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Sharing Losses in Dictator and Ultimatum Games: A Meta-Analysis

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Abstract

Are people less socially oriented when sharing losses instead of gains? This paper reports the findings of a meta-analysis of 33 studies with 114 estimates from ultimatum and dictator games in which participants share losses (of money, time, or even physical well-being) instead of gains. We provide evidence that dictators leave significantly more to receivers when sharing losses. Proposers are also fairer when sharing losses, but the result is only significant when protocol biases are controlled for. Receivers, on the other hand, demand significantly more in the loss-sharing ultimatum game than in the gain-sharing game. They also demand significantly more when the strategy method is employed. Moreover, we found that non-students are more generous and fairer when sharing losses than students. Finally, we found that, whether sharing a loss of time, a loss of money, or physical pain, players' behaviors do not differ in terms of the percentage of loss shared or demanded.

Keywords Dictator game; Ultimatum Game; Loss-Sharing; Meta-analysis; Non-monetary domain

JEL classification C13 · C91 · D03 · D64

APA classification 2260 · 2340 · 2360 · 3020

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1 Introduction

The dictator game (DG) and ultimatum game (UG) are traditionally used in experimental economics and psychology to measure generosity, altruism, fairness, and reciprocity. In these games, a first player (the allocator) decides how to share an endowment (e.g., 10 USD) with a second player (the receiver). In the DG, the receiver is passive, powerless, a mere recipient of what the allocator (the dictator) leaves. In the UG, receivers can reject the proposed split from the allocator (the proposer) and rejection results in neither party getting any stake. The rational prediction is that in the DG the self-interested dictator will keep the whole endowment, while in the UG, since the theory assumes that a rational receiver should accept any positive amount, the proposer is expected to offer the lowest possible share of the pie to the receiver.

Nevertheless, although these predictions are right for a sizeable number of players, the empirical literature indicates that a significant proportion are also motivated by other-regarding preferences such as altruism, fairness, and reciprocity, and so depart from the theory. Indeed, Engel's (2011) meta-analysis on the DG reported that 64% of dictators do give something, offering on average 28.3% of the endowment, while in their meta-analysis of the UG Oosterbeek et al. (2004) found that proposers offer 40% of the endowment and receivers reject positive offers 16% of the time.

Many variants of the DG and the UG have been investigated, mostly to study the effects of various parameters, such as the amount at stake (see the meta-analysis by Larney et al., 2019), the incentive procedure (probabilistic or not, cost-saving or not; see Walkowitz, 2021; Umer, 2023), the presence of punishment opportunities (Gago, 2021), the presence of disabled players (Max et al., 2020), or the degree of economic development of a country (see Cochard et al., 2021). In these studies participants share money from an endowment, which can be considered as a gain made at the expense of the organizers of the experiment. Indeed, a large majority of the studies concern situations in which the allocator basically splits gains between him/herself and the recipient, which is a situation of giving or of receiving gains. However, since the work of Buchan et al. (2005), an emerging experimental literature has investigated the situation in which players share losses instead of gains. Having to share losses is a very familiar real-life situation. Experiences of loss are rather common—for example, being robbed, getting fired, making mandatory contributions to resource-intensive programs like combating terrorism or preserving the environment, or navigating a financial crisis—and it is crucial to understand how people behave in such circumstances. Consider a business experiencing a significant economic loss in a time of crisis due to circumstances beyond its control (e.g., losing a valuable contract because of the pandemic or the Ukraine conflict). What will the CEO do? Transfer the entire loss to subordinates, share it with them, or incur the entirety herself? And how will the employees react? Will they unflinchingly suffer the loss (e.g., abolition of posts), or go on strike? As this example shows, the loss context may impact one-way sharing behaviors as well as more strategic behavior such as negotiations.

A growing literature is investigating these kinds of issues using modified DGs and/or UGs in a loss context. The typical experimental protocol proceeds as follows: both players receive an equal endowment (say 10 USD), but also incur a global loss of 10 USD that they have to share between them. The recipient has a passive role and can only accept the decision of the dictator in the DG, while in the UG he/she can reject the proposed share-out of the loss. Rejection results in both players losing 10 USD, thus ending the game with a final payoff of 0. Researchers therefore vary the reference point between the two treatments while keeping the final payoff fixed.[1]

This experimental design is not to be confused with the well-known "taking/gangster game" or the "take-option game", which involve a loss only for receivers and not for allocators. These games do not involve

[1] In the gain treatment, the reference point is assumed to be 0 since they start the game with no initial endowment. In the loss treatment, the reference point is the initial endowment. In some studies, players get an initial endowment even in the gain treatment, but then get a higher endowment in the loss treatment, so that the reference points are simply shifted upwards.

loss-sharing between receiver and allocator. Indeed, in the "take-option game" (see List, 2007 or Bardsley, 2008 for the well-known papers), the allocator plays the standard DG (could share an endowment, e.g., 10 USD) but also has the possibility of taking a small share of the receiver's endowment (e.g., 1, 2, or 5 USD, sometimes even from the participation fee). Therefore, he/she can choose to take or to give. In the "taking/gangster game" (e.g., Dreber et al., 2013; Kettner & Waichman, 2016; Korenok et al., 2017), the receiver owns the whole endowment (e.g., 10 USD) and the allocator can decide whether to take the endowment from the receiver.

In an effort to better simulate loss perception in a laboratory environment, some researchers employ the "prepaid mechanism" (e.g., Rosenboim and Shavit, 2012; Neumann et al., 2017, 2018). This method involves providing participants with money (e.g., 10 USD) several weeks before they experience the loss, enabling them to consider the money as their own. Alternatively, other researchers utilize "real losses" as endowments to be shared, such as time spent waiting in the laboratory, or even the distribution of 20 electric shocks (e.g., Berger et al., 2012; Noussair and Stoop, 2015; Erkut, 2022).

The evidence appears to be mixed: some studies found that individuals act more generously or more fairly in the loss versions of UGs and DGs compared to standard games (the control groups), while others found the opposite. The lack of empirical evidence on preferences for fairness, altruism, or reciprocity over losses (widely discussed in the literature on the subject; see Feng et al., 2021) is problematic, since there is a well-established theoretical literature documenting that people respond differently to losses and gains (e.g., Kahneman and Tversky's prospect theory).

All these studies have their own protocols, their own ways of reporting the results, and different sample sizes and populations tested. It is therefore relevant to carry out a meta-analysis (and meta-regression) to clarify the evidence and to ascertain why some authors found one result while others found the opposite. Our contribution aims at filling this gap and addresses the following main questions: How do allocators in DGs and in UGs share in the loss domain as compared to the gain domain? Do the UG receivers' demands vary with context? Are other-regarding preferences affected by the gain or the loss context? Does loss aversion offset the effect of other-regarding preferences? While various other-regarding preference models have been proposed to explain behavior in these games, the theoretical background presented in this paper will concentrate on Fehr and Schmidt's (1999) well-known inequality aversion model.

Finally, it should be noted that conducting a meta-analysis on loss-sharing can also help reveal whether people exhibit different behaviors when sharing non-monetary endowments (such as time loss or physical pain) as compared to monetary ones, thus addressing another unresolved issue in the literature. Indeed, most of the studies that have explored the non-monetary domain have been conducted in a loss context where the endowments shared were negative stimuli (painful or otherwise harmful), and while generosity and fairness have been extensively investigated in the monetary domain, less attention has been devoted to generosity or fairness in the non-monetary domain. Yet it does seem that the type of incentive might have an impact on behaviors, mainly due to the social norms associated with them (Erkut, 2022). Experimental research comparing monetary and non-monetary domains using the DG and UG yields mixed evidence. Some studies report significantly greater donations in the non-monetary domain (e.g., Davis et al., 2012; Erkut, 2022), while others find similar or nearly similar donation levels across both domains (e.g., Noussair and Stoop, 2015; Story et al., 2015), and one study observes lower donations in the non-monetary domain (Nguyen, 2022). Moreover, comparisons between the two domains are not always conducted on equal footing, creating ambiguity in the results. Many researchers compare monetary sharing in a DG or UG in a context of giving or receiving gains with sharing time carrying out a difficult task or enduring physical pain, which can be inherently considered as sharing losses. This approach therefore not only varies the nature of the endowment between treatments but also the gain/loss decision context. A meta-analysis on loss sharing would allow for a more accurate comparison between decisions made when sharing monetary endowments versus those made when sharing non-monetary ones, such as time loss or physical pain, by only varying the type of loss. We will therefore also investigate this question.

As said previously, meta-analysis methods have been widely used to clarify and study the behavior of participants in UGs and DGs when participants share gains. However, none of them study the behavior of participants in a loss-sharing context. This paper reports the findings of a meta-analysis of 33 studies (from 28 papers) with 114 estimates from UGs and DGs where the gain/loss context is varied, representing a total of 6,951 observations. By comparing the results of the control group (gain-framed) versus the experimental group (loss-framed) for each study where applicable, we provide evidence that dictators are significantly more generous towards receivers when they share losses instead of gains, although the effect size is small. Proposers are also fairer when sharing losses, but the result is only significant when protocol biases are controlled for. Receivers, on the other hand, demand significantly more in the loss-framed UG than in the gain game, suggesting a higher demand for fairness in the loss context. They also demand significantly more when the strategy method is employed. Moreover, we find that non-students are more generous and fairer when sharing losses than students. Finally, we observe no significant difference in players' behavior when sharing a loss of time as opposed to a loss of money or enduring physical pain, in terms of the percentage of loss shared or demanded.

The remainder of the paper is structured as follows. Section 2 provides a theoretical model and formulates hypotheses. In section 3, we present the data (from a literature overview), the method used to carry out the meta-analyses, and some considerations on publication bias. In section 4, we set out the overall results for all games and types of participants. Section 5 describes a multivariate meta-regression analysis with random effect and unrestricted WLS econometric models (Stanley and Doucouliagos, 2015, 2017). The final section concludes the paper.

2 Theoretical model and hypotheses

The principal issue here lies at the crossroads of two theoretical positions. Prospect theory (Kahneman and Tversky, 1979) holds that losses outweigh gains. The fall in expected utility from loss exceeds the rise in expected utility from a gain of the same order. Thus, an allocator (dictator or proposer) in the gain-framed DG or UG, with a reference point of zero, will obtain lower marginal utility from each unit he attributes to himself than the allocator in a loss-framed game (with the size of the endowment as the reference point). Psychological studies have suggested various explanations for this, based on selfishness or ethical concerns (e.g., Poppe and Valkenberg, 2003; Grolleau et al., 2016; Losecaat Vermeer et al., 2020). Accordingly, loss aversion means we can expect allocators to be less generous/fair when operating in loss frameworks than in gain frameworks when it comes to splitting a loss with recipients. Concerning the behavior of receivers in the UG, as the decrease in expected utility from a loss is greater than the increase in expected utility derived from a similar gain, and as rejection results in losing the entire endowment from the reference point, we can expect that they will be more likely to accept equivalent proposed sharing in a UG played in a loss context than in a gain context. This will also tend to push the strategic proposer to offer less, if this is anticipated. Therefore, proposers might give less due to loss aversion and/or due to anticipation of the receiver's loss aversion.

On the other hand, the vast literature on other-regarding preferences suggests that the allocator might also be more generous/fairer in the loss context than in the gain context, while the recipient might also be more demanding (rejecting more). In the first place, Handgraaf et al. (2008) point out that the receiver's lack of power could persuade dictators to behave pro-socially. This could be explained by social exchange theory, which implies that an imbalance in power may instill feelings of moral responsibility among allocators (Emerson, 1962; Blau, 1964; Greenberg, 1978). Such feelings supposedly prompt the more powerful player to behave in a socially responsible way, sacrificing his/her own income so as to help the other who is powerless. Receivers in UGs are not powerless, but many studies (e.g., Buchan et al., 2005; Leliveld et al., 2009; Zhou and Wu, 2011) show that unequal offers are perceived as less fair in a loss context than in a gain context. This could plausibly be explained by the fact that participants tend to associate loss with "unfair" and gain with "fair" (Zhou and Wu, 2011). The fact that "unfairness in losses looms larger than unfairness in gains" (Buchan et al., 2005) could induce the proposer to act more fairly. This is in line with the "do-no-harm" principle (Baron, 1995; Royzman and Baron, 2002): subjects could be more reluctant to cause losses to others (through action) than to reduce their gains. So, regardless of any moral responsibility, the loss context may induce "compassion" on the part of the allocator with respect to the recipient (Baquero et al., 2013). In short, experiencing feelings such as moral responsibility or compassion for the recipients could induce higher levels of generosity or fairness when dealing with losses, implying that in loss-framed DGs and UGs, allocators might behave so as to offset the loss-aversion effect with other-regarding preferences. Furthermore, and contrary to the prediction of the loss-aversion model, proposers in the UG could anticipate this greater demand from receivers and offer more to maximize their expected payoff. In the following, we develop a model of decision-making for the dictator, the UG receiver, and the UG proposer, integrating those two dimensions. As in Cochard et al. (2020), and based on Buchan et al. (2005), we rely on a natural extension of the Fehr-Schmidt (1999) inequality aversion and the Kahneman and Tversky prospect theory models (1979).[2]

Assume that two subjects, i and j, are interacting in a game in which they end up with payoffs x_i and x_j. In the gain context we have $x_i, x_j \geq 0$, and in the loss context $x_i, x_j \leq 0$. In the gain context, the utility function of subject i is:

$$u_i^g(x_i, x_j) = x_i - \alpha_i \max\{x_j - x_i, 0\} - \beta_i \max\{x_i - x_j, 0\},$$

where α_i is the parameter of aversion to disadvantageous inequality, while β_i is the parameter of aversion to advantageous inequality. As stated by Fehr and Schmidt (1999), it is reasonable to assume that $\beta_i \leq \alpha_i$ and $0 \leq \beta_i < 1$.[3] In the loss context, subject i's utility function can be written as:

$$u_i^l(x_i, x_j) = \theta_i x_i - \rho_i \alpha_i \max\{x_j - x_i, 0\} - \rho_i \beta_i \max\{x_i - x_j, 0\},$$

where $\theta_i \geq 1$ is a preference parameter measuring the size of loss aversion, reflecting the fact that losses loom more than gains in terms of utility, and $\rho_i \geq 1$ is a preference parameter denoting the fact that inequality aversion may be greater in the loss context. Indeed, our hypothesis, as for Buchan et al. (2005) and Cochard et al. (2020), is that subjects may be more inequality-averse in the loss domain, as explained above. Consistent with the assumption $\beta_i < 1$ in the Fehr and Schmidt model, it will be reasonable to assume $\rho_i \beta_i < \theta_i$.

