and 75 % of them were female. The sample is rather unbalanced in favour of females, reflecting the gender of the students enrolled in these two programmes. We tested differences in personal risk preferences and risk taking between females and males and found them insignificant (for brevity, the results are not reported).

In the case scenario, subjects assumed the role of managers of an investment fund. Their task was to select investments with varying return and risks, but the same expected value. Their payment consisted of fixed and variable pay. Fixed pay amounted to 4 EUR, whereas variable pay depended on the outcome of the decision taken, given their bonus scheme.

Subjects were asked to make an investment of 50 million EUR to purchase shares in a company A (a risky asset) or government bonds B (a risk-free asset). Additional information provided to help subjects assess the future performance of the risky asset explained that if the economic outlook persisted at present levels, the company shares could rise by the end of the period by 9 %. If the economic outlook deteriorated, the shares could fall by the end of the period by 4 %. Depending on the choice made, the fund could either gain 4.5 million EUR or lose 2 million EUR. The probabilities for both eventualities were estimated at 50 %. The subjects were informed that the actual economic conditions would be simulated by a computer-generated random number. Alternatively, subjects could place their investment in the government bonds which could earn 1.25 million EUR of interest or a 2.5 % return, with a probability of 100 %. Subjects were asked to make two different types of choices: (1) to choose one option in which to invest the entire amount and (2) to indicate what amount they would allocate to each option if they can invest in both options.

There were two rounds to the experiment, and the same investment alternatives were presented to the subjects in the both rounds. The total compensation was based on the choice between A or B and ranged from 0 to 13 EUR, depending on their actual choice, the simulated economic conditions and their bonus scheme. A maximum fee of 13 EUR, which they could earn in about 45 min, was roughly equal to the payment they would receive for 2.5 h of part-time student work. The amounts paid ensured that students considered them high enough to be attractive. On average, a participant earned 6.7 EUR. Once participants had made their investment choice, a random number was drawn by the computer, determining the financial return for the fund and the bonus for those who had chosen option A (Fig. 2).

After the task participants completed an exit questionnaire which, in addition to asking demographic questions, checked their understanding of the scenario. We excluded 7 subjects based on manipulation checks, so the total number of subjects in the analysis was 153.

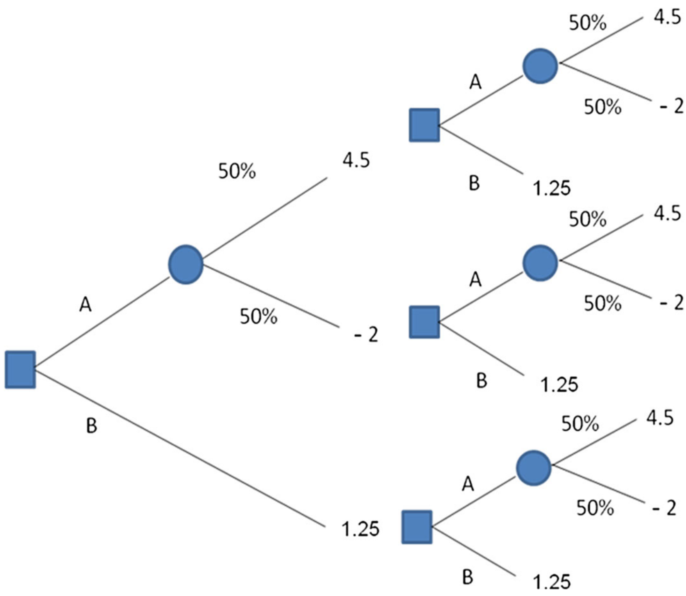


Fig. 2 The decision tree (for the high variance bonus scheme)

3.1 Independent variables

3.1.1 Two bonus characteristics

Two experimental conditions are related to the timing of bonus (immediate and deferred) and variance of bonus. Immediate and deferred bonus condition is denoted by Timing (0 immediate, 1 deferred). High and low variance bonus condition is denoted by Variance (0 high variance, 1 low variance). Participants were randomly assigned to four groups. The expected value of bonuses was held constant across all four conditions and between both investment decisions. The *immediate low variance* bonus scheme paid the bonus immediately after each round in proportion to the return, truncated negative return at zero, and capped the bonus at 2.5 EUR. The bonus for this group ranged from 0 to 2.5 EUR.

