Coordination under Loss Contracts*

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Abstract

In this paper we study the effects that loss contracts—prepayments that can be clawed back later—have on group coordination when there is strategic uncertainty. We investigate the choices made by experimental subjects in a minimum effort game. In control sessions, incentives are formulated as a classic gain contract, while in treatment sessions, incentives are framed as an isomorphic loss contract. Our results show that loss contracts reduce the minimum efforts of groups and worsen coordination between group members, both leading to lower payoffs. However, these results depend strongly on the group's gender composition; groups with a larger proportion of women are better at coordinating and exert more effort.

Keywords strategic uncertainty, loss aversion, coordination, contract design, framing, experiment

JEL Classification C91 · D84 · G11 · G41

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1 Introduction

Coordination is an important aspect of many organizational settings. In those contexts, a single member's decision can impact the firm's business process. This is apparent in assembly lines or just-in-time inventory systems but also applies to other less obvious settings, such as the timely revision of a scientific paper or the recent problems of the EU to meet the Covid-19 vaccination schedule.[1]

In such settings, having all members of a team coordinate on a high effort can be complicated, as individuals face a trade-off: while exerting more effort might result in higher productivity, such effort might be wasted if someone else along the chain (the "weakest link") is not keeping up to speed. One way to mitigate this coordination failure is to increase the monetary benefits from coordination (Brandts and Cooper, 2006); yet, this measure is expensive. A recent cost-effective suggestion to increase effort is the use of so-called loss contracts (e.g., Hossain and List, 2012), where individuals receive a prepayment which is clawed back if they do not meet certain productivity targets.

The intuition for the application of loss contracts rests on the presence of loss aversion: since losses loom larger than gains, loss-averse individuals will work harder to avoid losing a dollar than to gain an additional dollar (e.g., Hossain and List, 2012; Fryer Jr et al., 2012; Imas et al., 2017). However, this intuition relies on a series of restrictive assumptions. For example, most of the previous literature on loss contracts assumes that higher levels of effort guarantee a higher payoff or unambiguously reduces the probability of a clawback. This assumption might hold for some individual decision-making situations but is not realistic in many setups that require groups to coordinate. In a situation with strategic uncertainty (e.g., when productivity relies on the weakest link), the interaction between loss aversion and risk aversion might backfire and induce individuals to exert lower effort.

As shown in Pierce et al. (2020), if the effort strategies of individuals cannot be ordered following a first-order stochastic dominance criteria, then loss contracts might have perverse effects and drive individuals to reduce their efforts. The reason for this is that when losses loom larger than gains, the uncertainty of outcome-related losses might also loom larger than the potential gains, pushing individuals toward low effort "loss-minimizing" strategies. Relatedly, Armantier and Boly (2015), De Quidt (2017), and

[1] In the latter case, the slow delivery of vaccines by AstraZeneca resulted in a substantial delay in the vaccination targets that the EU had set for 2021 (European Comission, 2021).

De Quidt et al. (2017) show that the introduction of loss contracts might have ambiguous effects on effort provision.

Against this background, we study how loss contracts affect coordinated efforts within groups when strategic uncertainty is present. To do so, we design a between-subject experiment in which subjects play multiple rounds of the "minimum effort game" (Van Huyck et al., 1990), also known as the "weakest link" game (e.g., Knez and Camerer, 1994; Riedl et al., 2016). As in a production chain, in this setup each subject's payoff depends on her own effort and the lowest effort of all group members. To study the effects of loss contracts, we set up two treatments: a control group with a "classic" gain contract and a treatment group with an isomorphic payoff function framed as a loss contract. Because the only difference between both treatments is how the payoffs are presented, any change in subjects' behavior can be attributed to the *framing* of the payoff function (Tversky and Kahneman, 1981).

We find that sessions with loss contracts result in lower group productivity compared to sessions with gain contracts. We also find that loss contracts worsen coordination among group members, which is reflected in a higher variance of the groups' effort choices. The combination of higher variance and lower effort levels under loss contracts results in substantially lower payoffs in these sessions. Additionally, our results show that groups with a larger proportion of females exert higher minimum effort levels, coordinate better, and obtain higher payoffs.

Our study contributes to the literature on the effects of negatively framed incentives. While this literature is rich in the effect of loss contracts on individual worker effort (e.g., De Quidt et al., 2017; Imas et al., 2017; DellaVigna and Pope, 2018; Pierce et al., 2020), to the best of our knowledge, only a few papers have studied the effects that such contracts have on group coordination. In a field experiment, Hossain and List (2012) study the effects of loss contracts on group productivity and show that loss contracts increase group productivity. However, in their experiment, there is no strategic uncertainty.[2] Hong et al. (2015) study the effect of loss contracts with competing groups at the same factory as Hossain and List (2012) and find that groups incentivized with loss – instead of gain – contracts are more likely to win the contest.

[2]As explained on page five of the article, a subset of groups worked around belt lines with a speed that the group could alter or worked around guide rails with a fixed speed. It is unclear if strategic uncertainty existed in the two remaining groups (G3 and G4), but the results for these groups are mixed.

In the laboratory, Iturbe-Ormaetxe et al. (2011) study the effects of framing using different thresholds in a public goods game. Cachon and Camerer (1996) study *loss avoidance* and forward induction (implicit communication about subjects' expectations) as an equilibrium selection refinement in median and minimum effort games. Hamman et al. (2007) study the effect of imposing a penalty or bonus conditional on specified outcomes, while Brandts and Cooper (2006) look at the effect that reducing previous bonus payments has on coordination. However, all of these laboratory experiments have different focuses and, with several behavioral aspects at play, they cannot isolate the effects of negatively framed incentives on group effort and coordination.

Our contribution is to use a controlled laboratory experiment to study the effects of loss contracts on group coordination and productivity. We show that the effectiveness of loss contracts is context-dependent and can backfire in environments with strategic uncertainty, which is common in many organizational settings.

The paper is organized as follows. Section 2 presents our experimental design. Section 3 presents the experiment's results. Section 4 discusses the results. Finally, Section 5 concludes.

2 Experimental Design

2.1 Experimental Setup

We design a between-subjects experiment with two treatments: a gain contract and a loss contract. In both cases, subjects are divided into groups of six and simultaneously decide how much effort to exert in each given round. Subjects' payoffs decrease in their own effort and increase in the minimum effort chosen across all subjects in the group. Formally,

$$\Pi(e_i, e_{min}) = ae_{min} - be_i + C, \tag{1}$$

where e_i is the effort of subject i, e_{min} is the minimum effort across all subjects n in the group, a and b are parameters such that $a - b > 0$, and C is a constant to avoid negative payoffs. The parametrization follows Van Huyck et al. (1990), with $a = 20$ points, $b = 10$ points, and $C = 60$ points. At the end of the experiment, the exchange rate is of €1 for every 70 points, which is comparable to the rate in Engelmann and Normann (2010) and Leng et al. (2018). The game is played for ten consecutive rounds, maintaining the

	Gain Contract						
	Minimum Choice within Group						
	7	**6**	**5**	**4**	**3**	**2**	**1**
7	130	110	90	70	50	30	10
6		120	100	80	60	40	20
5			110	90	70	50	30
4				100	80	60	40
3					90	70	50
2						80	60
1							70

	Loss Contract						
	Minimum Choice within Group						
	7	**6**	**5**	**4**	**3**	**2**	**1**
7	–10	–30	–50	–70	–90	–110	–130
6		–20	–40	–60	–80	–100	–120
5			–30	–50	–70	–90	–110
4				–40	–60	–80	–100
3					–50	–70	–90
2						–60	–80
1							–70

Table 1: Payoff tables presented to subjects. In both cases, rows represent own effort and columns represent the group's minimum effort. The left panel shows the gain contract treatment where subjects see their final payoff in points, and the right panel shows the loss contract table. Here, points are subtracted from subjects' initial endowment (140) and not from final payoffs.

same group composition. After each round, subjects receive feedback about the group's minimum effort and the resulting payoff. After the ten rounds, we elicit several personality traits from our subjects. First, we measure subjects' cognitive ability using the CRT (Frederick, 2005), CRT2 (Thomson and Oppenheimer, 2016), and eCRT (Toplak et al., 2014) questions. Then we elicit their risk aversion, ambiguity aversion, and loss aversion through modifying the multiple price lists used in Rubin et al. (2017). Finally, subjects answer the short version of the Big Five personality traits suggested by Rammstedt and John (2007) and state their gender.

Our treatment is implemented through the framing of the payoffs. In the gain contract treatment, subjects are presented with the payoffs resulting from Equation (1), as depicted in the left panel of Table 1. The vertical axis of the payoff table denotes the effort choice of an individual subject i. The horizontal axis denotes the smallest effort level among subject i's group members. In the loss contract treatment, subjects are presented with isomorphic contracts that work through framing (Tversky and Kahneman, 1981). Subjects are endowed with 140 points before each round and are presented with the right panel of Table 1. Importantly, this second table does not represent a subject's final payoffs but the outcomes of all subjects' joint actions. To calculate the payoffs for each set of actions, subjects need to subtract the resulting outcome from their per-round endowment of 140 points. This is made clear in the instructions.

The experimental setup is designed to increase the strategic uncertainty of subjects. For example, in both panels of Table 1, the values presented are either all positive or all negative. By avoiding mixed gain-loss payoff tables as in Cachon and Camerer (1996) and Armantier and Boly (2015) or zeros as in Hamman et al. (2007), we prevent focal points.[3] Additionally, we do not allow peer-monitoring as is in Brandts and Cooper (2006), and unlike Cachon and Camerer (1996), we require *every* group member to increase their effort to reach a higher group payoff.