This model offers clear predictions for players in the DG and the UG. Let us now replace the indices *i* and *j* by 1 for the allocator (dictator in the DG or proposer in the UG) and 2 for the receiver.

Consider first the DG in the gain context. The dictator decides on the share (x_1, x_2) of a gain w, with $x_1 + x_2 = w$. Let us quickly rule out the case of disadvantageous inequality ($x_1 < x_2$) for the dictator ($x_1 < x_2$ or $\frac{w}{2} < x_2 \leq w$). Making such an offer would decrease both his/her monetary payoff and his/her inequality-aversion utility as compared with an offer $x_2 = \frac{w}{2}$. Therefore, we can focus on the case $0 \leq x_2 \leq \frac{w}{2}$, and the dictator's utility function simplifies to:

[2] Other behavioral hypotheses could obviously be made regarding other-regarding preferences. For example, Cooper and Dutcher (2011) examine the impact of reciprocity preferences on the receiver's decisions. The Fehr-Schmidt model nevertheless appears to be particularly simple and sufficient to highlight the potential effect of other-regarding preferences in the loss context.

[3] As stated by Fehr and Schmidt (1999), "If $\beta_i = 1$, then player i is prepared to throw away one dollar in order to reduce his advantage relative to player j, which seems very implausible. This is why we do not consider the case $\beta_i \geq 1$."

$$u_1^{DGg}(w - x_2, x_2) = (2\beta_1 - 1)x_2 + (1 - \beta_1)w.$$

If $\beta_1 < \frac{1}{2}$, then utility is strictly decreasing in x_2, so that the optimal offer will be minimal, i.e., $x_2 = 0$. If $\beta_1 > \frac{1}{2}$, then utility is strictly increasing in x_2, so that the optimal offer will be maximal, i.e., $x_2 = \frac{w}{2}$. If $\beta_1 = \frac{1}{2}$, then utility is independent of x_2, so that any value in the relevant interval will be optimal, i.e., $x_2 \in \left[0, \frac{w}{2}\right]$. Thus, the dictator's optimal offer in the gain context is:[4]

$$x_2^{DGg} = \begin{cases} 0 & \text{if } \beta_1 < \dfrac{1}{2}, \\ \in \left[0, \dfrac{w}{2}\right] & \text{if } \beta_1 = \dfrac{1}{2}, \\ \dfrac{w}{2} & \text{if } \beta_1 > \dfrac{1}{2}. \end{cases}$$

Therefore, a sufficient condition for equal sharing in the gain context is $\beta_1 > \frac{1}{2}$.

In the loss domain, the dictator decides on the share (x_1, x_2) of the loss $-w$, with $x_1 + x_2 = -w$. The cases of disadvantageous inequality for the dictator ($x_1 < x_2$ or $-\frac{w}{2} < x_2 \leq 0$), again, are strictly dominated by the equal offer $x_2 = -\frac{w}{2}$, by decreasing both parts of the utility function (lower payoff and higher inequality). Therefore, we can focus on the case $x_2 \leq x_1$, or $-w \leq x_2 \leq -\frac{w}{2}$, so that the dictator's utility function simplifies to:

$$u_1^{DGl}(w - x_2, x_2) = (2\rho_1\beta_1 - \theta_1)x_2 + \rho_1\beta_1 w.$$

Following similar reasoning as in the gain context, this implies that the dictator's optimal offer in the loss context will be:

$$x_2^{DGl} = \begin{cases} -w & \text{if } \beta_1 < \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}, \\ \in \left[-w, -\dfrac{w}{2}\right] & \text{if } \beta_1 = \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}, \\ -\dfrac{w}{2} & \text{if } \beta_1 > \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}. \end{cases}$$

Therefore, a sufficient condition for equal sharing in the loss context is $\beta_1 > \frac{1}{2}\frac{\theta_1}{\rho_1}$.

Confronting x_2^{DGg} and x_2^{DGl} , it follows that if $\theta_1 > \rho_1$ (the effect of loss aversion is greater than the effect of inequality aversion), then the condition for sharing equally is harder to achieve in the loss than in the gain domain, while the opposite is true if $\theta_1 < \rho_1$. Theory suggests that both effects may play a role but does not specify their relative magnitude. Therefore, we make the neutral hypothesis that both effects just offset each other, i.e., $\theta_1 = \rho_1$, implying that the dictator's offering behavior is equivalent across contexts, i.e., the dictator's offer in the gain (x_2^{DGg}) context is equal to the "equivalent gain" of the dictator's offered loss in the loss context (i.e., $w + x_2^{DGl}$, which is the share of the endowment left to the receiver):

H1. (DG) The dictators' average offering behavior is similar across contexts, i.e., $x_2^{DGg} = w + x_2^{DGl}$.

[4] The discontinuous prediction is due to the linearity of the model. This is a satisfactory approximation of decisions in the dictator game (see e.g., Engel, 2011).

Now, let us analyze the UG, starting with the receiver's behavior. In the gain context, rejecting the proposer's offer will result in a null payoff and thus a utility of 0. Let us first examine the case of advantageous inequality for the receiver ($x_1 \leq x_2$ or $\frac{w}{2} \leq x_2 \leq w$). In case of acceptance, the receiver's utility function simplifies to:

$$u_2^{UGg}(x_2, w - x_2) = x_2 - \beta_2(2x_2 - w),$$

which is always positive for $\beta_2 < 1$ (as $0 \leq 2x_2 - w \leq x_2$), so that accepting any offer is better than rejecting it. Now let us turn to the case of disadvantageous inequality, i.e., $x_2 < x_1$, according to which $0 \leq x_2 < \frac{w}{2}$, and, in case of acceptance, the receiver's utility function simplifies to:

$$u_2^{UGg}(x_2, w - x_2) = (1 + 2\alpha_2)x_2 - \alpha_2 w.$$

Denoting as x_2^{ming} the receiver's Minimum Acceptable Offer (MAO) in the gain context, this implies that:

$$x_2^{ming}(\alpha_2) = \frac{\alpha_2 w}{1+2\alpha_2},$$

which is equal to 0 when $\alpha_2 = 0$, is strictly increasing in α_2, and tends to $\frac{w}{2}$ when $\alpha_2 \to +\infty$.

The loss version of the UG was first defined by Buchan at al. (2005): consistency with the gain context requires that rejection leads to the worst possible outcome for both players (0 in the gain context, $-w$ in the loss context). Hence, rejecting the proposer's offer will result in a loss of $-w$ for both subjects. Considering that $x_1 + x_2 = -w$, let us first examine the case of advantageous inequality for the receiver ($x_1 \leq x_2 \leq 0$ or $-\frac{w}{2} \leq x_2 \leq 0$). In case of acceptance, the receiver's utility function simplifies to:

$$u_2^{UGl}(x_2, -w - x_2) = \theta_2 x_2 - \rho_2\beta_2(2x_2 + w),$$

which is to be compared with the utility of rejection, $u_2^{UGl}(-w, -w) = -\theta_2 w$. The difference is:

$$u_2^{UGl}(x_2, -w - x_2) - u_2^{UGl}(-w, -w) = \theta_2(x_2 + w) - \rho_2\beta_2(2x_2 + w),$$

which is always positive for $\rho_2\beta_2 < \theta_2$ (as $0 \leq 2x_2 + w \leq x_2 + w$), so that accepting any offer is better than rejecting it. Now, let us assume that $x_2 < x_1 \leq 0$, so that $-w \leq x_2 < -\frac{w}{2}$. The utility function simplifies to:

$$u_2^{UGl}(x_2, -w - x_2) = (\theta_2 + 2\rho_2\alpha_2)x_2 + \rho_2\alpha_2 w,$$

which is again to be compared with the utility of rejection. It follows that the receiver accepts if:

$$x_2 \geq \frac{-\rho_2\alpha_2 w - \theta_2 w}{\theta_2 + 2\rho_2\alpha_2},$$

which defines the *maximum* acceptable loss $x_2^{maxl}(\alpha_2, \theta_2, \rho_2)$. Again, for the sake of comparison, let us write the proposer's offered loss x_2 as its "equivalent" gain $w + x_2$. Therefore, we can define the receiver's equivalent MAO in the loss context as:

$$x_2^{minl}(\alpha_2, \theta_2, \rho_2) = x_2^{maxl}(\alpha_2, \theta_2, \rho_2) + w = \frac{\rho_2\alpha_2 w}{\theta_2 + 2\rho_2\alpha_2}.$$

For ease of interpretation, it will prove more convenient to write this as:

$$x_2^{min}(\alpha_2, \frac{\theta_2}{\rho_2}) = \frac{\alpha_2 w}{\frac{\theta_2}{\rho_2} + 2\alpha_2}.$$

Similarly to the gain context MAO, this is equal to 0 when $\alpha_2 = 0$, is strictly increasing in α_2, and tends to $\frac{w}{2}$ when $\alpha_2 \to +\infty$. With respect to $\frac{\theta_2}{\rho_2}$, this tends to $\frac{w}{2}$ when $\frac{\theta_2}{\rho_2} \to 0$, is strictly decreasing in $\frac{\theta_2}{\rho_2}$, is equal to the gain context MAO if $\frac{\theta_2}{\rho_2} = 1$ (i.e., $x_2^{ming}(\alpha_2) = x_2^{min}(\alpha_2, 1)$), and tends to 0 when $\frac{\theta_2}{\rho_2} \to +\infty$.

Comparing the MAOs in both contexts, i.e., $x_2^{min}\left(\alpha_2, \frac{\theta_2}{\rho_2}\right)$ and $x_2^{min}(\alpha_2, 1)$, it follows straightforwardly that if $\theta_2 > \rho_2$ (the effect of loss aversion is greater than the effect of inequality aversion), then the MAO is lower in the loss context, meaning that the receiver is less demanding in the loss context than in the gain context. The reason for this is that the receiver is more sensitive to losses than to inequality, and so more prone to avoid the situation of rejection, which is purely egalitarian but results in the highest possible loss $(-w, -w)$. In contrast, if $\theta_2 < \rho_2$, the MAO is higher in the loss context, meaning that the receiver is more demanding. The reason is that the receiver is more sensitive to inequality than to losses, and so more prone to choose the fully egalitarian situation of rejection. Again, theory highlights both effects but their relative magnitude is left for empirical research, so that we make the hypothesis that both effects exactly offset each other, i.e., $\theta_2 = \rho_2$, implying that the MAOs are equal across contexts:

H2. (UG) Receivers are on average as demanding in the loss context as in the gain context, i.e., the receivers' average MAO is similar in both contexts: $x_2^{minl} = x_2^{ming}$.

The proposers' behavior in the UG requires a more complex analysis given that it depends both on their own preferences $(\alpha_1, \beta_1, \theta_1, \rho_1)$ and on their beliefs regarding the receivers' preferences $(\alpha_2, \beta_2, \theta_2, \rho_2)$.

Let us first consider the case of complete information, where the proposer is perfectly informed of the receiver's preference parameters and, therefore, of his/her MAO. In the gain context, the proposer decides on the share (x_1, x_2) of a gain w, with $x_1 + x_2 = w$. As before, we can first quickly rule out the case of disadvantageous inequality for the proposer ($x_1 < x_2$ or $\frac{w}{2} < x_2 \leq w$). This would decrease both his/her monetary payoff and his/her inequality aversion utility as compared with an offer $x_2 = \frac{w}{2}$, which would be accepted with certainty, as seen before. Therefore, we can focus on the case $0 \leq x_2 \leq \frac{w}{2}$, and the proposer's utility function simplifies to:

$$u_1^{UGg}(w - x_2, x_2) = (2\beta_1 - 1)x_2 + (1 - \beta_1)w.$$

Then, following a similar line of reasoning as for the dictator but taking into account the receiver's MAO, $x_2^{min}(\alpha_2, 1)$, the proposer's optimal offer in the gain context will be:

$$x_2^{UGg} = \begin{cases} x_2^{min}(\alpha_2, 1) & \text{if } \beta_1 < \dfrac{1}{2}, \\ \in \left[x_2^{min}(\alpha_2, 1), \dfrac{w}{2}\right] & \text{if } \beta_1 = \dfrac{1}{2}, \\ \dfrac{w}{2} & \text{if } \beta_1 > \dfrac{1}{2}. \end{cases}$$

Therefore, the sufficient condition for equal sharing is analogous to that of the dictator. The difference is that when this condition is not satisfied, the proposer is constrained to offer the MAO instead of a null offer.