Table 1 Bonus payments for each possible set of outcomes under all schemes (Round 1, Round 2)

Fund performance	High variance immediate	Low variance immediate	High variance deferred	Low variance deferred
−2, −2	−2, −2	0, 0	0, (−2 − 2)	0, (0 + 0)
−2, 4.5	−2, 4.5	0, 2.5	0, (−2 + 4.5)	0, (0 + 2.5)
4.5, −2	4.5, −2	2.5, 0	0, (4.5 − 2)	0, (2.5 + 0)
4.5, 4.5	4.5, 4.5	2.5, 2.5	0, (4.5, 4.5)	0, (2.5, 2.5)
1.25, 1.25	1.25, 1.25	1.25, 1.25	0, (1.25 + 1.25)	0, (1.25 + 1.25)

Fixed pay amounts to 4 EUR

The *immediate high variance* bonus scheme differed in two aspects: negative bonus for a negative return for the fund and no upper cap. The bonus of this group ranged from −2 to 4.5 EUR.

Under the *deferred* scheme, the bonus was transferred to the bonus bank. Participants were told that they would be paid a bonus balance at the end of the experiment. A key aspect of a deferred scheme that may drive more conservative behaviour is that the gain from the initial period is at risk in the subsequent periods. This was incompatible with equal expected values between periods and among subgroups. The uncertainty was thus created by not telling participants how many rounds there would be and what would follow in the next round.

Investigating choices in which participants can *lose* money poses a particular problem for researchers. In prior experimental research the penalties were either hypothetical (c.g. Camerer 1995), not enforced (Schoemaker 1990), or expressed as opportunity costs withheld from the overall payment (Thaler 1981). Using hypothetical numbers, as is done in the majority of psychological experimental studies, has the advantage that a large magnitude of monetary amounts can be tested. But the concern is that decision-making on hypothetical numbers is less natural than working with real money. We use real money, yet this comes at the cost that the test is run only on small amounts. Fixed pay prevented the subjects from having to pay us money.

Figure 1 represents the lottery employed in the experiment in decision-tree format; the example given is for the *high variance* bonus scheme. Table 1 represents bonus payments for each possible set of outcomes under all schemes.

3.1.2 Prior outcome

It is important to realize that the size of the outlays involved are not factual 'gains' and 'losses' in themselves, but that they are denoted to be such, based on mental processing (Thaler 1999). We therefore coded prior outcomes as a loss (0) or a gain (1). The outcome from a non-risky asset is coded as a gain. The outcomes from a risky asset depend on the economic conditions generated by the random number. We coded a favourable outcome from both bonus schemes (i.e. 2 and 4.5 EUR) as a gain. After poor economic conditions, subjects could receive either −2 or 0 for a risky choice, depending on the bonus scheme. These outcomes were coded as a loss. Even in a low variance scheme a subject may consider the poorer of the two outcomes (0 EUR) as a loss.

3.2 Dependent variables: risk behaviour

3.2.1 Risk taking

We operationalize risk taking by the choice of the risky investment. There are two measures: the first is the *amount* of money allocated to the risky asset A in the first and the second round, and the second is the *choice* between the two investments with different outcome variance and probability of a loss (0 denotes the investment in the risky asset, 1 in the non-risky asset).

3.2.2 *Risk preference reversal*

In the second round we are interested in preference reversal as a result of the first round outcomes. We measure the dependent variable in two ways: first, as the difference in the amount allocated to the risky asset in the second round compared to the first round (DiffA2_A1). Increasingly positive value indicates that more money was invested in option A in the second round (higher risk taking). Second, we measure preference reversal as a switch in choice between options A and B in the second round. The value −1 indicates preference reversal from a non-risky choice in the first round to a risky choice in the second; value 1 indicates the reverse and value 0 indicates no change.