Given the high strategic uncertainty in our setup, we hypothesize that loss contracts will result in lower group minimum effort compared to gain contracts. The intuition behind this prediction follows from Pierce et al. (2020), who show that in an environment where the results from increasing effort are non-deterministic, loss contracts might backfire. In such setups, loss aversion modifies the risk tolerance of workers, pushing them towards lower effort levels if this can offset their exposure to losses. Since, in our experiment, a higher effort increases the chance of higher payoffs but *also* the loss exposure of subjects, we expect sufficiently loss averse individuals to trade off a lower effort level for a reduction in their loss exposure.[4]

2.2 Experimental Procedure

The experiment was run at two different points in time (Spring 2019 and Spring 2021). The first series of sessions was run at the Experimental Economics Laboratory of the Technische Universität Berlin and it consisted of four sessions with gain contracts and four with loss contracts. The second series of sessions was run online and, again, it consisted of four sessions with gain contracts and four with loss contracts.[5] In each session, we randomly divided subjects into 3 groups of 6 subjects for a total of 24 independent groups per treatment. The total number of subjects is 288, with the number of subjects equally divided across online and on-site sessions. Importantly, the subjects for both types of sessions came from the TU-WZB Experimental Economics Laboratory subject

[3] Cachon and Camerer (1996) show that in minimum effort games with negative and non-negative outcomes, the latter act as focal points with subjects avoiding losses by ignoring all strategies that result in negative outcomes. By showing only positive or negative values, we can exclude such *loss avoidance* as an equilibrium selection principle.

[4] Note that such a "loss-minimizing" strategy is closely related to the "loss-avoidance" strategies as observed in Cachon and Camerer (1996). Furthermore, since the adoption of such a 'loss-minimizing' strategy by a single group member is sufficient to pull down group productivity, loss exposure is most salient in such weakest-link environments.

[5] The reason for running sessions online was the onset of the COVID-19 pandemic, which forced most laboratories to close down.

pool, were recruited using ORSEE (Greiner, 2015), and used the same software based on z-Tree (Fischbacher, 2007). For the online sessions, the software was distributed using z-Tree Unleashed (Duch et al., 2020). Sessions run in the laboratory lasted less than one hour, with average earnings of €12.74 while those run online lasted around 90 minutes and the average payoff was of €20.07.[6]

3 Results

3.1 Minimum Effort

Figure 1 shows for each treatment the average minimum effort of all groups for each period (black dots), along with their 95% confidence intervals (vertical lines). The treatment effect is clear: under loss contracts the average minimum effort of groups is consistently lower than under gain contracts. A Mann-Whitney U test across treatments comparing the average effort of each group across all ten rounds confirms such differences (p-value = 0.047).

In Figure 2 we present the minimum choice of each group in each period (thin gray lines) for both the online (dashed) and laboratory sessions (solid) as well as the mean minimum effort across all groups in each period (thick red line). Underlying such lines, a heat map displays darker colors if more groups have a minimum effort at that value. The figure suggests that the difference across treatments comes from a faster convergence to the lowest minimum effort under loss contracts than under gain contracts. A Mann-Whitney U test of the average effort made by each group for the first five and the last five rounds confirms the asymmetric dynamics across treatments (p-value = 0.067 and p-value = 0.014, respectively).[7]

To study the data in a more disaggregated way, in Table 2 we present a random effects model with the per-group minimum effort (*periodmineffort*) for each period as the

[6]The difference in time needed for online and offline sessions is due to the ID-checking protocol used in the TU-WZB Experimental Economics Laboratory of the Technische Universität Berlin for online sessions. Because identification of the subjects (ID check via webcam) required privacy, each subject was admitted sequentially into a private zoom room. To compensate for the extra time, all subjects are paid an extra "participation fee" of €7 on top of the regular €5 "show-up" fee, which explains the difference in payoffs.

[7]In Table 13 of Appendix E we present a breakdown of the choices of each group across the first and last five periods of the session. The table is complemented by a boxplot representing all the minimum effort choices across groups and treatments for the first and last five periods of the session in Figure 7.

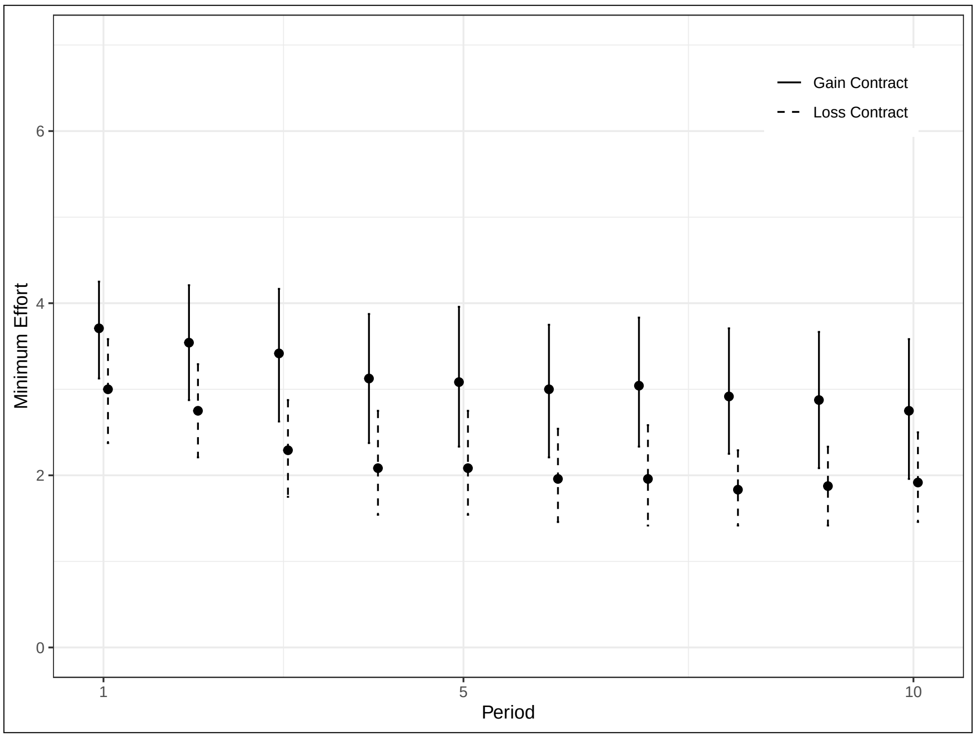


Figure 1: Summary of all minimum efforts per period across treatments. The figure presents the average minimum effort (black dot) and its bootstrapped 95% confidence interval (dashed line for loss contracts, solid line for gain contracts) per treatment.

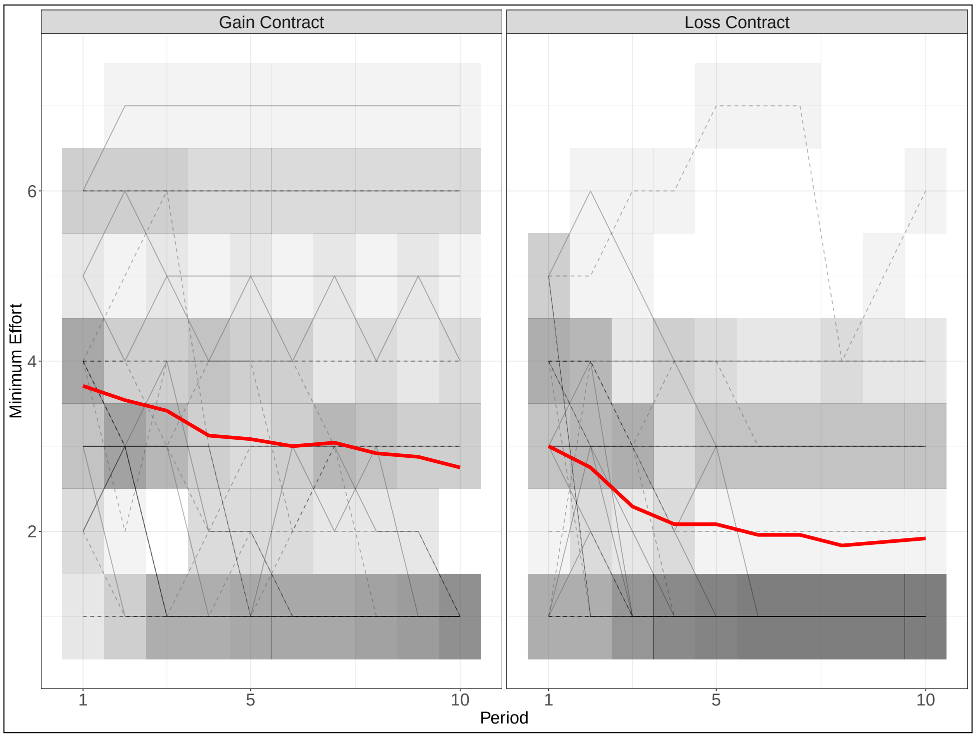


Figure 2: Summary of all minimum efforts per period across treatments. For both treatments, the thin gray lines represent the minimum effort played in each group, and the thick red line is the mean of this minimum effort. The dashed lines are for the online sessions and the solid lines for laboratory sessions. Underlying we use a heat map which has a darker color when there are more groups with a minimum effort at that value.