In the loss context, the proposer decides on the share (x_1, x_2) of the loss $-w$, with $x_1 + x_2 = -w$. Again, we can rule out the case of disadvantageous inequality for the proposer ($x_1 < x_2$ or $-\frac{w}{2} < x_2 \leq$

0), for similar reasons as in the gain context. Hence, we assume that $-w \leq x_2 \leq -\frac{w}{2}$, and the proposer's optimal offer in the loss context in equivalent gains ($x_2^{UGl} + w$) is similarly obtained as:[5]

$$x_2^{UGl} + w = \begin{cases} x_2^{min}(\alpha_2, \dfrac{\theta_2}{\rho_2}) & \text{if } \beta_1 < \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}, \\ \in \left[x_2^{min}\left(\alpha_2, \dfrac{\theta_2}{\rho_2}\right), \dfrac{w}{2}\right] & \text{if } \beta_1 = \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}, \\ \dfrac{w}{2} & \text{if } \beta_1 > \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}. \end{cases}$$

Consider first the case $\theta_2 > \rho_2$; recall that the MAO is therefore lower in the loss context. Three cases should then be considered. (i) If $\theta_1 > \rho_1$, then the condition for equal offer is harder to achieve in the loss context. Therefore, on average, we expect proposers to offer the MAO more often in the loss context, and the MAO is lower. So, on average, offers should be lower in the loss context. (ii) If $\theta_1 = \rho_1$, then the condition for equal offer is the same under both contexts and the MAO is lower under losses. Thus, on average, offers should be lower in the loss context. (iii) If $\theta_1 < \rho_1$, then the condition for equal offer is easier to achieve in the loss context. Here we have an ambiguous prediction, as proposers make the equal offer more often, but when they offer the MAO they are less generous in the loss context.

There are six additional cases that have been relegated to a footnote in order to conserve space.[6] Consistent with the previous hypotheses, we assume (i) $\theta_1 = \rho_1$, which implies that the conditions for the proposer's willingness to share equally are the same across contexts, i.e., $\beta_1 > \frac{1}{2}$, and (ii) $\theta_2 = \rho_2$, implying that the MAOs are also the same across contexts, i.e., $x_2^{ming} = x_2^{minl} = x_2^{min} = \frac{\alpha_2 w}{1+2\alpha_2}$. Under these assumptions, we may formulate the following hypothesis:

H3. (UG) The proposer's average offering behavior is similar across contexts, i.e., $x_2^{UGg} = w + x_2^{UGl}$.

In practice, the proposer typically does not have complete information on the receiver's preference parameters. In the online appendix we examine the situation of incomplete information. Just as under complete information, offers depend on the proposer's preference parameters ($\beta_1, \theta_1, \rho_1$) and on their beliefs on the receiver's MAO, which in turn rely on the preference parameters ($\alpha_2, \theta_2, \rho_2$). Precise

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[5] This comes from the computation of the optimal offer in losses:

$$x_2^{UGl} = \begin{cases} x_2^{maxl}(\alpha_2, \theta_2, \rho_2) & \text{if } \beta_1 < \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}, \\ \in \left[x_2^{maxl}(\alpha_2, \theta_2, \rho_2), -\dfrac{w}{2}\right] & \text{if } \beta_1 = \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}, \\ -\dfrac{w}{2} & \text{if } \beta_1 > \dfrac{1}{2}\dfrac{\theta_1}{\rho_1}. \end{cases}$$

[6] If $\theta_2 = \rho_2$, then the MAOs are equal across contexts. Three cases should be considered. (i) If $\theta_1 > \rho_1$, then the condition for equal offer is harder to achieve in the loss context. So, on average, offers should be lower in the loss context. (ii) If $\theta_1 = \rho_1$, then the condition for equal offer is the same under both contexts. Thus, on average, offers should be similar in both contexts. (iii) If $\theta_1 < \rho_1$, then the condition for equal offer is easier to achieve in the loss context. Hence, on average, offers should be higher in the loss context.
If $\theta_2 < \rho_2$, then the MAO is higher in the loss context. Three cases should be considered. (i) If $\theta_1 > \rho_1$, then the condition for equal offer is harder to achieve in the loss context. Here we have an ambiguous prediction as proposers make the equal offer less often, but when they offer the MAO they are more generous in the loss context. (ii) If $\theta_1 = \rho_1$, then the condition for equal offer is the same under both contexts. Thus, on average, offers should be higher in the loss context because of the MAO. (iii) If $\theta_1 < \rho_1$, then the condition for equal offer is easier to achieve in the loss context. Therefore, on average, we expect proposers more often to offer equally in the loss context, and the MAO is higher. So, on average, offers should be higher in the loss context.

predictions cannot be made without specifying the joint distribution function of variables $(\alpha_2, \theta_2, \rho_2)$, now representing the proposer's belief about the receiver's parameters. Various cases must be considered, depending on the proposer's parameters. In particular, when $\theta_1 = \rho_1$, the comparison of offers across contexts relies on the distributions of the MAOs, and thus on the proposer's beliefs. In summary, if proposers believe that the values of the MAO in the loss context tend to be larger than the values of the MAO in the gain context, they will likely offer more in the loss context to align with the receivers' demands. The reasoning is therefore akin to that under complete information. Assuming, as previously, that proposers believe that the loss aversion effect and the inequality aversion effect tend to counterbalance each other, leading to similar MAOs in both contexts, we arrive at the same hypothesis: proposers will make comparable offers under both circumstances. This enables us to derive the same hypothesis as under complete information, corresponding to a situation where $\theta_1 = \rho_1$ and where proposers also believe that both effects tend to offset each other in receivers, leading to comparable MAOs.

As mentioned earlier, investigating the loss-sharing context could also help determine whether people exhibit different behaviors when sharing non-monetary endowments, such as time loss or physical pain, compared to monetary ones. This would address another unresolved issue in the literature. Therefore, we examine the effect of the nature of incentives, i.e., monetary or non-monetary, in the loss context. Assuming that preference parameters may vary according to the type of incentives, we use the superscript ^{NM} to represent an individual's preference parameters in the non-monetary context. All previous models can be derived using these notations.

For dictators, the sufficient condition for equal sharing in the loss context when the incentives are non-monetary is therefore:

$$\beta_1^{NM} > \frac{1}{2}\frac{\theta_1^{NM}}{\rho_1^{NM}},$$

which is to be compared to $\beta_1 > \frac{1}{2}\frac{\theta_1}{\rho_1}$ in the monetary condition. Everything else equal, this condition is easier to achieve in the non-monetary context if $\beta_1^{NM} > \beta_1$, or $\rho_1^{NM} > \rho_1$, or $\theta_1^{NM} < \theta_1$. Although there is no comprehensive theory predicting differences in behavior, recent explanations suggest reasons for differences in generosity between the non-monetary and monetary domains. Indeed, in a well-executed experiment Erkut (2022) demonstrates that social norms for allocating monetary and non-monetary endowments differ, and that the divergence in social norms is the primary factor predicting the observed variations in generosity between the domains. According to her, "helping someone in need is an informal rule people are willing to follow; however, when money comes into play, the nature of the exchange can be transformed. It is possible that the use of money places the transaction in the context of a market exchange, thereby activating different social norms." Thus, not sharing a loss in the non-monetary domain (such as when sharing pain or the time required to perform a difficult task) might be viewed less favorably from a social perspective than not sharing it in the monetary domain. This line of reasoning would tend to support the hypothesis that $\beta_1^{NM} > \beta_1$.

Now we need conjectures on $\frac{\theta_1^{NM}}{\rho_1^{NM}}$. A way to do this is to compare $\theta_1^{NM}$with θ_1 and ρ_1^{NM} with ρ_1. Arguably, we might expect $\rho_1^{NM} > \rho_1$, i.e., the increase of inequality aversion due to the loss context might be higher in the non-monetary case, because a "real" or "physical" loss is to be shared. In the monetary case, the loss is often a framing effect. The subjects first get an initial endowment to absorb the potential loss. When pain or an unpleasant time is shared, subjects suffer a real loss. However, similar arguments would also suggest that loss aversion should tend to be higher in the non-monetary context, i.e., or $\theta_1^{NM} > \theta_1$. This effect would contradict the influence of heightened inequality aversion in such situations. It therefore seems difficult to draw a conclusion only on the basis of theoretical arguments. Hence, consistent with our previous line of reasoning, we make the hypothesis that both effects just offset each other, as in the monetary condition ($\frac{\theta_1^{NM}}{\rho_1^{NM}} = \frac{\theta_1}{\rho_1} = 1$), and leave it to empirical research to investigate the relative magnitudes of these two effects. Consequently, we assume that the effect $\beta_1^{NM} > \beta_1$ dominates. All these considerations lead us to the following hypothesis:

H4. (DGl^{NM}) In the loss context, dictators offer on average more when incentives are non-monetary than when they are monetary, i.e., $x_2^{DGl^{NM}} > x_2^{DGl} + w$.

Next, let us study the behavior of receivers in the loss context. On the basis of what we saw before, their MAO will be:

$$x_2^{minl^{NM}} = x_2^{min}\left(\alpha_2^{NM}, \frac{\theta_2^{NM}}{\rho_2^{NM}}\right) = \frac{\alpha_2^{NM} w}{\frac{\theta_2^{NM}}{\rho_2^{NM}} + 2\alpha_2^{NM}},$$

which is to be compared with the MAO in under monetary stakes, i.e., $x_2^{minl} = \frac{\alpha_2\, w}{\frac{\theta_2}{\rho_2} + 2\alpha_2}$. It is useful to recall that the function is increasing in α_2 and decreasing in $\frac{\theta_2}{\rho_2}$. In a similar vein to the above discussion, Erkut's argument suggests that $\alpha_2^{NM} > \alpha_2$. So, if we still assume that $\frac{\theta_1^{NM}}{\rho_1^{NM}} = \frac{\theta_1}{\rho_1} = 1$, we may formulate the following hypothesis regarding the receiver's MAO:

H5. (UGl^{NM}) In the loss context, receivers are on average more demanding when incentives are non-monetary than when they are monetary, i.e., $x_2^{minl^{NM}} > x_2^{minl}$.

Finally, hypotheses H4 and H5 trivially imply the following:

H6. (UGl^{NM}) In the loss context, proposers offer on average more when incentives are non-monetary than when they are monetary, i.e., $x_2^{UGl^{NM}} > x_2^{UGl} + w$.

3 Data, literature overview, and consideration for publication bias

To search for the data, we used Google Scholar, Econlit, and Elsevier's ScienceDirect, with the following keywords: "sharing losses", "sharing pain", "sharing time", "loss-framed," "dictator game," "ultimatum game," and "gain–loss framed". To compare results between the loss context and gain context, results are reported in terms of standardized mean difference (SMD). SMD, also known as "Cohen's d", is widely used in meta-analyses and represents the difference in mean outcome between treated and control groups over the standard deviation of outcome among participants. Thus, it expresses the size of the treatment effect (relative to the control group) in each study relative to the variability observed in that study. As explained before, for the sake of comparison of offers across contexts, the allocator's negative offer x_2^l in the loss context is considered as an "equivalent" positive offer $x_2^l + w$ where w is the total amount at stake. In this manner, we consider what the allocator leaves for the receiver in both contexts. Indeed, because participants cannot leave the laboratory with a loss, they are provided with an endowment equal to the maximum possible loss. Hence, an offered loss of 60% in the loss context is equivalent to a gain of 40%.

In the meta-analysis, we consider all articles that have implemented a standard sharing-losses DG or a standard sharing-losses UG (as defined in the introduction), with their control group in the gain context (when available). This therefore implies that we excluded:

- DGs or UGs in a "loss context" but in which no loss (of money, of time, or physical well-being) is actually shared by participants (e.g., Antinyan, 2014; Benistant and Suchon, 2021). For example, Antinyan (2014) investigates behaviors in the DG by looking at how participants split a reduced endowment (a gain) after incurring a loss (a reduction in the size of the pie).
- Experimental studies that were closely related to the gain–loss literature but used other games (e.g., Halamish et al., 2008; De Cremer, 2010; Bixter and Luhmann, 2014; Shang et al., 2021, Alós-Ferrer et al. 2021), such as "taking game" or "take-option game" UG and DG experiments (e.g., Tomasino et al., 2013; List, 2007; Bardsley, 2008), in which a loss could be incurred by the recipients but not shared between players.
- Non-standard sharing-losses games, such as binary modified DGs with only two options for participants and non-comparable payoffs (Fiedler and Hillenbrand, 2020; Boun My et al., 2018).
- Studies that involve more than two players by decisions (e.g., Li et al., 2017, who use multiple receivers and multiple proposers in their experiments).