3.3 Control variable: personal risk preferences

Some decision-makers enjoy the challenges of risk taking and the associated returns more than others. This personal risk preference is a dispositional predictor of individual risk behaviour (Sitkin and Pablo 1992). To control for it we measure risk preferences as tolerance for ambiguity (TFA). The instrument was developed by MacDonald (1970) and asks respondents to state whether they agree or disagree with thirteen statements about ambiguous situations. An example item is ‘I do not like to work on a problem unless there is a possibility of coming out with a clear-cut and unambiguous answer.’ The instrument has been used in several previous studies (e.g., Gul 1984, 1986; Hartmann 2005; Hartmann and Slapničar 2012). The measurement items are given in the “Appendix”. The instrument may not be a perfect proxy for measuring risk preferences but we used it instead of using questions relating to the context of financial decisions to avoid testing a tautology. It is important to control whether mean differences in personal risk preferences between subgroups in various conditions are significant. This was checked with ANOVA. We find no significant impact of manipulated variables on TFA, neither among the groups or between genders (for brevity, results are not reported).

4 Results

Table 2 shows that 59.5 % of the subjects in the first round manifested risky behaviour by opting for the risky asset A. Expressed in terms of the amounts invested in A, subjects allocated on average slightly less than half of the amount available to this option (mean 24.66 million EUR) in the first round. The majority of the subjects kept to their decision also in the second round. 22 % of subjects, however, changed their preference. Overall, fewer subjects chose the risky option A (55.6 %), but on average they invested slightly more into the risky asset than in the first round (to 25.53 million EUR) (Table 3).

In hypothesis 1 we investigate whether the high variance bonus scheme decreases risk taking. 66.7 % of the subjects under the high variance scheme opted for the risky asset, compared with 52.0 % of the subjects under the low variance scheme (for brevity, crosstabs are not reported). Analysis of covariance (ANCOVA)

Table 2 Descriptive statistics, N = 153

	Amount to A, Round 1 (in EUR)	Amount to A, Round 2 (in EUR)	Subjects selecting A, Round 1 (%)	Subjects selecting A, Round 2 (%)	Preference change (%)
Mean	24.66	25.53	91 or 59.5	85 or 55.6	22
Median	25.00	25.00			
SD	11.263	14.369	49	50	41.7

Table 3 Descriptive statistics—two-by-two design

Variance	Timing	Mean	SE	95 % CI	
				Lower bound	Upper bound
High	Immediate	28.45	1.781	24.925	31.965
	Deferred	24.39	1.783	20.871	27.917
Low	Immediate	23.87	1.785	20.338	27.393
	Deferred	21.71	1.855	18.048	25.380

Dependent variable: amount allocated to risky asset A in Round 1

Note: Covariates appearing in the model are evaluated at the following value: TFA = 2.8585

Table 4 Between-subject effects

Source	Type III sum of squares	*df*	Mean square	F	Sig.
Corrected model	970.377[a]	4	242.594	1.961	.103
Intercept	3,110.020	1	3,110.020	25.137	.000
Variance	502.854	1	502.854	4.064	.046
Timing	364.957	1	364.957	2.950	.088
Tolerance for ambiguity	60.417	1	60.417	.488	.486
Variance × timing	34.462	1	34.462	.279	.598
Error	18,310.704	148	123.721		
Total	112,332.139	153			
Corrected total	19,281.081	152			

Main effects and interactions. Dependent variable: amount to risky asset A in Round 1, N = 153

[a] $R^2 = 0.050$ (adjusted $R^2 = 0.025$)

(Table 4) reveals that the outcome variance has a significant impact on the choice of the amount invested in the risky asset (F = 4.064, $p = 0.046$). The subjects on the high variance bonus scheme invested significantly more into the risky asset (A) than those on low variance scheme, despite the fact that the former could be penalized for risk taking. The result is contrary to what our hypothesis would predict. It is, however, in accordance with the finding of Tversky and Kahneman (1992) that a loss-aversion coefficient of about 2 causes a preference change from a certain to a risky prospect. In our case the amount of a gain which was 2.5 times higher than the loss effectively offset a loss and made the subjects accept the gamble. The initial endowment which covered for losses in the gamble may have contributed to this effect (Thaler and Johnson 1990).

In hypothesis 2 we propose that the deferred bonus scheme decreases risk taking. 62.8 % of the subjects on the immediate bonus scheme chose the risky asset in the first round, compared to 56 % of subjects on the deferred scheme. The difference between the *immediate* and the *deferred* scheme is marginally significant (F = 2.050, $p = 0.088$). A control variable TFA has an insignificant effect.