	(1)	(2)	(3)
	periodmineffort	*periodmineffort*	*periodmineffort*
loss_contract	-0.971**	-1.119**	-1.130***
	(0.441)	(0.433)	(0.412)
online	0.088	-0.977*	-1.070**
	(0.441)	(0.517)	(0.501)
female_ratio		3.480***	4.409***
		(1.116)	(1.098)
avg_risk_av		-0.521**	-0.590***
		(0.220)	(0.213)
avg_loss_av		-0.056	-0.069
		(0.163)	(0.164)
avg_ambiguity_av		-0.012	-0.063
		(0.177)	(0.203)
avg_crt		0.305**	0.234
		(0.146)	(0.153)
constant	3.102***	4.719**	8.366**
	(0.450)	(2.292)	(4.140)
Big Five Ratios	No	No	Yes
N	480	480	480

Standard errors in parentheses

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

Table 2: Analysis of the Minimum effort of groups across rounds using a random effects GLS. In columns (1) to (3) we regress the individual payoffs for each subject on the dummies for the loss contract (*loss_contract*) and online sessions (*online*), along with the average personality measures of the group (Column (2)) and the average values of the Big Five (Column (3)). All standard errors are clustered at the group level. For session level clustered errors, see Table 6 in Appendix B.

dependent variable. In column (1) we use two dummies. The first one takes a value of 1 if the session had loss contracts (*loss_contract*) and zero otherwise, while the second (*online*) takes a value of 1 if the session was run online and zero otherwise. In column (2) we control for the ratio of females per group (*female_ratio*) and the average value of different personality traits (e.g., *avg_risk_av* is the mean value of the risk aversion across all subjects of a group). Finally, in column (3) we include the average score of all subjects in the group for the Big Five personality traits. The controls used in Table 2 do not present any mulitcollinearity problems and the distribution of characteristics is balanced across treatments (see Appendix A for a further discussion on the different control measures). In all models, the errors are clustered at the group level. To address any concerns about session level effects, in Appendix B we reproduce all the tables in the main text with errors clustered at the session level. The results are qualitatively identical in all cases.

The results in Table 2 show that loss contracts have a negative effect on the minimum effort of groups, reducing the minimum effort by approximately 1 effort level on average. This effect is significant at the 1% level (p-value = 0.010 for column (2) and p-value = 0.006 for column (3)) and consistent with the treatment effects observed in Figure 1. Therefore, from all of the results presented in this section, we conclude that loss contracts result in a lower minimum effort of groups.

Result 1: A loss contract results in a lower minimum effort of groups.

Table 2 also shows that the gender composition of groups has a strong effect on their minimum effort. The more females are in a group, the higher is the minimum effort exerted. In addition, while average risk, loss, and ambiguity aversion all have a negative coefficient, only average risk aversion has a significant effect on the group's minimum effort. Further, once we control for all other group characteristics, online sessions result in lower group minimum effort. The effect of online sessions might be attributed to a larger degree of "mistrust" and anonymity among subjects in comparison to laboratory sessions.

Since the minimum effort game is extremely sensible to a single subject's decision, one could conjecture that the subjects with the most extreme personality traits were driving the results rather than the group average. To test this, in Table 14 of Appendix

E we replicate Table 2 using the most extreme personality values within each group as independent variables. The results are similar across both tables. Additionally, if we look at the *individual* effort levels of subjects and their *individual* personality measures, only the treatment dummy is statistically significant (see Table 9 in Appendix C).

3.2 Coordination

In this section, we analyze how loss contracts affect subjects' coordination within groups. Within-group coordination is important as a larger within-group dispersion of efforts result in more "wasted efforts" and, therefore, in lower efficiency.

To study such effects, in columns (1) to (3) of Table 3, we regress the variance of all effort choices, across all rounds, for each group (*var*) on a dummy for loss contracts (*loss_contract*), a dummy for online sessions (*online*), the ratio of females in each group (*female_ratio*), and the average value of the different personality traits. In columns (4) to (6), we use a random effects model in which the dependent variable is the variance within each group for each period (*var_t*) using the same controls. In both cases, loss contracts result in higher within-group effort variance.

Result 2: A loss contract results in less coordination (larger variance) of effort choices within groups.

As in Table 2, group composition strongly influences how groups behave. The groups with a higher share of females and the groups with higher average CRT have less dispersed effort levels. In addition, it seems that groups with larger average loss aversion coordinate less.[8]

3.3 Payoffs

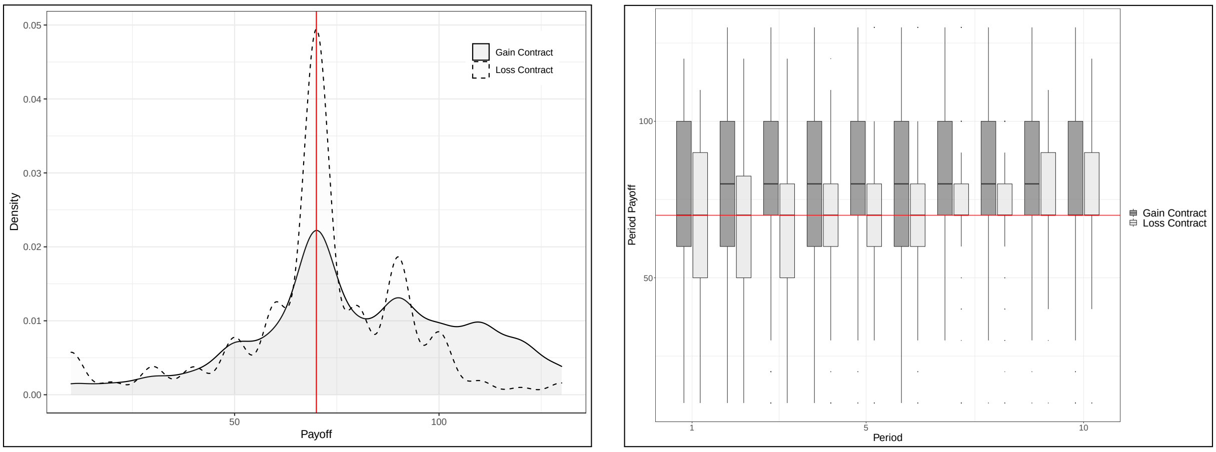
In this section, we analyze how loss contracts affect subjects' payoffs. To do so, in the left panel of Figure 3 we plot the density of the per-period payoff of all subjects across both treatments. The figure shows that the payoff distribution for gain contracts is skewed towards the higher payoffs (right of the graph), while the payoffs for loss contracts

[8] In Appendix D we investigate how personality traits affect the way subjects react to the observed minimum effort of their group. None of the explanatory variables (including the dummy for loss contracts) seem to have any effect on how subjects respond or best-respond to their groups' effort levels.

	OLS			Random Effects GLS		
	(1)	(2)	(3)	(4)	(5)	(6)
	var	*var*	*var*	*var_t*	*var_t*	*var_t*
loss_contract	1.063**	1.183**	1.248**	0.445	0.632**	0.590***
	(0.481)	(0.485)	(0.470)	(0.289)	(0.254)	(0.203)
online	-0.450	0.199	0.423	-0.121	0.149	0.152
	(0.481)	(0.615)	(0.680)	(0.289)	(0.312)	(0.311)
female_ratio		-2.999**	-4.702***		-1.274*	-1.861**
		(1.415)	(1.558)		(0.751)	(0.736)
avg_risk_av		0.027	0.198		-0.014	0.008
		(0.292)	(0.304)		(0.169)	(0.166)
avg_loss_av		0.162	0.109		0.173*	0.220***
		(0.168)	(0.188)		(0.094)	(0.079)
avg_ambiguity_av		-0.026	0.024		-0.116	-0.028
		(0.246)	(0.253)		(0.121)	(0.122)
avg_crt		-0.234	-0.101		-0.262***	-0.185**
		(0.167)	(0.172)		(0.081)	(0.087)
constant	2.518***	3.649	-1.798	1.575***	3.318**	-0.983
	(0.417)	(2.593)	(4.942)	(0.258)	(1.326)	(2.002)
Big Five Ratios	No	No	Yes	No	No	Yes
N	48	48	48	480	480	480

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Analysis of the aggregate variance in effort choices using OLS and random effects GLS. In columns (1) to (3) we regress the variance of all effort choices, across all rounds, for each group on the personality measures of each group using OLS. In columns (4) to (6) we use a random effects model where the dependent variable is the variance within each group for *each period* while controlling for each group's composition. All standard errors are clustered at the group level. For session level clustered errors, see Table 7 in Appendix B.



(a) Payoffs across Treatments

(b) Payoffs per Period

Figure 3: Payoffs. The left panel presents the density plots of all payments across treatments. The right panel disaggregates the data by period and treatment.

concentrate around the risk-dominant equilibrium payoff (i.e., 70 experimental units), which is marked with a red vertical line.[9] Moreover, in the right panel of Figure 3 we plot subjects' payoffs for each period. The panel shows that the median payoff is 70 experimental units *in every single period* under loss contracts, while it is greater than 70 in most periods under gain contracts. Another interesting feature of the right panel in Figure 3 is how the variance in payoffs seems to decrease faster under loss contracts as the experiment advances.

To quantify the effects of loss contracts on payoffs (*payoff*), in Table 4 we present a random effects models studying the effects of contract framing and group composition on payoffs. The models confirm our above result; a loss contract is detrimental to subjects' payoffs.

Result 3: A loss contract results in lower payoffs.

Consistent with our previous results, we find significant gender effects for payoffs, so that groups with a higher share of females see significantly higher individual payoffs for all group members. On the other hand, neither online sessions nor the shares of risk, ambiguity, or loss aversion have explanatory power over payoffs.

[9]There are other combinations by which a subject might get 70 experimental units. However, exerting the minimum effort is the only way a subject can guarantee these 70 experimental units.