In summary, then, we reviewed all the studies presented in the literature overview (Table 1). For each study, we identified the country where the experiment was conducted (in chronological order), the type of shared losses (monetary or non-monetary), and whether the authors compared the loss-sharing behavior to a symmetrical gain-sharing context. If applicable, we noted the results of this comparison. Lastly, we indicated the specific data used from each study for our meta-analysis, where relevant. Our goal is to minimize noise and only include relevant data in the meta-analysis. For instance, some articles feature a standard loss-sharing game as a baseline, along with treatments that are not suitable for the meta-analysis due to the unique investigated variables or because they are not UGs or DGs. As a result, we specify which data and treatments from each study have been considered for potential replication or informational purposes. For more details on the papers concerned, and on the data collected by the authors, a systematic review of the literature is available in the online appendix.[7]

Prior to conducting the meta-analysis, we observe that, contrary to prospect theory predictions, more studies report a result favoring egalitarian behavior in loss-sharing games (Sign. –) than the opposite (Sign. +). However, as we will discuss later, this difference in behavior is particularly evident for receivers, while it is less pronounced for allocators.

[7] Note that we conducted some robustness tests (see online appendix) to show that the main results hold under even stricter criteria, such as excluding studies conducted with non-monetary incentives, those that use the prepaid mechanism, or those with small sample sizes (< 60).

Table 1. Overview of sharing-losses DG and UG experiments

Country	*Study*	*Type of loss shared*	*Special info on data taken in the RMA*	*Effect*
USA	Camerer et al., 1993 UG	Money	Only first round of each treatment	N.S
	Buchan et al., 2005 UG	Money		Sign. –
	Buchan et al., 2005 study 2 UG	Money		Sign. –
	Lusk and Hudson, 2010 UG	Money	Corrected for bias (see online appendix)	Sign. +
	Thunström, 2019 DG	Money		Sign. –
	Thunström, 2019 study 2 DG	Money		N.S
	Antinyan et al., 2022 DG	Money	Only Loss Manipulation 2 (LM2)	Sign. –
	Antinyan et al., 2022 study 2 DG	Money	Only Loss Manipulation 2 (LM2)	Sign. –
China	Buchan et al., 2005 study 2 UG	Money		N.S
	Zhou and Wu, 2011 1a UG	Money		Sign. –
	Zhou and Wu, 2011 1b UG	Money		Sign. –
	Zhou and Wu, 2011 2 UG	Money		Sign. –
	Zhou and Wu, 2011 3 UG	Money		Sign. –
	Wu and Zhou, 2012 UG	Money		Sign. –
	Guo et al., 2013 UG	Money		Sign. –
	Wu et al., 2014 UG	Money		Sign. –
	Yin et al., 2017 DG	Money	Only “Sham” group without punishment	Sign. –
	Liu et al., 2020 DG	Money	Only Control group	N.S
	Yang et al., 2022 UG	Money	Only “Outcome distribution” treatment	Sign. –
Germany	Berger et al., 2012 UG	Time		N.A
	Baquero et al., 2013 UG	Money		Sign. –
	Baquero et al., 2013 DG	Money		N.S
	Neumann et al., 2017 UG	Money		Sign. –
	Doll et al., 2017 UG	Time		N.S
	Neumann et al., 2018 DG	Money	Only data from the games played first	N.S
	Neumann et al., 2018 UG	Money	Only data from the games played first	N.S
	Windrich et al., 2022 DG	Money		Sign. +
	Windrich et al., 2022 UG	Money		Sign. +
Netherlands	Leliveld et al., 2009 DG	Money	Only “Low dependency condition”	Sign. –
	Noussair and Stoop, 2015 DG	Time		N.A
	Noussair and Stoop, 2015 UG	Time		N.A
	Erkut, 2022 DG	Money		N.S
	Erkut, 2022 DG	Pain		N.S
	Erkut, 2022 tone 2 DG	Pain		N.A
Switzerland	Davis et al., 2012 DG	Money		N.S
	Davis et al., 2012 time DG	Time		N.S
	Davis et al., 2012 pain DG	Pain	Pilot study (footnote 11)	N.A
	Pradana et al., 2017 DG	Time		N.A
	Pradana et al., 2017 UG	Time		N.A
France	Cochard et al., 2020 DG	Money	Study 2 not taken (selection bias)	Sign. –
	Cochard et al., 2020 study 3 DG	Money	Data from supplementary materials	N.S
Finland	Hietaniemi, 2016 UG	Money		Sign. –
	Hietaniemi, 2016 DG	Money		Sign. –
UK	Story et al., 2015 DG	Pain		N.A
	Story et al., 2015 DG	Money		N.S
Israel	Yavneali, 2016 UG	Money	“Back luck” and loss for both players	N.A
South Korea	Lee et al., 2019 DG	Pain	No session, constant treatments	N.A
Japan	Buchan et al., 2005 study2 UG	Money		Sign. –

Notes: the caption for the *Effect* column is as follows: N.A indicates a study which did not compare the results of its loss-sharing game with a control group (gain-sharing). N.S indicates a non-significant framing effect. Sign. – indicates a positive effect of framing on offers (from allocators)/demand (from receivers). Sign. + indicates a negative effect of framing on offers/demand.

It should be remembered that studies reporting significant results are more likely to catch attention and be published than studies that report non-significant results. This in itself may bias the outcome should analysts look exclusively at the most widely reported studies on the topic. For this reason, our study includes published and unpublished papers alike. That said, this is insufficient to correct for a potential “file-drawer effect” (Rosenthal, 1979). Publication bias can be statistically evaluated in various ways. The “funnel plot” is the most common of these (a graph in the shape of an upturned funnel). Graphs of this kind plot the degree of precision of the study (or its sample size) on the y-axis and the effect size on the x-axis. When the distribution of the dots around the true value found is to be uneven and when they fail to form a picture of an upturned funnel, it is to be understood that publications are missing. Where significant publication bias is observed this may be corrected by the "trim and fill" method (Duval and Tweedie, 2000). It is assumed that the missing studies, as seen in the mirror image, produce results that are exactly the opposite of the results found in the studies that are reported. In our paper, we find a homogenous distribution of the dots around the true value, filling an image of an inverted funnel (see Fig. 1.1, Fig. 2.1, Fig. 3.1, and Fig. 4.1 in the appendix for the main results). This is also checked by the Egger's test ($p > 0.35$ for the four corresponding tests; Egger et al., 1997). Even so, if "random effects" (R-E) do seem to be the most suitable means by which to perform this meta-analysis, it cannot be said for certain that there is no publication bias, and accordingly we have also stated the results using the "unrestricted weighted least squares" (WLS) method (Stanley and Doucouliagos, 2015, 2017). This is a better method for handling potential publication bias. Effect sizes found using these two models are very similar and point to the same conclusions.

This paper reports the findings of a meta-analysis of 33 studies (from 28 papers) with 112 estimates from UGs and DGs when participants share losses instead of gains, representing a total of almost 7,000 observations. Note that the standard deviations or standard errors of these estimates were reported in most of these papers, and, for the others, it is fortunately possible to reconstruct the standard deviation on the basis of information about the distribution of offers, as observed by Engel (2011). It is common to set out this information graphically in the form of a histogram or a cumulative distribution. Moreover, it should be noted that in some papers studying the behavior of receivers in loss-sharing UGs, the rejection rates were reported but not the minimum acceptable offers (MAOs), and vice versa in other papers. Fortunately, in most of them, the rejection rate for each possible offer[8] was available graphically (knowing that each receiver was facing all possible offers, whether in the strategy method or not). This meant we could calculate both the MAO and the global rejection rate.

4 Overall meta-analysis results

We start by presenting the way in which the loss is shared between the players in existing experiments. To present the overall results, we use a random effects model, as it seems reasonable to assume that the real effect is not the same for every study (presence of between-studies heterogeneity). The loss is shared between the players as follows: dictators impose around 61% of the loss on the receivers (61.32% to be precise), ultimately representing a 39% [95%-CI: 34.93; 42.81] donation (N = 28, study level), which is far more than the donation made in the game in standard form (28.5%, meta-analysis by Engel, 2011). So presenting the game as a loss to be shared between players could have a positive impact on offers in DGs. Proposers in UGs offer around 52% (52.26%)[9] of the loss on the receivers (N = 21, study level), which represents a 48% [95%-CI: 45.33; 50.30] donation. Once again, this represents a bigger donation than in the game in standard form (40%; meta-analysis by Oosterbeek et al., 2004; 42.3%; meta-analysis by Tisserand, 2014). Finally, we found that the maximum loss accepted by the receivers (MAL) was, on average, 64.28% of the pie (N = 16, study level), which represents a mean demand (or minimal accepted

[8] Note that in many of the papers, specifically those which do not use a strategy method, the authors studied the behavior of receivers for the most plausible offers where the first-mover earns at least as much as the recipient—5/5, 6/4, 7/3, 8/2, and 9/1 (e.g., Zhou and Wu, 2011)—but they did not study the behavior of receivers for other offers. To calculate the MAO, we thus assumed, in a very intuitive way and consistently with the model presented above, that receivers systematically reject extremely disadvantageous offers (10/0) and accept advantageous offers (4/6, 3/7, 2/8 etc.).

[9] Note that this result is in particular agreement with the study by Boushey (2005) (who finds 51.3%), which we were not able to include in the meta-analysis because of a lack of information on the sample size and the variance of the result.

offer or MAO) of 35.72% [95%-CI: 32.13; 39.30] percent of the pie. We cannot really compare this last result with previous meta-analyses because, to our knowledge, none of them analyzed the average demand of receivers in the standard UG. For example, Oosterbeek et al. (2004) report the average rejection rate, i.e., the percentage of people who decline an offer, but the rejection rate does not consider the offer made (note that this could be the subject of another study). Thus, although this is much less precise than the average MAO, we have also calculated the average rejection rate. On average, 31% of the offers are rejected (N = 17, study level) in a loss context, which is higher than the average rejected offers (16%) in the gain domain (see Oosterbeek et al., 2004).

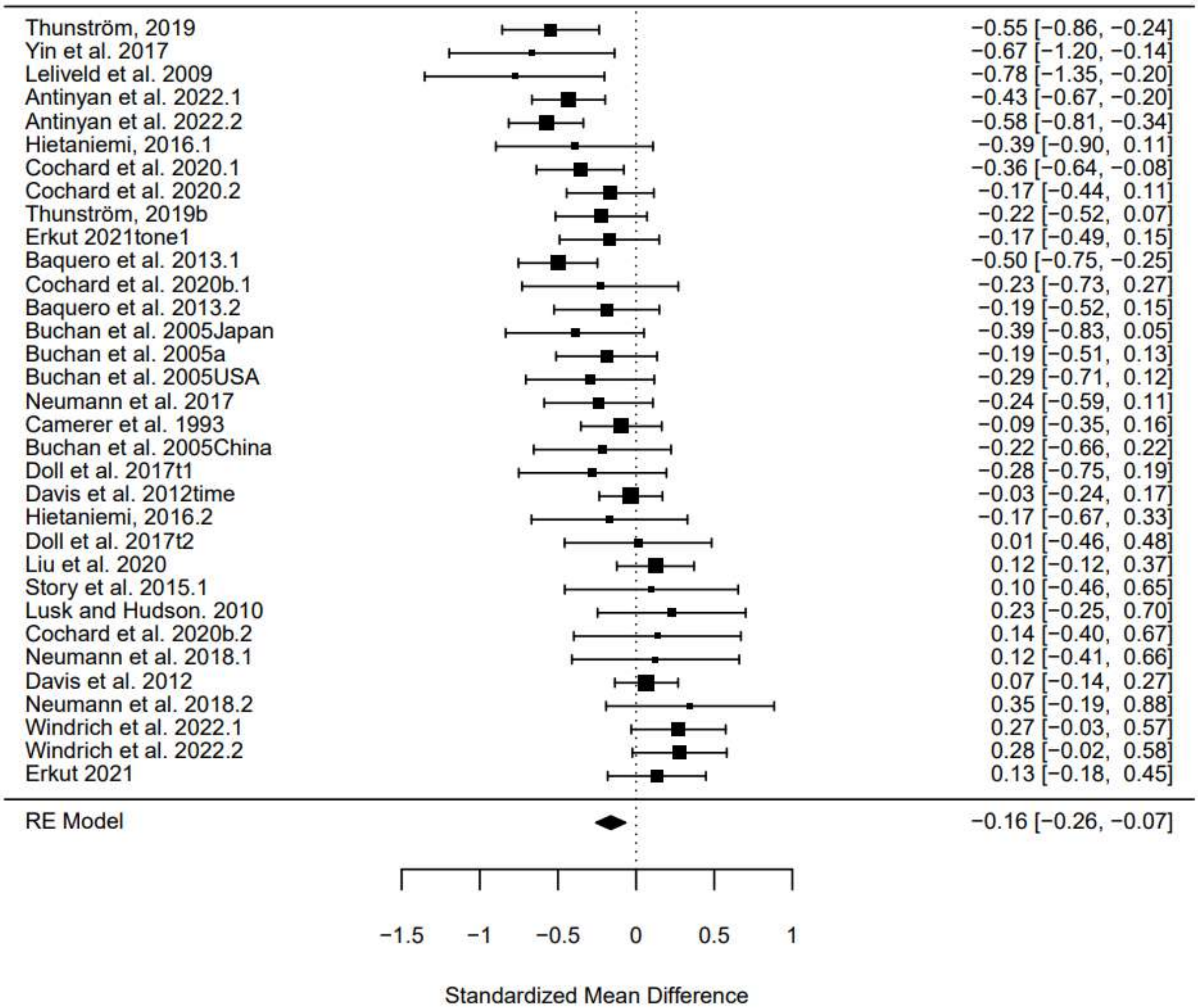
These figures and comparisons, although interesting, must be put into perspective. Beyond a smaller data sample, there may be substantial mean differences between the samples. A more reliable approach for drawing conclusions is to compute the differences between the loss and gain treatments within each study and then compare these differences across studies. Indeed, in most UGs and DGs in loss contexts, authors have compared the results with a control group (baseline) in a gain context. A meta-analysis of differences (or other effect sizes with a comparison between a control group and an experimental group, e.g., odds ratios or risk ratios) requires fewer studies than a meta-analysis of means to be robust (as it controls for intra-study observable and unobservable variables). In the rest of the section, we thus perform a difference-in-means meta-analysis, using SMD.