We also analyzed the probability that subjects would choose the risky asset A. The results of logistic regression are reported in Table 5. The significant effect of bonus variance is confirmed (b = 1.032, $p = 0.035$), whereas the impact of the deferred scheme is insignificant. The model shows no evidence of lack of fit based on the Hosmer–Lemeshow χ^2 test that is insignificant ($\chi 2 = 80.11$, $p = 0.239$) (Fig. 3).

In the third hypothesis we test the effect of prior outcome on risk taking. Figure 4 shows that very few of the subjects on the immediate bonus scheme changed their preferences regardless of prior outcome, whereas prior outcome had a considerable impact on the subjects on the deferred bonus scheme. Table 6 reports marginal means, showing the difference in the amounts invested into the risky asset A in the second round compared to the first round. In the deferred scheme the subjects who incurred a loss in the first period invested 6.3 million EUR less into the risky asset, whereas those who incurred a gain increased the investment by 3.3 million EUR, making a spread of 9.6 million EUR or 19.2 % of the amount available. Table 7 reports the results of the ANOVA on the differences in the amounts invested into the risky asset A. Prior outcome has a significant effect (F = 6.593, $p = 0.011$).

The importance of the deferred scheme becomes evident in the second round of the experiment in the interaction with prior outcome. In the fourth hypothesis we investigate whether the outcome of the first round has a stronger effect on the decision in the second round under the deferred bonus scheme. The interaction of deferred bonus scheme with the prior outcome is marginally significant in ANOVA (F = 3.722, $p = 0.056$).

The alternative analysis with multinomial logit model (reported in Table 9) which examines the preference change in the second round compared to the first round supports the results of ANOVA. Table 8 shows that in the second round

Table 5 Logistic regression

	Coef.	SE	Z	Sig.	Marginal effects
Timing	.688	.500	1.38	0.168	.164
Variance	1.032	.491	2.10	0.035	.243
Variance × timing	−.778	.678	−1.15	0.252	−.175
Tolerance for ambiguity	.305	.375	0.81	0.415	.073
Constant	−1.938	1.165	−1.66	0.096	

Dependent variable: probability of choosing risky asset A in Round 1, N = 153

Hosmer and Lemeshow test: $\chi^2 = 80.11$, sig. = 0.2397

Fig. 3 Deferred/immediate by high/low variance bonus plotted by the amount invested in the risky asset A in Round 1 (estimated marginal means of Amount A in Round 1)

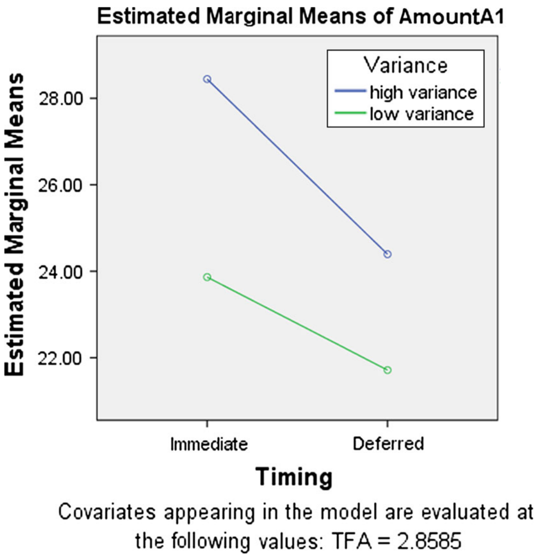
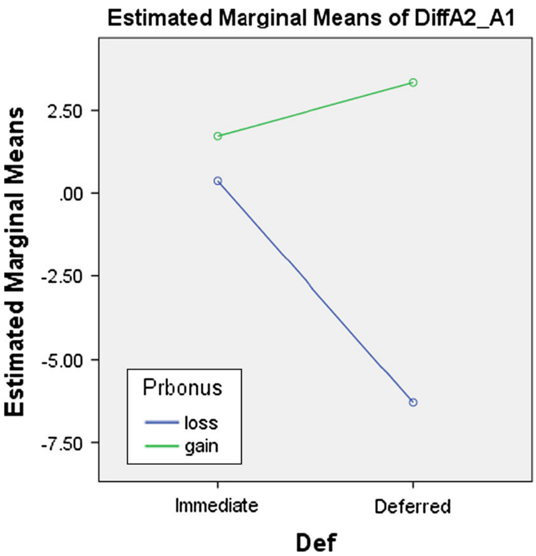