	(1)	(2)	(3)
	payoff	*payoff*	*payoff*
loss_contract	-10.47**	-12.86**	-12.98***
	(5.243)	(5.125)	(4.796)
online	0.826	-10.51*	-10.96*
	(5.243)	(6.097)	(5.719)
female_ratio		37.81***	50.10***
		(13.39)	(13.83)
avg_risk_av		-4.421	-5.355*
		(2.841)	(2.927)
avg_loss_av		-1.574	-1.633
		(1.841)	(1.833)
avg_ambiguity_av		0.179	-0.357
		(2.103)	(2.471)
avg_crt		4.164**	3.100*
		(1.736)	(1.838)
constant	79.98***	88.05***	144.4***
	(5.438)	(26.48)	(48.30)
Big Five Ratios	No	No	Yes
N	2880	2880	2880

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: Analysis of the individual payoff of subjects across rounds using a random effects GLS. In columns (1) to (3) we regress the individual payoffs for each subject on the dummies for the loss contract (*loss_contract*) and online sessions (*online*), along with the average personality measures of the group (Column (2)) and the average values of the Big Five (Column (3)). All standard errors are clustered at the group level. For session level clustered errors, see Table 8 in Appendix B.

4 Discussion

Our results show that contract framing has an effect. By manipulating how we present the payoff tables to subjects, sessions with loss contracts had lower minimum effort levels, less coordination within groups, and lower payoffs. This is in contrast with most of the previous literature where loss contracts had either a positive effect on individual effort (e.g., Hannan et al., 2005; Imas et al., 2017) or helped groups coordinate better (Hossain and List, 2012). However, unlike these previous cases, in our setup subjects face loss contracts under strategic uncertainty.

As shown in Pierce et al. (2020), relaxing the assumptions made in the previous literature and implementing loss contracts in a stochastic context can backfire. This is because stochastic loss contracts present a risk-reward trade-off that pushes loss-averse individuals to avoid any exposure to losses by taking a low-risk low-productivity strategy.[10] In our setup, such conservative strategies push subjects towards the risk-dominant equilibrium, which results in the race to the bottom we observe in the data.

In this paper, we try to pin down the mechanism that drives our results, but we cannot identify a robust behavioral pattern across groups. While we do not detect an effect of the average loss aversion of groups on the group minimum effort, we do find a strong negative effect of the group average risk aversion: The higher the average risk aversion, the lower the minimum effort of the group. However, when zooming in at the individual characteristics of subjects, risk aversion does not explain individual effort levels, nor the response of subjects to the observed minimum effort of the group.[11] Gender is the only individual and group characteristic that plays a strong role across our measures. The higher the number of females, the higher the minimum effort and coordination levels of a group. Additionally, females achieve significantly larger payoffs than males. Because of the strong, and unexpected, effects of gender, in Appendix F we study in depth the effects of loss contracts on gender. The results show that the gender differences come mostly from the different way in which females confront loss contracts, especially in the second half of the experiment.

[10] Note that Cachon and Camerer (1996) also identify loss avoidance as an influential behavior selection principle.

[11] Similarly, we cannot detect any significant effects of individual levels of loss aversion on the behavior of subjects.

One reason we cannot fully identify a behavioral pattern in the data is that subjects are making decisions in a *group*. This group interaction can introduce other complementary explanations to the low effort we observe, such as social preferences (Charness and Rabin, 2002) or the willingness to punish low effort contributors (Fehr et al., 2002). After all, it is likely that the negative externality of other subjects' actions (i.e., their low effort) is more salient when framed as a loss.[12] Such salience would explain why we see a much faster drop in effort levels under loss contracts than under grain contracts.

The influence of groups is also reflected in the negative impact of online sessions on the minimum effort of groups (see Table 2). This is consistent with the results from Chen and Li (2009) who show that low group identity leads to a deterioration in coordination. Based on social distance theory (Akerlof, 1997), the higher anonymity of online sessions translates into lower group identity. This is also supported by Charness et al. (2007) who find that reducing social distance leads to higher trust and reciprocity. Finally, the subjects' lack of familiarity with loss contracts might also be contributing to our results. Since loss contracts are not common, subjects might be unsure about how other subjects react to them, adding an extra layer of complexity that increases the strategic uncertainty of the setup. In a similar way that an increase in the size of groups increases the strategic uncertainty in experiments (Weber, 2006; Heinemann et al., 2009), the lack of subjects' familiarity with loss contracts might push subjects towards playing safer options.

5 Conclusion

From assembly line settings to the management of a global pandemic, the final outcome of many collaborations might depend on the weakest link. Yet, coordination on high effort is complicated (Devetag and Ortmann, 2007). It has been suggested that one way of increasing the effort in the workplace is to present incentives as loss contracts (Hossain and List, 2012).

The literature studying loss contracts is large and points toward such contracts weakly increasing worker productivity in the field (e.g., Hossain and List (2012), Fryer Jr et al. (2012), and Hong et al. (2015)) and in the laboratory (e.g., Armantier and Boly (2015), De Quidt (2017), and Hannan et al. (2005)). However, in all these cases, workers know

[12]If subjects are loss averse, low-effort behavior by other subjects will result in a bigger disutility under loss-framed contracts than gain contracts.

that higher effort will result in a higher probability of keeping the salary (or bonus). Such a straightforward relationship between effort and final payoffs might not resemble many organizational settings which exhibit strategic uncertainty

In this paper, we create an environment of coordination under strategic uncertainty by implementing a minimum effort game (Van Huyck et al., 1990) in the laboratory. Laboratory experiments have proven to be a useful way to test the effects of different work environments and contracts schemes (Charness and Kuhn, 2011; Charness and Fehr, 2015; Herbst and Mas, 2015). They allow for full control of the environment and policies can be 'pre-tested' at a low cost (Plott, 1987), potentially avoiding multi-million losses (as, e.g., shown by Pierce et al., 2020).

Our results show that, unlike most of the previous literature, loss contracts reduce the effort of subjects. Such a drop in effort has strong welfare effects, leading to higher within-group effort variance and lower payoffs. While our main result is robust, we cannot trace the behavior of subjects to a single behavioral trait. We interpret the divergence between our results and those of previous studies as a word of caution: Loss contracts cannot be judged on their own, but need to be evaluated in the context of their environment. Some settings might favor the introduction of loss contracts but, in other cases, implementing claw back policies might lead to destructive results.

Given the mostly positive outcomes reported in the literature, one would expect to see loss contracts implemented often. However, these are rare. This might be because many jobs require interactions with colleagues, contract partners, or service providers under strategic uncertainty, an environment in which loss contracts are likely to backfire. Thus, the negative results of our experiment can help explain why loss contracts are not commonly observed in the field.

Another point of interest of our experiment are the strong gender effects we observe. Groups with a larger proportion of females have higher minimum effort levels, are more coordinated, and thus have higher payoffs. These results seem to be driven mostly by gender differences in the loss contract sessions (see Appendix F). To our knowledge, we are the first to report gender effects under loss contracts. Furthermore, the previous literature on games with strategic complements reports that gender has no effect on the degree of coordination among experimental subjects (e.g., Dufwenberg and Gneezy, 2005; Heinemann et al., 2009; Engelmann and Normann, 2010; Di Girolamo and Drouvelis, 2015).

Therefore, we also contribute to this literature by presenting evidence that the previously reported gender neutrality in games with strategic complements does not generalize to loss contracts.

To conclude, we study the effects of loss contracts in an environment with strategic uncertainty. Contrary to much of the previous literature, we show that if we relax some common assumptions, loss contracts can be detrimental and result in lower effort and coordination. Such results appear to be driven by the reluctance of subjects to expose themselves to losses and can help explain why loss contracts are not seen more often in the field.

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A Balanced Randomization

In Figure 4 we present the density plots for all the personality measures across treatments. The distributions look very similar, showing that the randomization of subjects into the different treatments resulted in a balanced distribution of characteristics. A series of Mann-Whitney U tests confirms that there are no statistical differences for personality across treatments. The only exception is the number of correctly answered CRT questions where those subjects in the loss sessions answered correctly a higher number of questions (Mann-Whitney U p-value = 0.017). It is also interesting to note that the correlation between the different personality measures is low (see Figure 5).