We begin by setting out the overall results of a meta-analysis that compared results reported in standard/gain-framed DGs and UGs (control group) to results reported in loss-framed DGs and UGs (recall that offers are calculated in "equivalent gains" in the loss context). We are able to use 66 estimates representing 33 SMDs. To present the overall results, we once again use a random effects model, as it seems reasonable to assume that the real effect is not exactly the same for every study (presence of between-studies heterogeneity).

Note that we combined equivalence tests (two one-sided *t*-tests: TOST,[10] Schuirmann, 1987; Rogers et al., 1993) and standard null-hypothesis statistical tests (NHST) to determine if the observed effects are statistically equivalent to zero (as suggested by Hyp. 1, 2, and 3) and also statistically different from zero. Note that not finding equivalence does not automatically mean there is a significant difference. Figure 1 is a forest plot and presents the overall results on allocators' decisions.

[10] Please note that we employed standard equivalence bounds of –0.20 and 0.20, with an alpha of 0.05, to conduct these tests.

Fig.1: Standard vs. Loss-framed (Allocators)



Note: This forest plot (figure 1) displays the standardized mean difference of offers in each study (point estimate as a square, two standard errors as lines). The diamond at the bottom indicates the effect size across studies (N = 33: study level, 4.852 observations; TOST: p-value = 0.205; NHST: p-value < 0.001, tau2 = 0.04 with *SE = 0.01, I-squared = 60%)*

The left-hand column lists the names of the authors. The right-hand side of the forest plot indicates the standardized mean differences between control and treatment groups in each study and their 95% confidence interval. The calculation for the effect sizes involves subtracting the average offers in the treatment group (loss-context) from the average offers in the control group (gain context), and then dividing the result by the pooled standard deviation. Consequently, positive values (or negative, respectively) represent situations in which allocators give more (or less, respectively) in gain-framed contexts than in loss-framed ones. The weight given to each result is represented by the size of the boxes. The dotted vertical line (y-axis) indicates no difference between gain-framed and loss-framed. The diamond indicates the global effect size.

We can see that *d* is equal to –0.16, which indicates a small positive effect of treatment on offers (NHST p-value <0.001; TOST p-value: 0.205). Based on the equivalence test and the null-hypothesis test combined, we can conclude that the observed effect is statistically not equivalent to zero and different from zero. Unlike the predictions of prospect theory, the overall results indicate that allocators are significantly more generous when sharing losses instead of gains. Interestingly, if we separate offers made by allocators in the DG and offers made by allocators in the UG (see Fig. 2 and 3 in appendix), we find a similar framing effect for both game types (*d* equal to –0.18 for DG, and –0.13 for UG).

As said above, in the UG the proposer's choice is strategic and also depends on his anticipation of the receiver's behavior. Thus, increased offers in loss-framed UGs may also stem from an anticipation of higher minimum acceptable offers (MAOs) from receivers. However, the fact that the effect size is of the same order of magnitude suggests a relatively minimal impact of strategic motivations. Therefore, the proposer could offer more in the loss domain not necessarily because he anticipates that the receiver will be more demanding, but also because he may be intrinsically motivated to do so.

Nevertheless, the framing effect is only significant for dictators (NHST p-value < 0.01), while it just misses significance for proposers (NHST p-value = 0.06). Results are not consistent with hypotheses 1 and 3 of equivalence (TOST p-values: 0.378 for DG and 0.200 for UG) but we can only conclude to a significant difference for DG offers. For the offer in the UG, the data indeed do not support the equivalence hypothesis, but they also do not fully support a significant difference.

Result 1: Dictators' average offers are larger in the loss-framed than in the gain-framed treatment, i.e., $\boldsymbol{x_2^{DGg} < w + x_2^{DGl}}$.

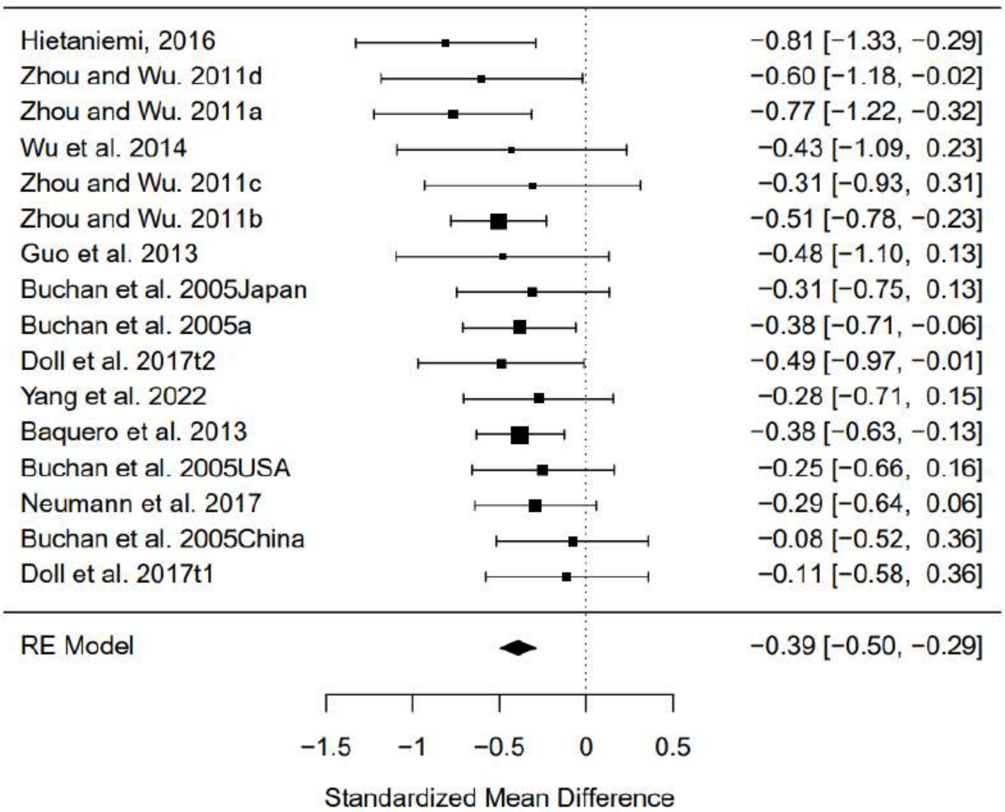
We might think that the specific context of the DG explains this result. In this setting, the dictator is all-powerful, and therefore responsible for the recipient's well-being (or unhappiness). While losses in money, time, or physical well-being generally have a greater impact on utility than equivalent gains, participants tend to perceive inequality in losses as more unfair than inequality in gains ("unfairness in losses looms larger than unfairness in gains"; Zhou and Wu, 2011). Consequently, allocators' utility is more affected when receivers lose a certain sum of money than when they gain the same amount. Intuitively, the recipient's position in a loss context appears less enviable. This result is consistent with an effect of loss aversion being lower than the increase of inequality aversion $\theta_1 < \rho_1$ (also called the "responsibility effect", "empathy effect", or even the "compassion effect" in the literature).

We continue by studying the behavior of receivers in a context of loss (in terms of minimum acceptable offer (MAO) or maximum acceptable loss). As for the allocator's offer, the recipient's maximum acceptable loss x_2^{maxl} will be presented in terms of "equivalent MAO" $x_2^{minl} = x_2^{maxl} + w$. Figure 4 presents the overall results for receivers: control group average MAO vs. experimental group average MAO of each study. Once again, positive values (resp. negative) represent situations in which receivers demand more (resp. less) in gain-framed than in loss-framed UGs.

We can see that *d* is equal to –0.39, which indicates a medium-to-high positive effect of framing on demand (NHST p-value < 0.0001; TOST p-value = 1). Consistently with the adage "unfairness in losses looms larger than unfairness in gains", receivers demand significantly more in loss-framed than in gain-framed UGs. As Zhou and Wu (2011) said, even if this represents the same offer in terms of monetary payoff, it could be because "in subjective rating, unfair offers were perceived as being more unfair in the loss than in the gain domain." We therefore reject Hypothesis 2, which postulated equivalence between contexts, and further conclude that there is a significant difference between the contexts.

Result 2: Receivers' average demands are greater in the loss-framed than in the gain-framed treatment, i.e., $x_2^{minl} > x_2^{ming}$.

Fig. 4: Standard vs. Loss-Framed (Receivers)



Note: This forest plot (figure 1) displays the standardized mean difference of receivers' MAOs in each study (point estimate as a square, two standard errors as lines). The diamond at the bottom indicates the effect size across studies (TOST: p-value = 1; NHST p-value < 0.0001, N = 16: study level; 1.517 observations, tau2 = 0.00 with *SE = 0.014, I-squared = 0.00%).*

This result is consistent with the effect of loss aversion being lower than the effect of inequality aversion $\theta_2 < \rho_2$, as was found for the allocators. The recipient is more sensitive to inequality than to losses, making them more likely to choose the fully egalitarian situation of rejection in the loss context than in the gain context. It is important to note that the impact of loss context is medium to high for receivers, while it is small for allocators. This can be attributed to the fact that receivers, unlike allocators, are dealing with aversion to disadvantageous inequality. Participants' inequality aversion is multiplied by ρ_i in the loss domain, but α_i (aversion to disadvantageous inequality) is greater than β_i (aversion to advantageous inequality). Even though we generally cannot compare the preference parameters of two individuals, we may expect that on average, $\alpha_2 \geq \beta_1$. This implies that if $\rho_1 = \rho_2 = \rho$, the loss context has a greater total impact for recipients than for allocators $(\alpha_2\rho \geq \beta_1\rho)$. If $\rho_2 \geq \rho_1$, suggesting that the inequality aversion effect is even more pronounced in cases of disadvantageous inequality (for the recipient) compared to cases of advantageous inequality (for the allocator), then the likelihood of the above inequality being true increases even further.

The aforementioned results demonstrate that loss-sharing promotes more socially oriented behavior among participants. While comparing control and experimental groups within each study largely controls for intra-study unobservable variables, it is also important to control for variables characterizing all studies (between-study variation). Furthermore, it is valuable to study variables influencing player behavior solely in a loss-sharing context, even without comparing it to the gain domain, particularly to examine the impact of incentive type. We will address these issues in the following section, using multivariate meta-regressions.

5 Meta-regression analysis

In this section, we present multivariate regression analyses (MRA) in order to examine the determinants of behavior in a loss-sharing context and to examine the variables that influence the treatment effect (Gain–Loss). We use a standard random effects model and an unrestricted weighted least squares (WLS) model (Stanley and Doucouliagos, 2015, 2017), the most recent and conservative econometric model. While a meta-analysis concentrates on the value taken by the variable of interest, a meta-regression concentrates on the variables influencing this variable.

We investigate a variety of factors that may influence player behavior, such as strategic interaction, methodology, participant demographics, or other experimental settings. We also explore the impact of less common variables, like the field of expertise of the researchers conducting the experiments, which might have significant unobservable effects on results due to differences in experimental procedures across scientific fields (see Alós-Ferrer and Yechiam, 2020). Notably, economics experiments often involve economics students, while psychology experiments typically involve psychology students. Furthermore, we examine the effects of using the prepaid mechanism, where treatments consist of two sub-sessions. The first sub-session, during which participants receive a show-up fee and sign a receipt for confirmation, occurs weeks before the main experiment. They are informed and are required to accept the possibility that they might have to return money in the second sub-session. For example, in the gain-treatment condition, players received 10 USD in the first sub-session and had to share a gain of 10 USD in the second one. Conversely, in the loss-treatment condition, players received 20 USD in the first sub-session and had to share a loss of 10 USD in the second one. To ensure fair comparison, it is important that participants come back to the lab twice even in the gain treatment. We will distinguish between the cases where this method was employed in both treatments (variable "*Prepaid Mechanism*" hereafter) and those where it was used exclusively in the loss treatment (variable "*Prepaid Loss Only*" hereafter).

Note that unfortunately there are not enough studies reporting results based on the gender of the participants to include this variable in the meta-regression. There is also so little variability in the database regarding age that it is not useful to take this variable into account. Besides, this small variability can be considered as already controlled for by the variable *Student*.

Our baseline model for the MRA is specified as follows:

$$y_j = \beta_0 + \beta_1 x_{1j} + \beta_2 x_{2j} + \cdots + \varepsilon_j$$

where y_j is the share of the endowment left to the receivers in the loss-framed treatment of study j (Table 2) or the SMD between the share left in the gain-framed treatment of study j and the share left in the loss-framed treatment of study j (Table 3) of the experiment j and β_0 is the intercept. The variables x_i specify different characteristics of the experiment, such as type of students, incentives, amount shared, etc. ε_j in this baseline model specifies the between-subgroup variation. Using the SMD rather than the offered (or accepted) percentage of the pie as the response variable makes it possible to control for intra-study unobserved variables.