Fig. 4 Deferred/immediate bonus by economy (prior bonus) plot (dependent variable: difference in the amounts invested in the risky asset A in Round 2 compared to Round 1, DiffA2_A1)



9.2 % of the subjects chose a more risky option, 13.1 % a less risky option, and 77.8 % made no change. Our analysis focuses on the factors that made 22.2 % of the subjects change their preferences. The variables explain the choices asymmetrically: a prior outcome does not explain subjects' less risky behaviour on its own, but in interaction with deferred bonus (b $= -3.368$, $p = 0.012$). In other words, prior outcome combined with deferred bonus negatively affects less risky

Table 6 Descriptive statistics for the difference in amounts invested in risky asset A in Round 2 compared to Round 1, N = 153

Timing	Prior outcome	Mean	SE	95 % CI	
				Lower bound	Upper bound
Immediate	Loss	.364	2.574	−4.723	5.451
	Gain	1.732	1.614	−1.456	4.921
Deferred	Loss	−6.304	2.518	−11.279	−1.329
	Gain	3.333	1.674	.025	6.642

Table 7 Between-subjects effects

Source	Type III sum of squares	*df*	Mean square	F	Sig.
Corrected model	1,546.624[a]	3	515.541	3.536	.016
Intercept	6.080	1	6.080	.042	.838
Timing	203.721	1	203.721	1.397	.239
Prior outcome	961.229	1	961.229	6.593	.011
Timing × prior outcome	542.595	1	542.595	3.722	.056
Error	21,724.076	149	145.799		
Total	23,386.889	153			
Corrected total	23,270.700	152			

Main effects and interactions. Dependent variable: difference in amounts invested in risky asset A in Round 2 compared to Round 1, N = 153

[a] $R^2 = 0.066$ (adjusted $R^2 = 0.048$)

behaviour. Prior bonus has a significantly positive effect on more risky behaviour (b = 14.467, $p = 0.000$), while the effect is not significant in the interaction with deferred bonus. The results imply that the subjects who have had a prior gain are more likely to revert to more risky behaviour in the next round, irrespective of the timing of the bonus. Deferred bonus as a main effect is significantly negatively associated with risky behaviour in the second round (the coefficient for more risky behaviour is: b = −0.571, $p = 0.067$ (significant at 10 %), and for less risky behaviour: b = 1.759, $p = 0.019$).

5 Discussion

Our findings suggest that the high variance scheme promotes high variance investments, despite the potential for a loss. And, vice versa, risk taking is mitigated by the low variance scheme. The question is whether the result is attributable to the method of analysis or whether it can be generalized? According to prospect theory (Kahneman and Tversky 1984; Tversky and Kahneman 1992) subjects accept risk taking only if a gain is considerably larger than a loss. In our experiment the gain was 2.5 times higher than the loss, somewhat above the break-even point suggested

Table 8 Descriptive statistics on preference change (Prefchange) in Round 2: decision to invest to risky asset A in Round 2—decision to invest to risky asset A in Round 1

	N	Marginal percentage (%)
Preference change		
−1 (more risky)	14	9.2
0 (no change)	119	77.8
1 (less risky)	20	13.1
Timing		
Immediate	78	51.0
Deferred	75	49.0
Prior outcome		
Loss	45	29.4
Gain	108	70.6
Valid	153	100.0
Missing	0	
Total	153	
Sub-population	4	

Table 9 Multinomial logistic regression

Preference change	Coef.	SE.	z	Sig.	Marginal effects
More risky (−1)					
Timing	−0.671	0.367	−1.83	0.067	−0.002
Prior outcome	14.467	0.470	30.78	0.000	0.117
Timing × prior outcome	0.671	0.686	0.98	0.328	0.002
Constant	−16.305	0.232	−70.42	0.000	
Less risky (1)					
Timing	1.759	0.751	2.34	0.019	0.149
Prior outcome	−0.329	0.783	−0.42	0.674	−0.037
Timing × prior outcome	−3.368	1.348	−2.5	0.012	−0.218
Constant	−1.846	0.623	−2.96	0.003	