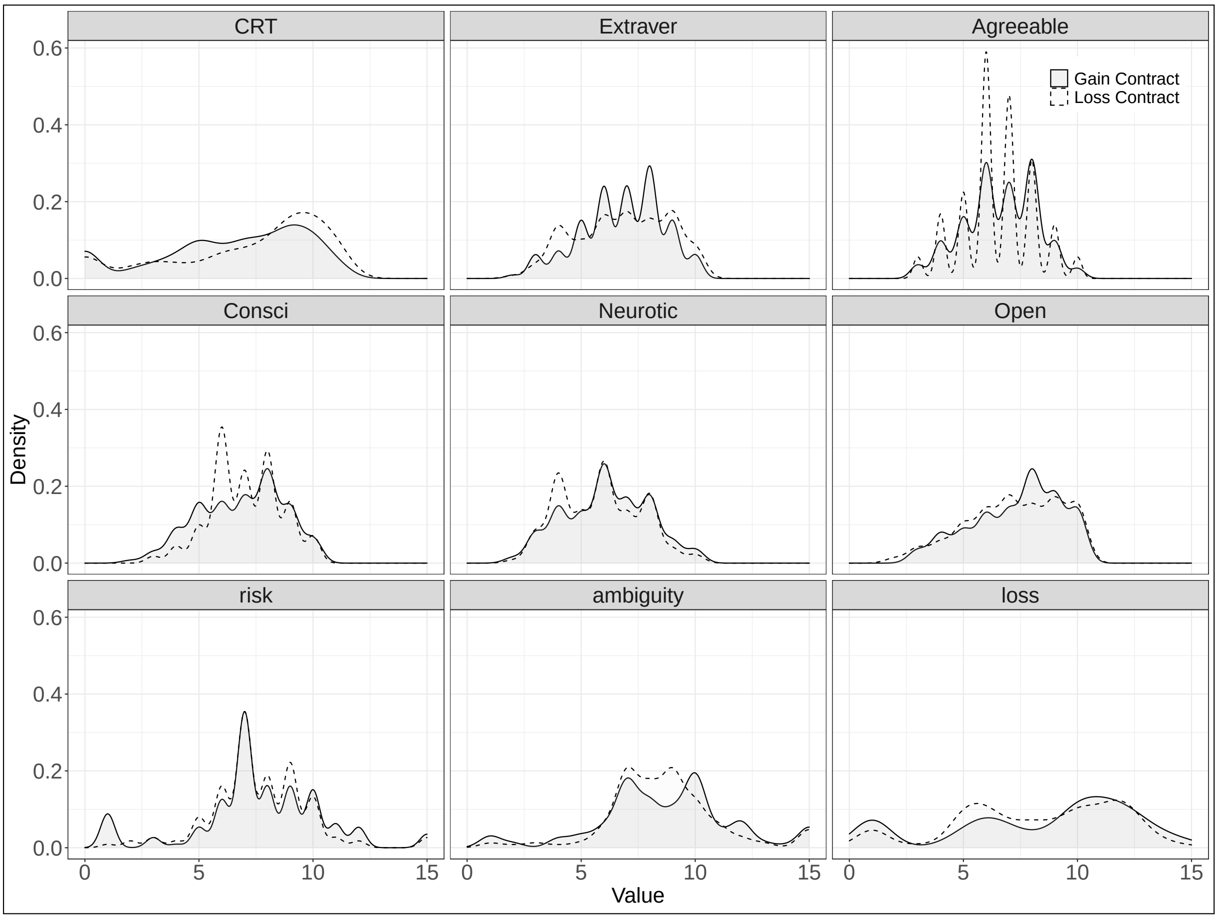

Figure 4: Density plots of each measure used as control for each treatment.

Finally, when looking at gender, the proportion of females across treatments is very similar. In control we have 63/144 females (∼43%), while in treatment we have 59/144 (∼41%). A detailed breakdown of the number of males and females across sessions is

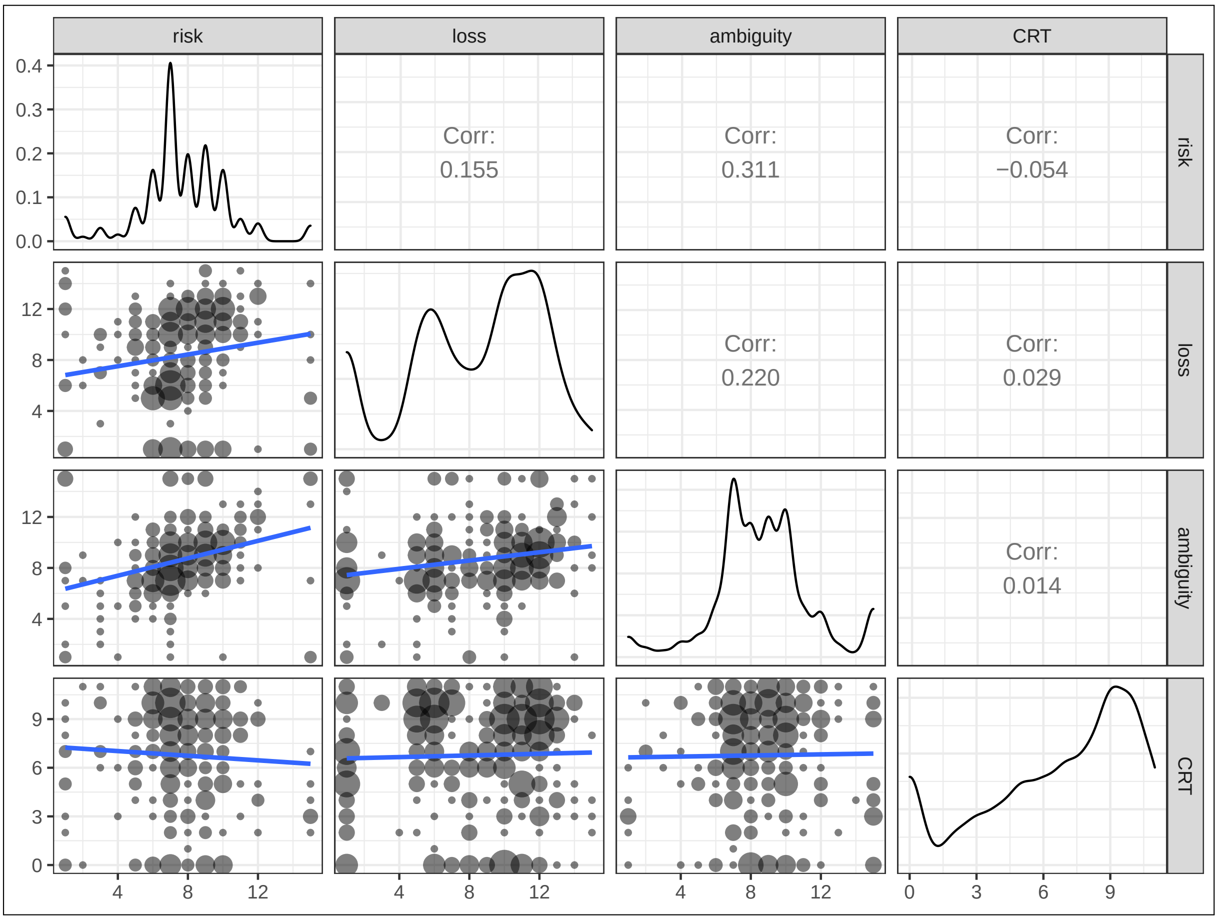

Figure 5: Correlations across different personality measures (risk aversion, loss aversion, ambiguity, and CRT score). In the diagonal we plot the density estimates for each measure. The lower triangle shows a scatter plot between each pair of measures, while the upper triangle shows the Pearson correlation ρ.

provided in Table 5. A test of proportions finds no statistical differences in the number of females across the two treatments (p-value $= 0.634$).

Gain Contract			**Loss Contract**		
Session	Male	Female	Session	Male	Female
In Laboratory			In laboratory		
1	10	8	1	7	11
2	12	6	2	15	3
3	11	7	3	12	6
4	12	6	4	15	3
Total	*45*	*27*	*Total*	*49*	*23*
Online			Online		
5	11	7	5	11	7
6	9	9	6	9	9
7	9	9	7	8	10
8	7	11	8	8	10
Total	*36*	*36*	*Total*	*36*	*36*

Table 5: Number of males and females per session. On the left we present the number of males and females per session in gain contract treatment. On the right we present the number of males and females per session in the loss contract treatment. In total 166 males and 122 females participated in our experiment.

B Wild-Block-Bootstrap Tables

In this section we replicate Table 2, Table 3, and Table 4 clustering the errors at the session level.

	(1) *periodmineffort*	(2) *periodmineffort*	(3) *periodmineffort*
loss_contract	-0.971**	-1.119**	-1.130***
	(0.467)	(0.493)	(0.429)
online	0.088	-0.977	-1.070
	(0.476)	(0.713)	(0.820)
female_ratio		3.480***	4.409***
		(1.207)	(1.248)
avg_risk_av		-0.521*	-0.590*
		(0.306)	(0.320)
avg_loss_av		-0.056	-0.069
		(0.206)	(0.216)
avg_ambiguity_av		-0.012	-0.063
		(0.212)	(0.213)
avg_crt		0.305*	0.234
		(0.185)	(0.184)
constant	3.102***	4.719*	8.366*
	(0.609)	(2.693)	(4.673)
N	480	480	480
Big Five Ratios	No	No	Yes

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Analysis of the Minimum effort of groups across rounds using OLS. In columns (1) to (3) we regress the individual payoffs for each subject on the dummies for the loss contract (*loss_contract*) and online sessions (*online*), along with the average personality measures of the group (column (2)) and the average values of the Big Five (Column (3)). All wild block bootstrap standard errors are clustered at the session level. For group level clustered errors, see Table 2.

	OLS			Random Effects GLS		
	(1)	(2)	(3)	(4)	(5)	(6)
	var	*var*	*var*	*var_t*	*var_t*	*var_t*
loss_contract	1.063**	1.183***	1.248***	0.445	0.632**	0.590***
	(0.403)	(0.407)	(0.389)	(0.324)	(0.302)	(0.219)
online	-0.450	0.199	0.423	-0.121	0.149	0.152
	(0.312)	(0.459)	(0.518)	(0.336)	(0.366)	(0.432)
female_ratio		-2.999**	-4.702***		-1.274*	-1.861**
		(1.225)	(1.134)		(0.680)	(0.936)
avg_risk_av		0.027	0.198		-0.014	0.008
		(0.348)	(0.324)		(0.265)	(0.215)
avg_loss_av		0.162	0.109		0.173**	0.220***
		(0.176)	(0.172)		(0.082)	(0.063)
avg_ambiguity_av		-0.026	0.024		-0.116	-0.028
		(0.188)	(0.205)		(0.121)	(0.098)
avg_crt		-0.234	-0.101		-0.262***	-0.185**
		(0.163)	(0.171)		(0.096)	(0.090)
constant	2.518***	3.649**	-1.798	1.575***	3.318***	-0.983
	(0.388)	(1.606)	(3.152)	(0.404)	(1.141)	(1.781)
Big Five Ratios	No	No	Yes	No	No	Yes
N	48	48	48	480	480	480

Standard errors in parentheses

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

Table 7: Analysis of the aggregate variance in effort choices using OLS. In columns (1) to (3) we regress the variance of all effort choices, across all rounds, for each group, on the personality measures of each group. In columns (4) to (6) we use a random effects model where the dependent variable is the variance within each group for *each period* while controlling for each group's composition. All wild block bootstrap standard errors are clustered at the session level. For group level clustered errors, see Table 3.