The model can be estimated in several ways. The fixed-effect (FE) estimator assumes that the same real effect size is common to all experiments. Care is required when interpreting the results because of potential unobserved differences in protocols and in the population under test. While it allows for within-subgroup variability, this type of estimator ignores between-subgroup variation. This means that parameter estimates are biased where between-subgroup variation cannot be ignored, which is the case in our study. We do not use this model, which may be better suited to medical studies.

Conversely, the random effects (RE) estimator allows the variables of interest to vary from one experiment to the other, but this method may be sensitive to possible publication bias.

Finally, Stanley and Doucouliagos (2015, 2017) propose estimating this baseline model using an unrestricted least squares model. This involves estimating the equation using weighted least squares (WLS) with $1/se^2(y_j)$ (where se is the standard error of the dependent variable) as the weights. Where publication selection bias does occur, the WLS-MRA estimates prove more appropriate than the random effects estimates. Both RE and WLS models are used in the following meta-regressions.

In the interest of thoroughness, and considering that some authors report multiple experiments within one or more papers, we follow the approach suggested by Stanley and Doucouliagos (2012) by clustering standard errors at the author level in all specifications. This method makes the standard errors robust to intra-author dependence. Our analysis encompasses a total of 24 clusters across 28 papers. Importantly, the effect sizes are fairly uniformly distributed among the clusters, though the distribution is not perfect, ensuring a reasonably balanced analysis. A sensitivity analysis of principal results relative to clusters is provided in the online appendix.

Finally, multicollinearity is not to be overlooked in our regressions since a meta-regression analysis is more prone to this phenomenon than classical econometrics. Indeed, most explanatories are dummy variables. In our case, we choose to present only the regressions where all explanatory variables present a variance inflation factor (VIF) of less than 3, indicating low correlation among them. Data and descriptive statistics of variables used in the MRA are provided in appendix (Table 6).

Let us first study the behavior of allocators (dictators and proposers, subsection 5.1), and then the behavior of the receivers (subsection 5.2). We set up models which list all the control variables. These variables are not all included simultaneously in the analysis, so as to avoid issues related to multicollinearity.

5.1 Behavior of allocators

In Table 2 (subsection 5.1.1), the results are reported in terms of share of the endowment left for the receivers in the loss-framed game and in Table 3 (subsection 5.1.2) in terms of SMD between gain-framed and loss-framed games.

5.1.1 Determinants of behavior in loss-sharing context

Table 2. Meta-Regression Loss-Sharing (Allocators)

	Model used							
	REML				WLS			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	38.20***	39.02***	34.00***	34.76***	38.53***	39.21***	39.82***	38.51***
	(2.01)	(2.12)	(5.52)	(5.12)	(1.88)	(1.89)	(4.56)	(4.42)
Ultimatum Game[a]	9.43***	10.03***	9.285***	14.48***	10.27***	11.06***	10.30***	15.24***
	(3.03)	(3.32)	(4.50)	(4.08)	(2.40)	(2.49)	(3.73)	(3.11)
Non-Monetary[b]	1.874	1.063	2.257	6.816	2.071	1.391	5.931	4.666
	(3.49)	(3.54)	(4.44)	(4.94)	(4.00)	(3.90)	(4.85)	(3.99)
Prepaid Mechanism [c]		–7.306	–4.952	–7.652		–7.871	–4.498	–9.821
		(6.33)	(7.36)	(6.53)		(6.46)	(7.13)	(6.62)
Both role[e]			0.082	5.311			0.774	4.116
			(5.99)	(4.42)			(3.53)	(2.90)
Strategy method[f]			1.616				6.161	
			(4.83)				(4.63)	
Not in Lab[g]			3.623	–1.647			–5.153	–5.741
			(4.43)	(4.88)			(3.52)	(3.70)
Hypothetical[h]			2.671	–2.255			–3.982	–4.575
			(4.94)	(4.54)			(4.40)	(4.01)
Not Student[i]				12.87**				11.54*
				(4.51)				(4.26)
Repeated[j]			0.954				0.894	
			(4.99)				(4.50)	
Within[k]			2.439				–1.062	
			(3.94)				(3.76)	
Non Economics Papers[l]				7.788*				9.303**
				(3.66)				(3.28)
Prepaid x Ultimatum Game		1.132	0.442	–2.584		0.932	–1.972	–0.211
		(8.29)	(9.01)	(7.91)		(7.36)	(7.79)	(6.99)
Non-Monetary	–3.436	–4.040	–2.772	–9.798	–2.886	–3.671	–9.439	–6.396
x Ultimatum Game	(5.24)	(5.40)	(6.43)	(6.31)	(4.90)	(4.81)	(6.96)	(4.84)
N Offers	2959	2959	2959	2840	2959	2959	2959	2840
N Subgroups	49	49	49	45	49	49	49	45

Notes. Robust standard errors in parentheses. ***p < 0.001, **p < 0.01, and *p < 0.05. Reference: [a] Dictator game, [b] Monetary [c] Standard procedure, [e] Only one role (Bothrole is a variable which takes the value 1 when the same participants played as proposer and dictator in the same experiment) [f] Standard method, [g] Lab, [h] paid according to action, [i] Student, [j] One-shot, [k] Between, [l] Economics Papers.

We observe several interesting results from this table. Concerning the nature of the shared loss, the *Non-Monetary* variable is not significant in any of the regressions and models tested. This suggests that dictators do not behave differently when sharing non-monetary losses compared to monetary ones (in terms of the percentage of loss shared). Our study utilizes sample sizes that are large to identify significant differences, even minimal ones, should they exist.[11] Consequently, we reject Hypothesis 4.

Result 3: In the loss context, the dictators' average offering behavior when incentives are non-monetary is similar to how it is when they are monetary, i.e., $x_2^{DGNMl} = x_2^{DGl}$.

This result may be somewhat surprising, given the predictions in the literature. Indeed, the social norms for allocating monetary and non-monetary endowments differ: not sharing a loss in the non-monetary domain (such as when sharing pain or the time required to perform a difficult task) might be viewed less favorably from a social perspective than not sharing it in the monetary domain. Therefore, one might expect even more prosocial behaviors in the non-monetary domain (due to $\beta_1^{NM} > \beta_1$).

Nevertheless, this result could be due to the context of losses itself. Indeed, in the loss-sharing context, the monetary amounts left for the recipients are already high, making it more difficult to leave more than 40–50% of the endowment in a non-monetary context. Consequently, there may be a threshold effect that prevents a larger margin of generosity when sharing non-monetary losses.

Moreover, this could also be due to another factor specific to the loss context in laboratory experiments. Indeed, as said before, in the monetary case the loss is often a framing effect. The subjects first receive an initial endowment to absorb the potential loss. However, when pain or a loss of time is shared, subjects experience a real loss. Consequently, it is possible that in addition to higher inequality aversion coefficients (β_1^{NM} and ρ_1^{NM}) due to different social norms and an increased sense of loss, the allocators' loss aversion θ_1^{NM}could also be higher. These effects may cancel each other out, ultimately leading to relatively similar behavior: $\beta_1^{NM} - \frac{1}{2}\frac{\theta_1^{NM}}{\rho_1^{NM}} = \beta_1 - \frac{1}{2}\frac{\theta_1}{\rho_1}$.

In addition, none of the regressions or models tested found a significant effect for the sum of the *Non-monetary* coefficient and the *Ultimatum x Non-monetary* coefficient. This suggests that in the UG, proposers do not exhibit different behavior when sharing non-monetary losses compared to monetary losses.[12] Thus we can also reject hypothesis 6.

Result 4: In the loss context, the proposer's average offering behavior when incentives are non-monetary is similar to how it is when they are monetary, i.e., $x_2^{UGNMl} = w + x_2^{UGl}$.

Furthermore, we note that the variable *Not Student* is positive and significant, indicating that the amount left for receivers is higher when allocators are not students. This result is consistent with empirical literature in the gain-domain according to which students are more likely to behave as selfish and rational agents than non-students. As remarked by Engel (2011) or Belot et al. (2015), student experiments underestimate the deviation from the theoretical predictions of the standard economic model.

Result 5: Non-students leave more to receivers than students in the loss-sharing context.

Finally, we see that the variable *Non-Economics Papers* is also positive and significant, which indicates that studies done by non-economics researchers reported higher level of fairness or generosity from participants than studies done by economics researchers. This might be related to differences in procedures or in the type of subject pools used by the respective researchers. Economists are more likely

[11] In order to identify a 1% difference in offer rates between the groups (non-monetary vs. monetary) with a statistical power of 0.80 and a significance level of 0.05, we require a minimum of 405 participants in each group. This sample size is comfortably within the scope of the studies encompassed by our meta-analysis. Furthermore, detecting larger differences between the groups would necessitate even smaller sample sizes.

[12] Note that the analyses presented later in the paper show that the receivers do not demand more when the endowment is non-monetary compared to when it is monetary. Result 4 is therefore consistent with the fact that proposers correctly anticipate this and, as seen for dictators in result 3, have no preference for giving more when incentives are non-monetary.

to use economics students, who have been found to behave more closely to the selfish and rational "homo economicus" paradigm (e.g., Carter and Irons, 1991; Frank et al., 1993). Nevertheless, recent experiments (Alós-Ferrer et al., 2022) put this result into perspective and suggest that it is only valid when the interactions are bilateral (as in standard DG or UG).

Result 6: Studies done by economics researchers report a lower level of fairness or generosity from participants than studies done by non-economics researchers.

In a very intuitive way, and consistent with empirical literature in the gain-domain (e.g., Cochard et al., 2021), we can see that the amount left by allocators in UG is significantly higher than amount left in DG. Note that this amount is close to perfect equity (see coefficient for *Intercept* + *Ultimatum Game*).

In the next subsection, we investigate the variables that could influence the gain/loss treatment effect (the difference between the amount left for receivers in the gain-context and the amount left in the loss-context). In this case, as the results are reported in terms of differences, positive values indicate an effect that goes in the direction of a lower offer in loss-sharing than in gain-sharing, and vice versa for negative values.

5.1.2 Variables that influence the gain/loss treatment effect

Table 3. Meta-Regression Gain-Sharing vs. Loss-Sharing (Allocators)

	Model used							
	REML				WLS			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Intercept	–0.237***	–0.180*	–0.247*	–0.248*	–0.222*	–0.181*	–0.234**	–0.238***
	(0.06)	(0.09)	(0.12)	(0.12)	(0.09)	(0.07)	(0.07)	(0.05)
Ultimatum Game[a]	–0.032	0.046	–0.016	–0.029	–0.012	–0.001	–0.114	–0.111
	(0.09)	(0.12)	(0.13)	(0.14)	(0.11)	(0.11)	(0.17)	(0.16)
Non-Monetary[b]	0.091	–0.077	0.003	–0.014	0.149	–0.095	–0.025	–0.024
	(0.15)	(0.16)	(0.18)	(0.19)	(0.09)	(0.08)	(0.11)	(0.11)
Prepaid Both Treatments[c]	–0.026	–0.007	–0.006	–0.012	–0.006	–0.030	–0.038	–0.037
	(0.24)	(0.25)	(0.28)	(0.29)	(0.08)	(0.09)	(0.09)	(0.08)
Prepaid Loss Only[d]	0.458***	0.363***	0.419***	0.423***	0.493***	0.394*	0.487*	0.494*
	(0.24)	(0.18)	(0.19)	(0.19)	(0.06)	(0.19)	(0.21)	(0.22)
Bothrole[e]		0.032	–0.120	–0.120		0.102	–0.036	–0.043
		(0.18)	(0.19)	(0.19)		(0.16)	(0.24)	(0.21)
Strategy method[f]		–0.295				–0.293		
		(0.15)				(0.20)		
Not in Lab[g]		0.094	0.103	0.120		0.131	0.153	0.149
		(0.15)	(0.17)	(0.18)		(0.24)	(0.23)	(0.21)
Hypothetical[h]		0.077	0.068	0.051		0.072	0.045	0.041
		(0.15)	(0.18)	(0.18)		(0.23)	(0.24)	(0.24)
Not Student[i]		–0.166	–0.111	–0.107		–0.198	–0.169	–0.163
		(0.14)	(0.17)	(0.16)		(0.23)	(0.22)	(0.22)
Repeated[j]		–0.163	–0.106	–0.086		–0.135	–0.052	–0.049
		(0.12)	(0.13)	(0.15)		(0.12)	(0.15)	(0.14)
Within[k]			–0.020				–0.016	
			(0.12)				(0.12)	
Non Economics Papers[l]				–0.056				–0.000
				(0.20)				(0.24)
Non-Monetary	–0.010	0.210	–0.036	–0.011	–0.047	0.275	0.043	0.052
x Ultimatum Game	(0.26)	(0.28)	(0.30)	(0.29)	(0.12)	(0.17)	(0.16)	(0.17)
N Offers	4853	4853	4853	4853	4853	4853	4853	4853
N SMD	33	33	33	33	33	33	33	33

Notes. Robust standard errors in parentheses. ***p < 0.001, **p < 0.01, and *p < 0.05. Reference: [a] Dictator game, [b] Monetary [c][d] Standard procedure, [e] Only one role (Bothrole is a variable which takes the value 1 when the same participants played as proposer and dictator in the same experiment), [f] Standard method, [g] Lab, [h] paid according to action, [i] Student, [j] One-shot, [k] Between, [l] Economics Papers.