Dependent variable: preference change in Round 2 compared to Round 1, N = 153

The reference category is 0 (unchanged), goodness of fit test: $\chi^2 = 2{,}114.23$, $p = 0.000$

by Tversky and Kahneman. This implies the importance of the relative weightings of negative and positive bonuses: if a positive bonus or other forms of compensation substantially outweigh a negative bonus, penalty may not have any effect. However, it has to be recognized that experiments are susceptible to initial endowment effect—in our case, the fixed pay might have compensated for losses (Thaler and Johnson 1990).

Recent survey findings support the conclusions from our experiment. Examining a non-banking sector, Sanders and Hambrick (2007) find that CEO stock options—which are to a certain extent similar to the high variance bonus scheme—lead to higher variance investments and more extreme performance outcomes. DeYoung et al. (2013), investigating US commercial banks, also report that the high wealth incentives embedded in CEO compensation contracts are strong determinants of bank risk taking.

Our second hypothesis was related to the deferred bonus payment: the underlying assumption is that a manager whose bonus is deferred and contingent on the performance of subsequent periods will become more risk-averse in order to protect future bonus payouts. We do not find conclusive evidence relating to deferred bonus, although the signs are in line with our expectations. The impact of deferred payment is only marginally significant in the first round. Understanding deferred bonus effects warrants further investigation with a more powerful design, one which takes into consideration various other aspects of deferred bonuses that may further complicate the implications for incentives. A deferred bonus system brings about a smoothing effect which may dilute the effect on risk taking. If, for example, one third of a year's bonus is deferred to an escrow account and one third of bonus balance is paid out, the payout becomes less sensitive to performance fluctuations and may then be perceived as more or less constant. In other words, after an initial vesting period a constant flow of rewards follows. Executives will weigh up the value of unvested rewards versus the potential to gain new rewards. To the best of our knowledge, these issues have not yet been explored in the literature. The findings from equity-based pay research are controversial, and despite the fact that equity-based pay incorporates deferred pay, the implications may not be directly transferrable to a deferred bonus system.

The relevance of deferred payment is shown in the second round. The significant interaction between deferred payment and prior outcomes supports the interpretation that the prior outcome effect is exacerbated under a deferred payment scheme. Participants with deferred bonus payment became more risk-averse if they had experienced a loss in the earlier round and more risk-seeking if they had experienced a gain. No such effect is found for immediate payment. This suggests that deferred bonus payment facilitates integration of prior outcomes and adoption of broader frames. As suggested by Thaler and Johnson (1990, p. 659), the implication of this finding to the real world may mean that "managers of profitable enterprises, flushed with initial successes, will become more risk seeking". We find that they may become also risk-averse, but, all in all, that these inclinations may be pro-cyclical.

The validity of our findings needs to be weighed in relation to their limitations. These are attributable to the method of analysis. The experimental method is useful for isolating effects from those that could confound them and for predicting behaviour under conditions that cannot be easily found or accessed in the real world. The typical limitation of this approach, which limits also the validity of our findings, is that the choices elicited relate only to small amounts of money and the subjects are protected against negative outcomes. Another feature that distinguishes this experiment from a real-life setting is the manipulation of economic conditions over which the subjects had no control. While managers also have little or no control over the economic conditions, they assess these conditions and make informed decisions. Our subjects could not do so. However, the care with which we organized the experiment means that its results cannot be explained solely by randomness.

6 Conclusion

Bonuses in banks have created serious controversy and public upheaval since the beginning of the financial crisis. In the recent past, banks operated beyond their lending capacity, creating a lending bubble. Annual bonuses for bank executives for performance in which incurred but not expected losses are considered have led to bonus payouts reaching many multiples of the base salary. This is strikingly different to bonuses in other public companies that are capped at one or two times salary. Leaving aside the question of fairness extant literature stresses that dysfunctional risk behaviour can stem from excessively risk-stimulating compensation schemes for managers (DeYoung, Peng and Yan 2013). In an attempt to remove such incentives in the future, the European Commission adopted a set of bonus restrictions to be applied in all EU countries by the beginning of 2014. However, pay distribution is remarkably different across banking sectors (investment and retail) and across countries (see the European Banking Authority report on the high earners, 2013). Consequently, the new measures will have much bigger impact in some banking sectors and countries than in others.