	(1)	(2)	(3)
	payoff	*payoff*	*payoff*
loss_contract	-10.47*	-12.86**	-12.98**
	(6.131)	(6.212)	(5.346)
online	0.826	-10.51	-10.96
	(6.266)	(9.259)	(10.449)
femrale_ratio		37.81**	50.10***
		(15.330)	(17.744)
avg_risk_av		-4.421	-5.355
		(4.290)	(4.465)
avg_loss_av		-1.574	-1.633
		(2.196)	(2.429)
avg_ambiguity_av		0.179	-0.357
		(2.706)	(2.698)
avg_crt		4.164*	3.100
		(2.410)	(2.401)
constant	79.98***	88.05***	144.4**
	(8.015)	(31.677)	(57.551)
N	2880	2880	2880
Big Five Ratios	No	No	Yes

Standard errors in parentheses

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

Table 8: Analysis of the individual payoff of subjects across rounds using OLS. In columns (1) to (3) we regress the individual payoffs for each subject on the dummies for the loss contract (*loss_contract*) and online sessions (*online*), along with the average personality measures of the group (column (2)) and the average values of the Big Five (column (3)). All wild block bootstrap standard errors are clustered at the session level. For group level clustered errors, see Table 4.

C Individual effort provision

Table 9 presents a random effects model of subjects' individual effort ($effort_{i,t}$) across all periods t. The standard errors are clustered at the group level. Unlike Table 2, in Table 9 the independent variables are individual personality measures and not group averages. The findings of Table 9 complement and confirm the results of Table 2. Loss contracts do not only lower the *minimum* effort of groups, they also decrease subjects' individual effort levels. However, in contrast to Table 9 we do not detect a significant effect of gender or online sessions on individual effort levels or on any other personality measures.

	(1)	(2)	(3)
	effort	*effort*	*effort*
loss_contract	-0.895**	-0.922**	-0.908**
	(0.390)	(0.389)	(0.388)
online	0.0924	-0.0367	0.00958
	(0.390)	(0.383)	(0.377)
female		0.229	0.290*
		(0.158)	(0.172)
risk_av		-0.0480*	-0.0506
		(0.0292)	(0.0327)
loss_av		-0.0287	-0.0286
		(0.0235)	(0.0251)
ambiguity_av		-0.0195	-0.0212
		(0.0304)	(0.0315)
crt		0.0349	0.0290
		(0.0283)	(0.0283)
constant	4.207***	4.726***	5.316***
	(0.370)	(0.522)	(1.067)
Big Five	No	No	Yes
N	2880	2880	2880

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: Column (1)-(3): Analysis of the individual effort provision using a random effects GLS. In columns (1) to (3) we regress the individual effort levels for each subject on the dummies for loss contract (*loss_contract*) and online sessions (*online*) along with the individual personality measure (column (2)) and the individual values of Big Five (column (3)). All standard errors are clustered at the group level.

D Response to Observed Minimum Effort

To understand better the dynamics within groups, in this section we examine the way subjects react to the last observed minimum effort of the group. To do this, we define the variable $response_{i,t}$, which measures the difference between the effort exerted by subject i in period t ($effort_{i,t}$) and the minimum effort of the group g in period $t-1$ ($minimum_{g,t-1}$). Formally:

$$response_{i,t} = effort_{i,t} - minimum_{g,t-1}. \tag{2}$$

If the value of $response_{i,t}$ is above zero, then subject i has played an effort level above last period's group minimum effort ($minimum_{g,t-1}$), trying to push the effort level of the group upwards. If $response_{i,t}$ takes a value below zero, then it means the subject undercut the effort level of her group, playing a lower effort than that observed in the previous period. Finally, if $response_{i,t}$ takes a value of zero, then subject i is best-responding to the last observed minimum effort level of the group.

Table 10 shows the results of an OLS regression (column (1) to (3)) using only data for the second period of the experiment and a random errors GLS (column (4) to (6)) for periods 2 to 10.[13] The dependent variable in both cases is $response_{i,t}$. In line with the regression on individual effort provision (Table 9), the results indicate that none of personality traits can significantly explain the behavior of subjects. Further, against our previous results, loss contracts do not seem affect on the response of subjects.

In Table 11 we use a logit model to study the likelihood that subjects *best respond* to the last minimum effort played by the group. The dependent variable is $best\_response_{i,t}$, which takes a value of 1 if the subject exerts the same level of effort as the minimum effort of its group in the previous period (i.e., if $effort_{i,t} = minimum_{g,t-1}$) and of 0 otherwise. In columns (1) to (3) we present a logit using only the data for period $t = 2$. In columns (4) to (6) we present a random effects model for all periods $t > 2$. We cannot detect any personality traits on the likelihood to best respond to the last observed minimum effort of the group. Only the dummy for online sessions seems to have explanatory power, with online sessions increasing the likelihood to best respond to the group minimum effort of

[13] We are especially interested in period $t = 2$ because it is the first period with feedback of the groups' behavior.

	OLS (t=2)			**Random Effects GLS** (t>1)		
	(1)	(2)	(3)	(4)	(5)	(6)
	response	*response*	*response*	*response*	*response*	*response*
loss_contract	0.264	0.256	0.263	0.0324	0.0379	0.0504
	(0.297)	(0.297)	(0.292)	(0.126)	(0.124)	(0.119)
online	-0.153	-0.143	-0.0556	0.0262	-0.00312	-0.0204
	(0.297)	(0.324)	(0.330)	(0.126)	(0.128)	(0.131)
female		-0.297	-0.213		-0.0747	-0.128
		(0.220)	(0.252)		(0.0710)	(0.0886)
risk_av		-0.0130	-0.0183		-0.00940	-0.00797
		(0.0388)	(0.0389)		(0.0200)	(0.0200)
loss_av		0.00215	0.00992		-0.0161	-0.0205*
		(0.0346)	(0.0349)		(0.0109)	(0.0117)
ambiguity_av		-0.0252	-0.0226		-0.0177	-0.0160
		(0.0391)	(0.0395)		(0.0156)	(0.0155)
crt		-0.00218	-0.00989		-0.0156	-0.0131
		(0.0309)	(0.0321)		(0.0118)	(0.0119)
constant	1.750***	2.188***	3.459***	0.880***	1.388***	0.842*
	(0.227)	(0.619)	(1.001)	(0.102)	(0.220)	(0.454)
Big Five	No	No	Yes	No	No	Yes
N	288	288	288	2592	2592	2592

Standard errors in parentheses

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

Table 10: Analysis of the response of subjects. In columns (1) to (3) we use an OLS regression to analyze the response of subjects to the minimum effort of the group observed in period one. In columns (4) to (6), we regress the response of subjects across all periods using random effects GLS. We regress response on the dummies for loss contract (*loss_contract*) and online sessions (*online*) along with the individual personality measure (column (2) & (5)) and the individual values of Big Five (column (3) & (6)). All standard errors are clustered at the group level.

period $t = 1$. As in Table 10, the treatment dummy (*loss_contract*) is not statistically significant.

	Logit (t=2)			**Random Effects Logit** (t>1)		
	(1) *best response*	(2) *best response*	(3) *best response*	(4) *best response*	(5) *best response*	(6) *best response*
loss_contract	0.181	0.201	0.212	0.250	0.257	0.253
	(0.297)	(0.301)	(0.307)	(0.276)	(0.273)	(0.266)
online	0.727**	0.957***	0.919***	-0.0896	0.0345	0.0792
	(0.297)	(0.326)	(0.344)	(0.274)	(0.278)	(0.283)
female		-0.187	-0.251		-0.148	-0.113
		(0.327)	(0.355)		(0.174)	(0.181)
risk_av		0.104	0.105		0.0302	0.0287
		(0.0693)	(0.0691)		(0.0302)	(0.0329)
loss_av		0.0110	0.00552		0.0240	0.0306
		(0.0460)	(0.0489)		(0.0256)	(0.0279)
ambiguity_av		0.0736	0.0724		0.0511	0.0537
		(0.0603)	(0.0603)		(0.0335)	(0.0343)
crt		-0.0405	-0.0381		-0.000228	-0.00462
		(0.0398)	(0.0416)		(0.0290)	(0.0285)
constant	-1.918***	-3.260***	-4.017**	0.00575	-0.868	-0.136
	(0.275)	(1.037)	(1.578)	(0.259)	(0.548)	(0.920)
Big Five	No	No	Yes	No	No	Yes
N	288	288	288	2592	2592	2592

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: Analysis of the response of subjects. In columns (1) to (3) we use a logit regression to analyze whether a subject played a best response to the minimum effort of the group observed in period one. In columns (4) to (6), we conduct a random effects logit regression across all periods to investigate whether subjects best responded to the observed minimum of the previous period. We regress the dummy variable *best response* on the dummies for loss contract (*loss_contract*) and online sessions (*online*) along with the individual personality measure (column (2) & (5)) and the individual values of Big Five (column (3) & (6)). All standard errors are clustered at the group.

To have a better understanding of the undercutting behavior of subjects, Table 12 displays the frequencies of the variable $response_{i,t}$ per period. The table shows a clear convergence of *response* towards 0. This convergence comes both from the positive and negative side of the table. Interestingly, Table 12 also shows that only a minority of subjects ever pick an effort level below the last observed minimum effort of the group. Out of the 2,880 decisions made across all periods and sessions, only 74 responses were below the observed $minimum_{g,t-1}$. Since some subjects repeatedly went below the observed $minimum_{g,t-1}$, in total, only 53 out of the total 288 subjects (18%) ever undercut their last observed group minimum.[14] On the other hand, a substantial amount of subjects pick effort values above the last observed minimum.