We observe that few variables have a significant impact, which is unsurprising since our explained variable concerns a difference in offers between treatments, and not the amount of the offer. For example, the type of subject pool has a recognized impact on the offers (Engel, 2011; Oosterbeek et al., 2004), but there is no obvious reason why this impact should vary with the gain/loss context. The only explanatory variables with an impact are those which change the difference in offers, i.e., that have a greater impact on one treatment than on the other.

This is the case for the variable *Prepaid Loss Only.* Indeed, as indicated by the name of the variable, the mechanism was ultimately only used in the experimental group (loss-context) and not in the control group (gain-context). As previously stated, in experiments using this mechanism, sessions of the loss treatments consisted of two sub-sessions (only one for gain treatments). The amount that was given in the first sub-session could be lost in the second sub-session a few weeks later, thus inducing a more realistic loss effect than the standard loss-sharing procedure. This could indeed explain the positive value of the *Prepaid Loss Only* coefficient, indicating a tendency towards less generosity when sharing losses than when sharing gains.

However, note that with this mechanism, participants have to come to the lab twice to win the same payoff as in the gain treatment, and they come to the second session not to gain money but at best avoid losing some (which can annoy them excessively). This could also explain the on-average less altruistic behavior in the loss-context. Furthermore, since participants were informed (and had agreed) that their payment could decrease during the second sub-session of the experiment and that they might need to return some money, they had several days to devise strategies for avoiding monetary loss in the second part of the experiment or to discuss these strategies with friends or acquaintances. This is an opportunity that participants in the control group did not have. Hence, this observed effect could be attributed to the experiment's protocol rather than to an enhanced perception of loss. This line of explanation is all the more plausible as when the mechanism applies to both treatments (as in Neumann et al., 2017), the results are similar to the standard procedure without the prepaid mechanism (the results point clearly in the direction of greater equality in the context of losses, coeff. *Intercept* + coeff. *Prepaid Both Treatments*). Hence, the prepaid mechanism should apply to both treatments, in order to induce a greater feeling of loss while keeping experimental control.

When the effect of *Prepaid Loss Only* is controlled for (i.e., focusing on the standard protocol), the results indicate that proposers and dictators are significantly more generous and fairer when sharing losses rather than gains (coeff *Intercept* and coeff *Intercept* + coeff *Ultimatum Game* are negative and significant at the 5 percent level for both models and all regressions). We thus confirm the result mentioned in the above meta-analysis regarding the dictators (Result 1) and we gain significance regarding the proposers. As seen previously in the meta-analysis section, the results indicate that adding strategic interactions, i.e., being a proposer in a UG instead of a dictator in a DG, does not significantly change the difference in the offer across contexts (it obviously changes the offers, as seen in Table 2, but not the difference in offers). We can therefore reject hypothesis 3:

Result 7: The proposer's average offers in the loss-framed treatment are larger than in the gain-framed treatment, i.e., $x_2^{UGg} < w + x_2^{UGl}$.

It is not possible to draw definitive conclusions on the preference parameters from this result, as proposers' decisions depend on both their preferences and their beliefs. However, this finding aligns with the earlier results of the paper showing that the effect of loss aversion is smaller than the effect of inequality aversion $\theta_i < \rho_i$ for both dictators and receivers. Indeed, proposers might accurately anticipate that receivers demand more in the loss context ($\theta_2 < \rho_2$), and this expectation could be reinforced by their own preferences ($\theta_1 < \rho_1$). Nevertheless, we cannot rule out alternative hypotheses, such as proposers having incorrect beliefs ($\theta_2 \geq \rho_2$) being compensated by their own prosocial preferences ($\theta_1 \ll \rho_1$).

5.2 Behavior of the receivers

Let us now study the behavior of the recipients. Note that there are fewer variables to control for, because the database was already very homogeneous (the recipients were all students, etc.), as were the results of the meta-analysis (see *tau2* and *I-squared*). The results of the meta-regression are reported in Table 4 (in terms of demand in the loss context) and 5 (in terms of standardized mean difference in demand between both contexts) in the appendix.

As we can see in Table 4, the variable *Strategy method* is positive and significant, which implies that receivers demand significantly more when the strategy method is employed. This confirms an important result of the literature on gain-sharing UGs: receivers are more demanding when the strategy method is employed (see the meta-analysis by Oosterbeek et al., 2004). Asking the receiver how he/she would react to all possible offers before being confronted with the real specific decision of the proposer strengthens fairness considerations (Güth and Tietz, 1990).

Result 8: In the loss context, the receivers' demand is significantly higher when the strategy method is employed.

Note that the *Non-Monetary* variable is not significant in any of the tested regression models. This shows that the demand from receivers does not increase when players share non-monetary losses compared to monetary ones. We therefore reject hypothesis 5.

Result 9: In the loss context, receivers are on average as demanding when incentives are non-monetary as when they are monetary, i.e., $x_2^{minl^{NM}} = x_2^{minl}$.

The same reasons mentioned earlier for allocators can be used to explain this result. Since the average MAO in a loss context is already high with monetary stakes, there may be a threshold effect that prevents the revelation of a higher demand when using non-monetary stakes. Furthermore, when pain or loss of time is shared, subjects experience a tangible loss. As a result, it is possible that, in addition to higher inequality aversion coefficients (α_2^{NM} and ρ_2^{NM}) due to different social norms and an increased sense of loss, the receivers' loss aversion (θ_2^{NM}) could also be elevated. Therefore, similar to allocators, these effects may counterbalance each other, ultimately leading to relatively comparable behavior. In the model, this result is consistent with the equality $\frac{\alpha_2^{NM} w}{\frac{\theta_2^{NM}}{\rho_2^{NM}} + 2\alpha_2^{NM}} = \frac{\alpha_2\, w}{\frac{\theta_2}{\rho_2} + 2\alpha_2}$.

Considering these reasons, the results may not be easily generalizable to scenarios involving gains. It would be valuable to carry out a meta-analysis in a gain context to explore the influence of various types of shared endowments. However, as of now, there is an insufficient number of studies in this field to effectively examine this effect.

In Table 5, only the intercept (difference between the treatments) is significant, indicating that the meta-analysis results are robust while controlling for multiple variables. This suggests that receivers consistently demand significantly more in the loss-sharing UG compared to the gain-sharing UG.

6 Conclusion

By means of a meta-analysis using data from 33 studies with 114 estimates, we have provided answers to many major research questions relating to generosity and fairness in DGs and UGs in a loss-sharing context (as compared to a gain-sharing context). We have shown that sharing decisions are dependent on framing. Indeed, our results indicate that sharing losses rather than gains pushes participants into more prosocial behavior. Dictators impose around 60% of the loss on receivers, which ultimately represents a 40% "equivalent donation". This is much more than the donation made in the standard gain game of previous studies (28.5% in Engel, 2011), and significantly larger than in the (gain-sharing) control groups of each of the studies considered in our meta-analysis, although the effect is small (d = –0.18). So, presenting the game as a loss to be shared between players has a positive impact on offers in DGs. We made a similar observation regarding proposers' offers in UGs: they offer around 52% of the loss on the receivers, which represents a 48% equivalent donation, that is, almost a perfect sharing between the participants. Once again, this represents a larger donation than was observed in the standard-form game (40% in Oosterbeek et al., 2004; 42% in Tisserand, 2014). Finally, we found that the maximum loss accepted by the recipients was around 65% of the pie, which represents an equivalent mean demand of 35% of the pie. On average, 31% of the offers are rejected in the loss context, which is higher than the average percentage of rejected offers in the gain domain found in previous studies (16% in Oosterbeek et al., 2004). Thus, sharing losses pushes individuals to share more equally and to demand more equal offers.

While dictators could simply attempt to protect their endowment, they also recognize that receivers may be attached to it as well. In this context, dictators hold all the power, making them responsible for the receiver's well-being or unhappiness. Intuitively, it might be expected that a loss-averse dictator would share less equally in a loss-framed DG than in a gain-framed DG. However, pure loss aversion seems to apply especially in the cases where the loss is not shared, where there is no 'responsibility effect' (or 'compassion' or 'empathy' effect). It is indeed true that "unfairness in losses looms larger than unfairness in gains" (Buchan et al., 2005): participants tend to view inequality in losses as more unfair than inequality in gains. Consequently, the recipient's situation becomes even less favorable in a loss context, which seems quite intuitive. It appears that the heightened inequality aversion resulting from the loss context outweighs the influence of loss aversion. In accordance with the 'do-no-harm' principle (Baron, 1995; Van Beest et al., 2005), dictators become more reluctant to optimize their payoffs at the expense of actively harming others when outcomes are framed as losses.

Furthermore, in the UG, receivers feel more aggrieved in the loss context than in the gain context (d = –0.39) for the same final payoff, involving a higher minimum acceptable offer (MAO). Like dictators, proposers may also feel this form of responsibility towards recipients, but they could also anticipate a greater demand from receivers, which leads them to offer more in order to maximize their expected utility.

A meta-analysis on loss-sharing can also help reveal differences in behavior when sharing non-monetary endowments (like time loss or physical pain) compared to monetary ones. Indeed, the social norms for allocating monetary and non-monetary endowments differ: consistent with Erkut (2022), the social perception of not sharing a loss in the non-monetary domain (e.g., sharing pain or the time needed for a challenging task) could be less favorable compared to not sharing a loss in the monetary domain. Current experimental research provides mixed evidence, and many studies do not compare the two domains on equal footing, leading to ambiguity in the results. By running a separate meta-regression on loss treatments only, we properly investigate the impact of the type of endowment across a large number of studies in the loss domain. Interestingly, we found that behavior in the DG and the UG does not seem to be impacted by the nature of the stakes. This result may be somewhat surprising given the predictions in the literature. However, since average offers and demands in a loss context are already high with monetary stakes, there might be a limiting factor that inhibits the disclosure of even greater offers and demands when non-monetary stakes are employed. Moreover, when individuals share pain or time loss, they undergo a real loss. Consequently, the increased inequality aversion coefficients, which may be attributed to distinct social norms and a heightened perception of loss, could also be accompanied by increased loss aversion. As such, both allocators and receivers might experience these effects balancing each other out, ultimately resulting in fairly similar behavior.

We recommend that researchers conduct further inquiries into the effects of incentive types (monetary vs. non-monetary), both in the context of losses, so as to increase the number of observations, and within the domain of gains, as this may help reveal significant differences between the two types of incentives.

We also found that when sharing losses, non-students share more equally that students, and receivers demand more when the strategy method is employed, which is in line with results observed in the gain context (see e.g., Oosterbeek et al., 2004; Engel, 2011; Tisserand 2014; Cochard et al., 2021). This suggests that these results can be generalized to the domain of losses.

Our main findings have some managerial or policy implications. First, individuals in a situation framed as possibly loss-making from a given reference point seem more prone to share losses equally, in contrast to what they would do in a gain-framed situation. This might suggest that in hard times, generosity and fairness (at least in bilateral interactions) could increase relative to the normal situation. Second, a natural implication of our findings for decision-makers is that they should devote sufficient attention to the perception of gains–losses and to what may be the potentially unintended effects of framing.

This study could benefit from several extensions. Although our results are significant, additional studies comparing behavior in gain and loss contexts would be valuable for expanding the dataset and refining the investigation of factors influencing differences in behavior across contexts. Specifically, there have been few laboratory studies conducted using the prepaid mechanism, and we are not aware of any field or natural experiments exploring more realistic monetary losses. Future experimental studies should examine the impact of various factors, such as stake size or, more broadly, the context of the scenario being considered. In particular, individuals might exhibit reduced empathy and responsibility feelings in a market context. Moreover, recent studies suggest that prosocial behavior can decrease significantly when decisions affect a large group of people (as in Alós-Ferrer et al., 2022). Since the games considered in our analysis only involve bilateral interactions, an important follow-up question is whether our findings remain true when decisions impact a larger number of individuals.