As one function of a remuneration package is also to attract the most talented managers, there is a considerable resistance to the measures in the banks with the highest bonuses (particularly in the UK). Some recent disclosures in the financial press on executive compensation in the large European banks (Bowers et al. 2013) indicate that compensation structures are already being altered such that managers will be compensated for an increased exposure to pay risk as a result of the new measures with other forms of compensation (i.e. flexible salaries or increased fixed salaries). It is therefore debatable whether the new measures will bring any reductions at all in the compensation levels.

In this paper we investigate the effects of negatively framed, capped and deferred bonus schemes, focusing on cognitive biases that might be created by changing the framing of the compensation scheme. All in all, our results support the notion that different bonus schemes affect cognitive frames of a decision-maker, which in turn affect risk-taking behaviour.

Our results contribute to the current discussion on how to design compensation packages that will reduce risk taking in the financial sector. They suggest that potential losses will not prevent risk taking if the manager is shielded from negative results. The finding that prior outcome effect is stronger with a deferred bonus scheme may also have some important implications for practice. Any compensation design that will not deal with this effect is likely to contain a risk of pro-cyclicality that may induce excessive risk taking in expansion of the economy and excessive risk aversion in recession. Great care is needed in implementing general recommendations to defer bonuses and to introduce negative bonuses. These two measures alone may not bring the intended results unconditionally, but may do so when combined with other measures which were not part of this study, such as accentuated reliance on risk indicators, more intensive prudential monitoring and independent risk management (Hilb 2011).

Our results were obtained in an experiment, and the question arises as to whether they would hold for managers whose bonuses are many times larger and who are taking into account factors other than monetary compensation. An empirical investigation of this effect would be very valuable, but would only be possible once the new remuneration system is in place in a large number of institutions. Future studies could usefully complement the present study by exploring real-life settings, using methods other than experiments and observing the behaviour of managers rather than students.

Another research direction that might be taken from here would be to systematically explore the reference points that managers use in forming utility judgments and to identify how they change their judgements over time according to their compensation regimes. The characteristics of performance evaluation, probability and the timing of the compensation payouts play a major role in changing the frames that managers take in their decision-making and influence their propensity to risk. This may be a final area worthy of further research.

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Appendix

Control variable

Personal risk preference was measured as a tolerance for ambiguity (MacDonald (1970)).

For each of the following questions, respondents were asked to indicate their level of agreement with the statements on a five-point Likert scale (1 = completely disagree, 2 = I disagree, 3 = neutral, 4 = I agree 5 = completely agree). TFA score was calculated as an average of all items.

I’m just a little uncomfortable with people unless I feel that I can understand their behaviour	1	2	3	4	5
There is a right way and a wrong way to do almost everything	1	2	3	4	5
I get pretty anxious when I am in a social situation over which I have no control	1	2	3	4	5
It bothers me when I am unable to follow another person’s train of thought	1	2	3	4	5
I have always felt that there is a clear difference between right and wrong	1	2	3	4	5
It bothers me when I do not know how other people react to me	1	2	3	4	5

If I were a doctor, I would prefer the uncertainties of a psychiatrist to the clear and definite work of a surgeon. (Reverse)	1	2	3	4	5
Vague and impressionistic pictures really have little appeal for me	1	2	3	4	5
If I were a scientist, it would bother me that my work would never be completed because science will always make new discoveries	1	2	3	4	5
Before an examination, I feel much less anxious if I know how many questions there will be	1	2	3	4	5
Sometimes I rather enjoy going against the rules and doing things I am not supposed to do. (Reverse)	1	2	3	4	5
I do not like to work on a problem unless there is a possibility of coming out with a clear-cut and unambiguous answer	1	2	3	4	5
I like to fool around with new ideas, even if they turn out later to be a total waste of time. (Reverse)	1	2	3	4	5

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