Gain Contract										
	Period									
Response	2	3	4	5	6	7	8	9	10	Total
-3	0	0	1	0	0	0	0	0	0	1
-2	3	3	2	2	1	0	1	1	0	13
-1	5	3	3	1	4	2	4	1	6	29
0	**26**	**47**	**49**	**73**	**76**	**85**	**89**	**96**	**103**	**644**
1	38	45	50	37	31	30	33	29	18	11
2	29	16	20	13	16	14	11	5	8	132
3	27	12	9	10	8	6	3	6	2	83
4	7	11	4	6	3	3	2	3	1	40
5	7	5	2	1	1	4	0	2	4	26
6	2	2	4	1	4	0	1	1	2	17
Total	144	144	144	144	144	144	144	144	144	1296

Loss Contract										
	Period									
Response	2	3	4	5	6	7	8	9	10	Total
-4	2	0	0	0	0	0	0	0	0	2
-3	1	1	0	0	0	0	1	0	0	3
-2	0	2	1	0	2	0	0	0	0	5
-1	3	8	5	2	2	0	0	0	0	20
0	**30**	**38**	**58**	**69**	**86**	**97**	**106**	**108**	**113**	**705**
1	31	43	38	40	32	32	23	23	17	279
2	26	11	13	13	8	4	3	5	7	90
3	25	18	11	10	5	4	5	6	3	87
4	9	13	7	6	2	2	1	1	1	42
5	3	6	4	1	3	0	2	0	0	19
6	14	4	7	3	4	5	3	1	3	44
Total	144	144	144	144	144	144	144	144	144	1296

Table 12: Frequency of responses to the group minimum effort of the previous period for period 2 to 10. The upper (lower) panel presents the number of times that each frequency of responses under gain contracts, whereas the A response of zero (in bold) corresponds to the best response.

The descriptive behavior observed in Table 12 could explain the variance observed in

[14]An analysis like that of Table 11 of those subjects that undercut their group (not presented) reveals no statistically significant personality traits of these subjects.

Table 3. Because subjects are seldom willing to undercut their groups' past minimum behavior ($minimum_{g,t-1}$), this value acts as a *de facto* lower bound for their choices. This is confirmed in Figure 6, where we present the boxplots for each level of $minimum_{t-1}$ across both treatments. The level of dispersion of responses is greater the lower the group's minimum. In other words, groups that reach high minimum effort values present little variance in the response of its components. Because the minimum effort of groups drops faster under loss contracts, this "wider" space for the subject to pick effort levels translates into higher variance, more wasted efforts, and contributes to the lower payoffs reported in Section 3.3.

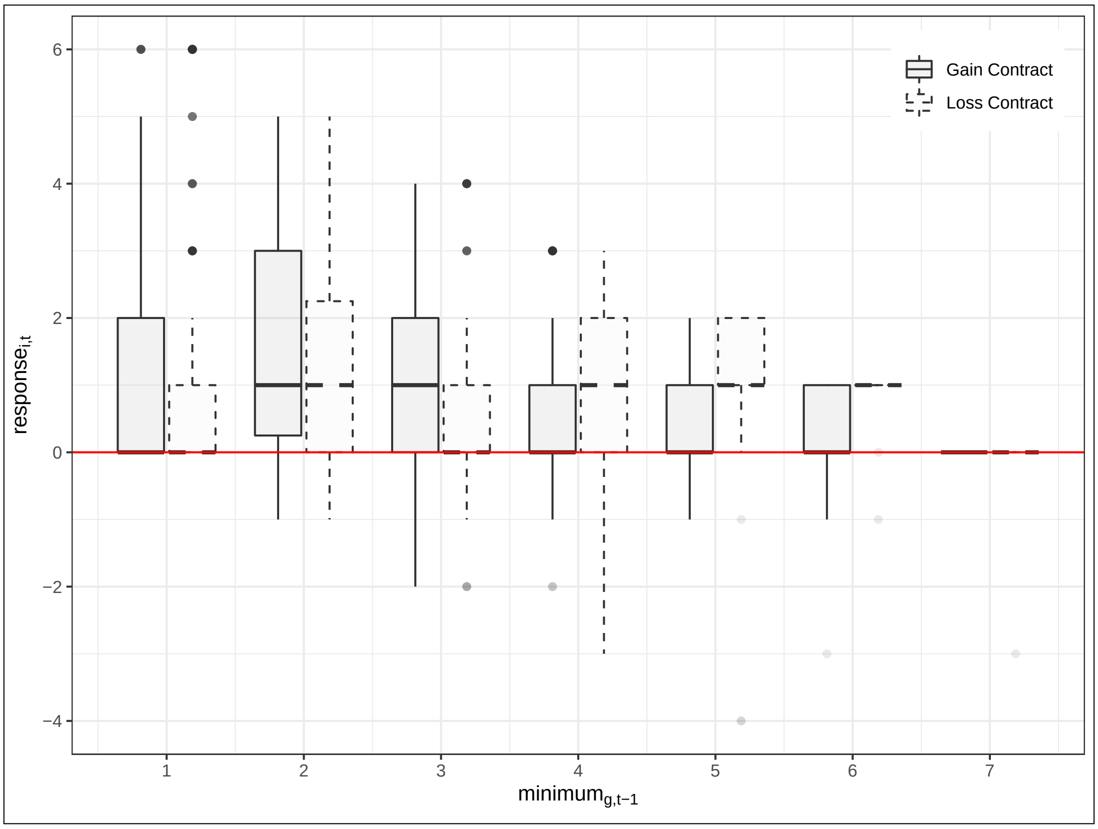

Figure 6: Comparison ($response_{i,t}$) ($gminimum_{i,t-1}$).

E Extra Figures & Tables

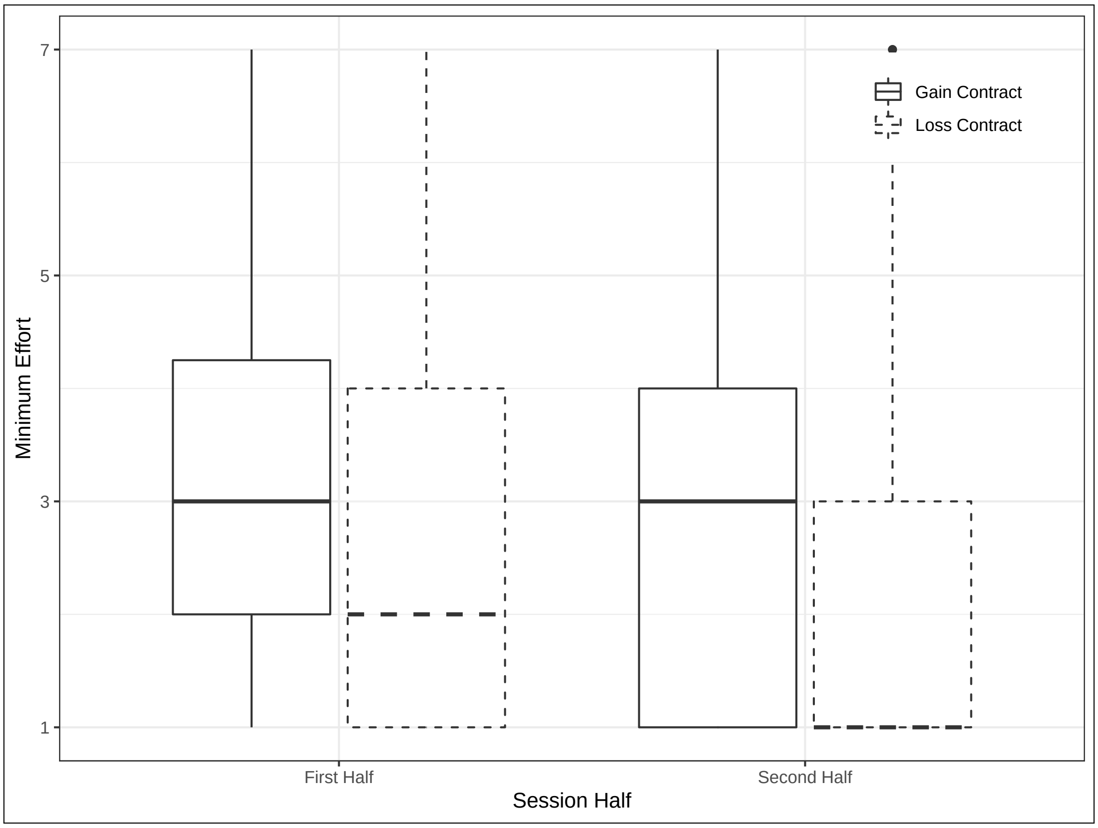

Figure 7: Comparison of the distribution of minimum efforts across treatments for the first and second half of the experiment.

Gain Contract											
	Period										
Minimum effort	1	2	3	4	5	6	7	8	9	10	Total
1	2	4	7	7	8	8	8	9	10	12	75
2	3	1	0	3	3	3	2	2	2	0	19
3	5	9	6	4	3	4	6	5	4	4	50
4	8	4	4	5	4	4	2	3	2	3	39
5	2	1	2	1	2	1	2	1	2	1	15
6	4	4	4	3	3	3	3	3	3	3	33
7	0	1	1	1	1	1	1	1	1	1	9
Total	24	24	24	24	24	24	24	24	24	24	240

Loss Contract											
	Period										
Minimum effort	1	2	3	4	5	6	7	8	9	10	Total
1	7	7	11	13	14	15	15	15	15	15	127
2	1	3	2	3	1	1	1	1	1	1	15
3	5	6	7	3	5	5	5	5	5	5	51
4	7	6	2	4	3	2	2	3	2	2	33
5	4	1	1	0	0	0	0	0	1	0	7
6	0	1	1	1	0	0	0	0	0	1	4
7	0	0	0	0	1	1	1	0	0	0	3
Total	24	24	24	24	24	24	24	24	24	24	240

Table 13: Frequency of effort levels played as minimum effort within a group in each round of each treatment. In the upper (lower) panel we present the number of times that each level of effort (first column) was played for each Period (columns 2-11) und gain contracts (loss contracts).

	(1) *periodmineffort*	(2) *periodmineffort*	(3) *periodmineffort*
loss_contract	-0.971**	-0.920**	-1.000**
	(0.441)	(0.427)	(0.435)
online	0.0875	-0.0682	0.0944
	(0.441)	(0.501)	(0.505)
female_ratio		2.044*	2.543**
		(1.183)	(1.015)
maxg_risk_av		0.0642	0.0799
		(0.112)	(0.112)
maxg_loss_av		-0.117	-0.130
		(0.190)	(0.173)
maxg_ambiguity_av		0.0353	-0.0224
		(0.117)	(0.124)
minimumg_crt		0.118	0.0824
		(0.0798)	(0.0783)
constant	3.102***	2.328	7.763
	(0.450)	(2.791)	(4.891)
Big Five Ratios	No	No	Yes
N	480	480	480

Standard errors in parentheses

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

Table 14: Random effects GLS controlling for extreme personality values. All standard errors are clustered at the group level.

F Gender

Given the strong gender effects detected in our analysis, in this section we investigate its effects on the minimum effort of groups. Our results show that groups with a higher share of females coordinate on higher effort levels (Table 2), coordinate better (Table 3), and consequently, have a higher average payoff (Table 4). When analyzing the personality traits across genders, we find that women are more risk averse than men and score lower at the CRT test. These are well known facts in the literature (e.g., Borghans et al., 2009; Brañas-Garza et al., 2019, respectively). However, it cannot explain the treatment differences as gender is balanced across treatments (see Appendix A).

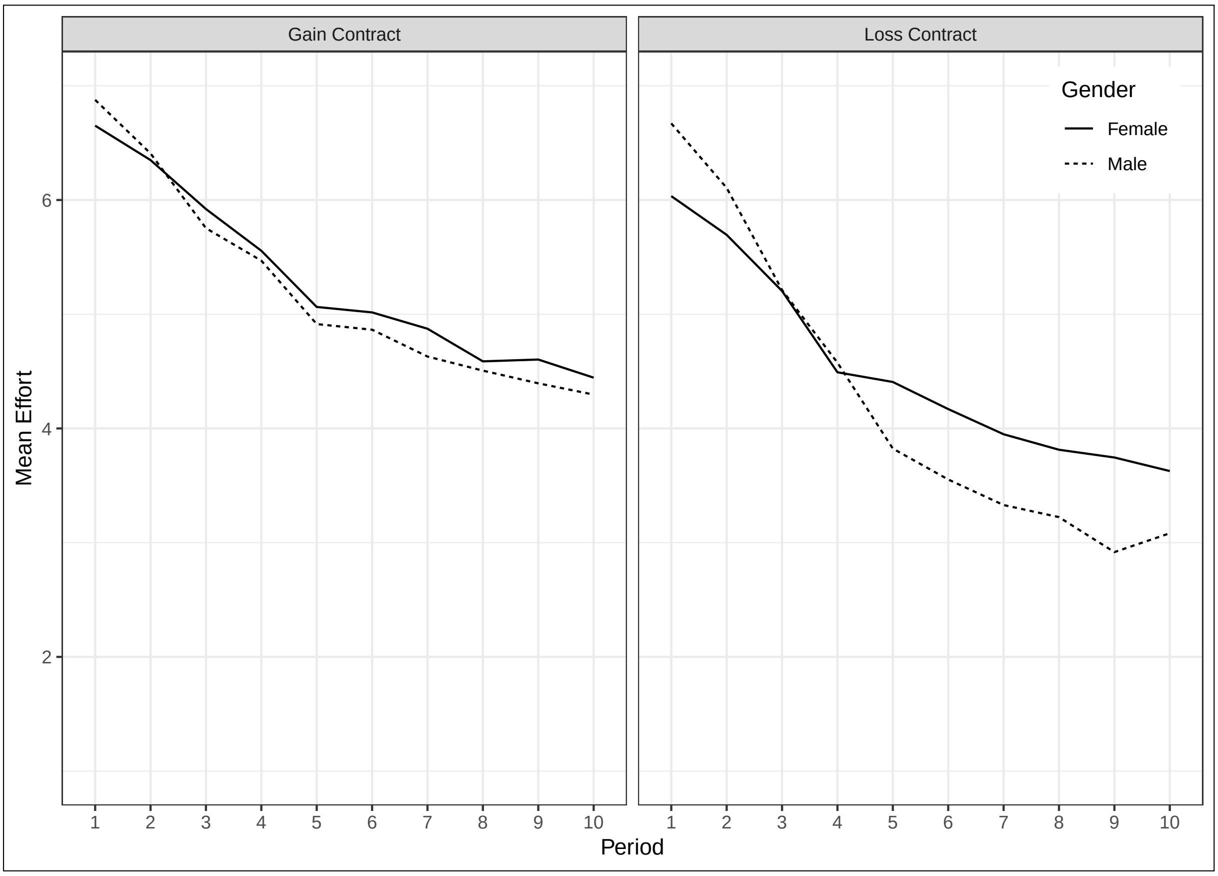

Figure 8: Mean effort decisions by gender and treatment. The left panel shows the mean effort decision of all women per round (solid line) and the mean effort decisions of all men per round (dashed line) for gain contracts. The right panel shows the same for loss contracts.

In Figure 8 we plot the average choices of women and men in each period for both treatments. The figure shows that most of the gender differences stem from the loss contract treatment. A series of Mann-Whitney U tests confirm this. While we cannot reject the null that men and women exert the same level of effort at the beginning of the session under gain contracts (p-value $= 0.227$), we can for loss contracts (p-value $= 0.005$). This difference is driven by females changing their behavior under loss contracts. A Mann-Whitney U test comparing the initial effort of men across treatments cannot reject the null of same effort across treatments (p-value $= 0.442$). In contrast, the same test finds a significant difference in initial female effort across treatments (p-value $= 0.024$).

Moreover, as seen in Figure 8, the differences across gender reverses as the experiment progresses only under loss contracts. While males start exerting significantly more effort in the first period, by the end of the session they are considerably below the effort of females. In Table 15 we present a GLS regression in which the dependent variable is the group minimum effort using either the gain contracts (columns (1) to (3)) or loss contracts (columns (4) to (6)). In all models, we interact the ratio of females in each group with the period of the session. Such interaction has no effect on the evolution of the group minimum effort when using only the data from the gain contract sessions. However, once we use the loss contracts data, we see a strong positive effect of the interaction between the ratio of females in each group and the session period. In other words, the results of Table 15 show that groups with a larger proportion of females have a higher minimum effort as the sessions progress under loss contracts but not under gain contracts.

The results that gender has no effect under gain contracts is in line with the existing literature on gender effects in coordination games with strategic complements (e.g., Dufwenberg and Gneezy, 2005; Heinemann et al., 2009; Engelmann and Normann, 2010; Di Girolamo and Drouvelis, 2015). However, the differences we observe under loss contracts indicate that this might not be a generalizable result and deserves further study. That is why we plan on designing and running specific experiments to test the effects of gender and loss framing in the future.

	Gain Contract			Loss Contract		
	(1)	(2)	(3)	(4)	(5)	(6)
	periodmineffort	*periodmineffort*	*periodmineffort*	*periodmineffort*	*periodmineffort*	*periodmineffort*
female_ratio	0.195	2.686*	1.342	2.171**	2.771**	4.581***
	(1.645)	(1.619)	(1.335)	(0.983)	(1.257)	(1.525)
period	-0.145***	-0.145***	-0.145***	-0.203***	-0.203***	-0.203***
	(0.0487)	(0.0491)	(0.0497)	(0.0525)	(0.0529)	(0.0535)
female_ratio × *period*	0.107	0.107	0.107	0.219**	0.219**	0.219**
	(0.0936)	(0.0944)	(0.0954)	(0.0946)	(0.0954)	(0.0964)
online	-0.106	-1.635*	-1.294	-0.426	-0.454	-0.853
	(0.768)	(0.930)	(1.064)	(0.417)	(0.418)	(0.530)
avg_risk_av		-0.924***	-1.050***		-0.262	-0.717**
		(0.227)	(0.228)		(0.331)	(0.361)
avg_loss_av		-0.324	-0.379*		0.134	0.167
		(0.210)	(0.217)		(0.146)	(0.151)
avg_ambiguity_av		0.0509	0.110		0.0609	-0.0265
		(0.288)	(0.263)		(0.164)	(0.219)
avg_crt		0.664***	0.927***		0.0352	-0.0276
		(0.191)	(0.207)		(0.127)	(0.186)
constant	3.651***	8.440**	2.399	2.121***	2.006	5.191
	(0.773)	(3.663)	(4.827)	(0.491)	(2.893)	(8.217)
Big Five Ratios	No	No	Yes	No	No	Yes
N	240	240	240	240	240	240

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 15: Random effects GLS by treatment. For columns (1) to (3), we use only data from gains contract sessions, for columns (4) to (6) we use data only from loss contract sessions. The dependent variable is the minimum effort of each group. All standard errors are clustered at the group level.