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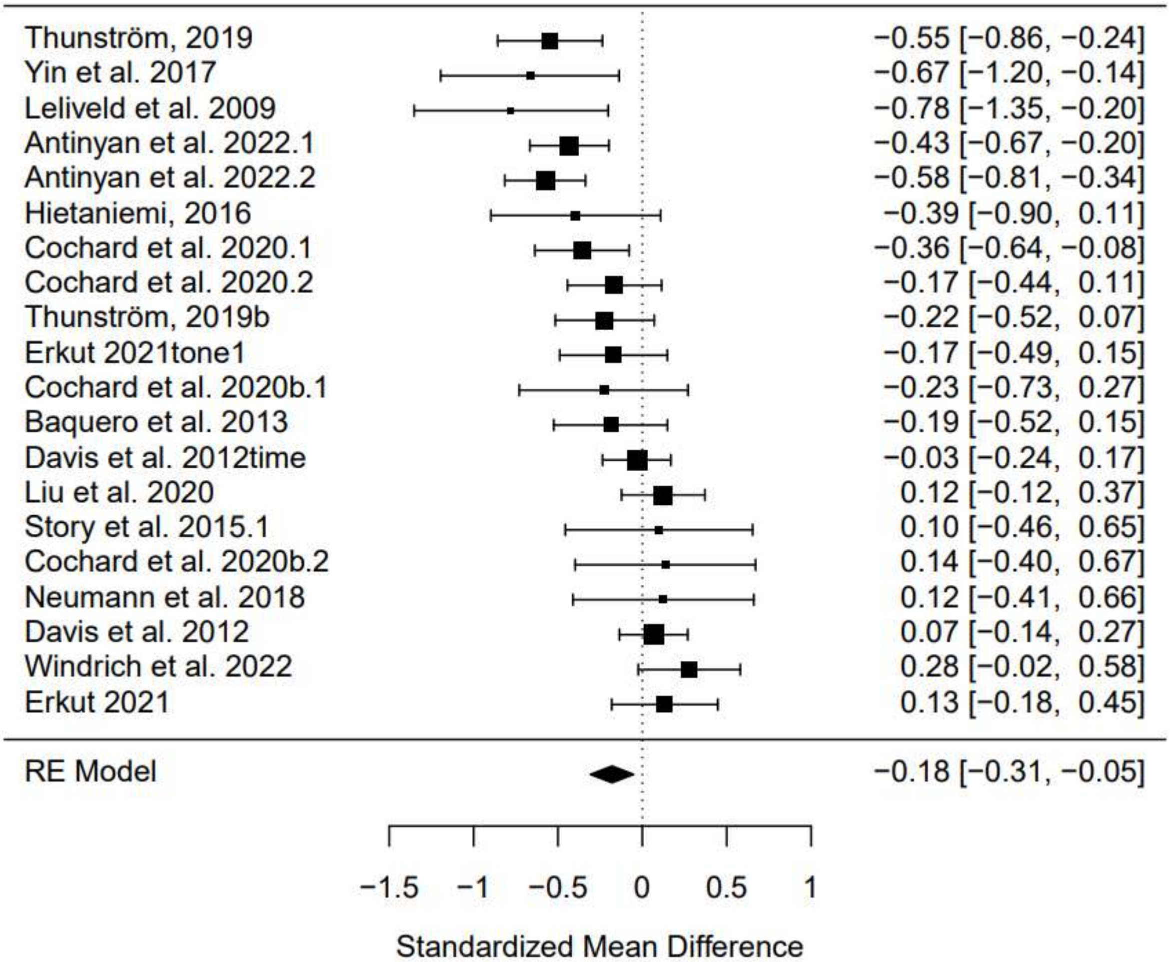
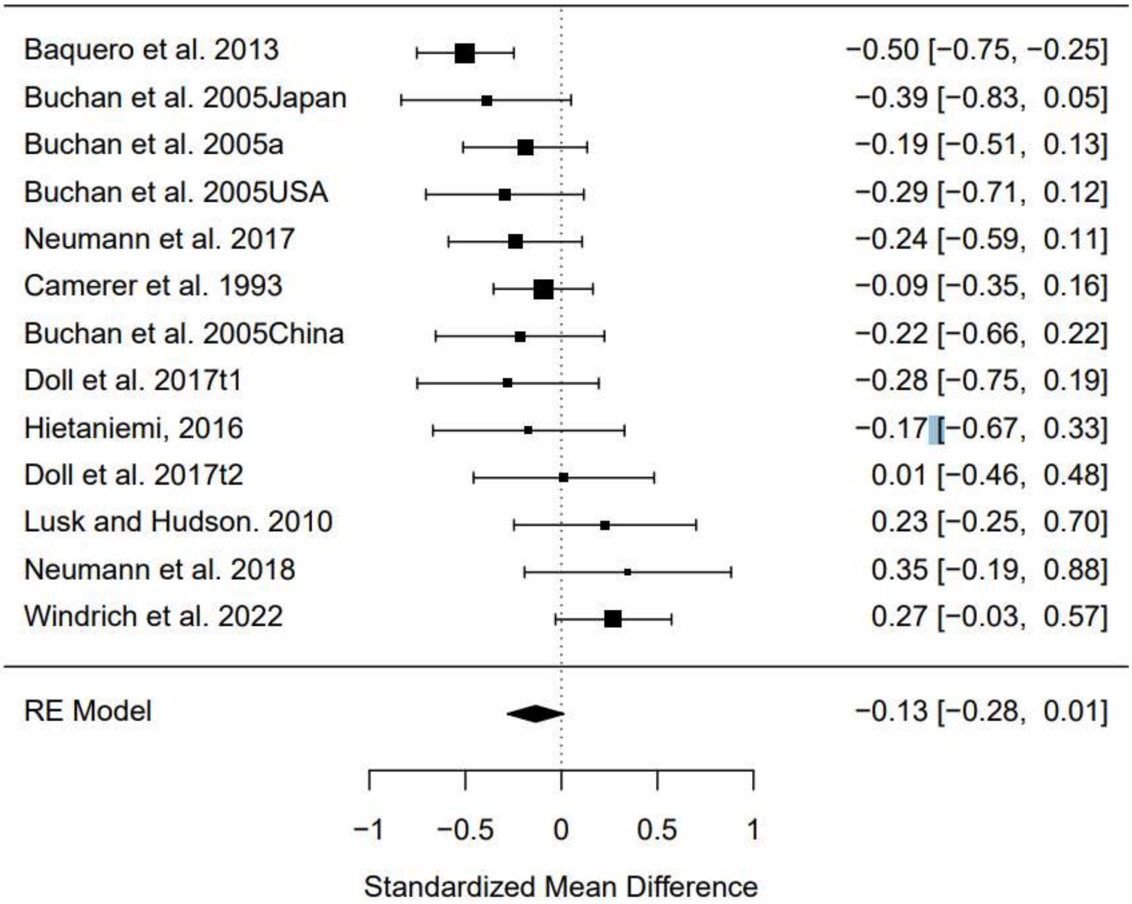
Appendix

Fig. 2: Standard vs. Loss-framed (Dictators only)



Note: This forest plot (figure 1) displays the standardized mean difference of offers in each study (point estimate as a square, two standard errors as lines). The diamond at the bottom indicates the effect size across studies (TOST p-value: 0.378; NHST p-value = 0.005, N = 20: study level; 3.352 observations, tau2 = 0.05 with *SE = 0.02, I-squared = 67%).*

Fig. 3: Standard vs. Loss-framed (Proposers only)



Note: This forest plot (figure 1) displays the standardized mean difference of offers in each study (point estimate as a square, two standard errors as lines). The diamond at the bottom indicates the effect size across studies (TOST p-value: 0.20; NHST p-value: 0.06, N = 13: study level; 1.500 observations, tau2 = 0.03 with *SE = 0.02, I-squared = 48%).*

Fig. 1.1. Funnel plot (Allocators)

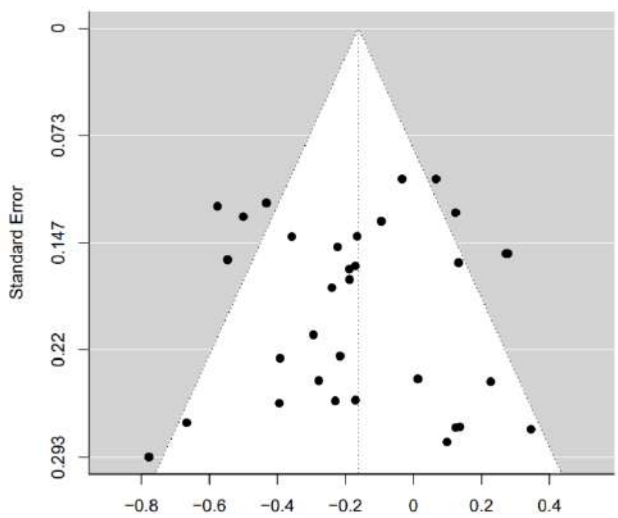


Fig. 2.1. Funnel plot (Dictators)

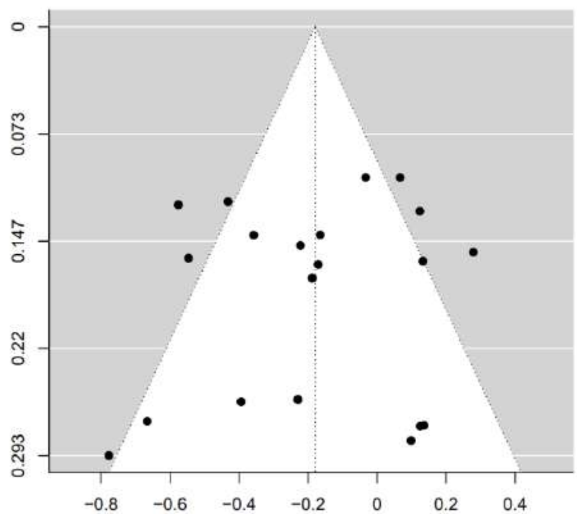


Fig. 3.1. Funnel plot (Proposers)

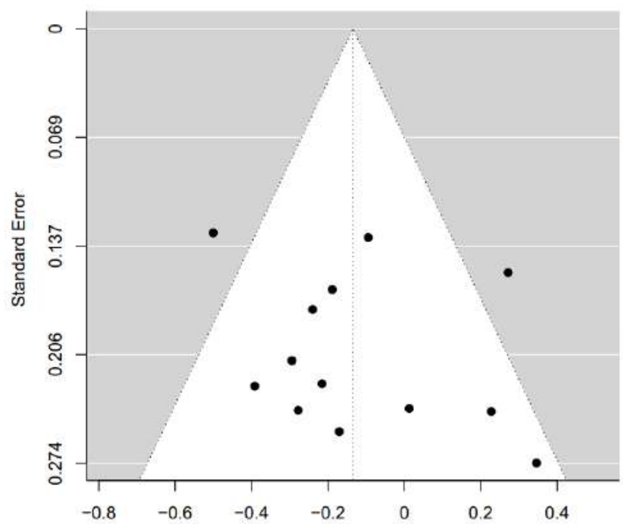
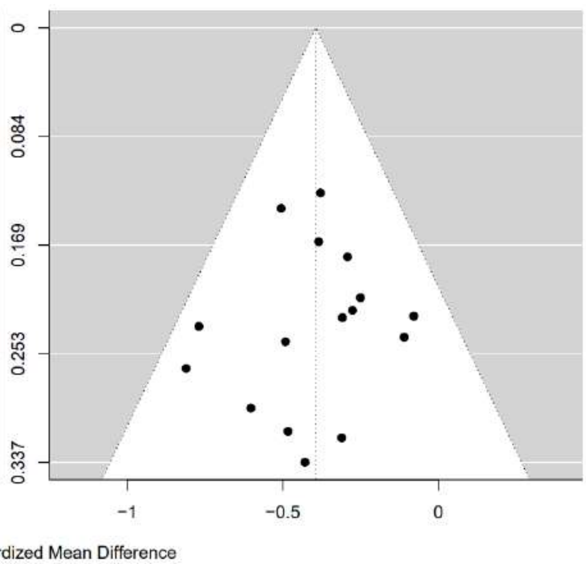


Fig. 4.1. Funnel plot (Receivers)



Note: each dot represents a SMD estimated against the standard error of the SMD, with a reversed scale that places the larger, most powerful studies toward the top.

Table 4. Meta-Regression Loss-Sharing (Receivers)

	Model used					
	REML			WLS		
	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	34.897***	29.084***	29.101***	33.626***	28.174***	28.173***
	(1.92)	(2.72)	(2.80)	(1.87)	(1.44)	(1.46)
Non Monetary[(a)]	6.611	–1.017	–3.272	7.933	–1.42	–2.343
	(5.45)	(5.50)	(5.80)	(6.93)	(4.57)	(4.68)
Strategy method[(b)]		13.456***	15.694***		14.806***	15.729***
		(3.64)	(3.97)		(3.00)	(3.10)
Within[(c)]		0.359	0.189		2.035	2.016
		(3.32)	(3.51)		(2.22)	(2.33)
Both role[(d)]		–2.493	–2.270		–4.830	–2.958
		(3.67)	(4.21)		(3.08)	(3.88)
Prepaid[(e)]			–2.306			–2.560
			(4.78)			(4.18)
Not in lab[(f)]			–7.200			–6.812
			(4.36)			(4.37)
Hypothetical[(g)]			0.738			0.137
			(4.34)			(4.41)
N Offers	1517	1517	1517	1517	1517	1517
N Experiments	16	16	16	16	16	16

Notes. Robust standard errors in parentheses. ***p < 0.001, **p < 0.01, and *p < 0.05. Reference: [(a)] Monetary [(b)] Standard method, [(c)] between [(d)] One role, [(e)] Standard procedure, [(f)] Lab, [(g)] paid according to action.

Table 5. Meta-Regression Gain Sharing vs. Loss-Sharing (Receivers)

	Model used					
	REML			WLS		
	(1)	(2)	(3)	(1)	(2)	(3)
Intercept	–0.430***	–0.439***	–0.438***	–0.430***	–0.439***	–0.438***
	(0.10)	(0.10)	(0.11)	(0.08)	(0.07)	(0.09)
Strategy method[(a)]	0.116	0.142	0.144	0.116	0.142	0.144
	(0.13)	(0.13)	(0.17)	(0.10)	(0.09)	(0.13)
Within[(b)]	–0.138	–0.106	–0.108	–0.138	–0.106	–0.108
	(0.133)	(0.139)	(0.181)	(0.10)	(0.10)	(0.138)
Both role[(c)]	0.173	0.211	0.211	0.173	0.211	0.211
	(0.13)	(0.16)	(0.16)	(0.10)	(0.11)	(0.12)
Prepaid[(d)]		–0.101	–0.101		–0.100	–0.101
		(0.21)	(0.21)		(0.15)	(0.16)
Not in lab[(e)]		–0.232	–0.232		–0.232	–0.232
		(0.18)	(0.18)		(0.13)	(0.14)
Hypothetical[(f)]		–0.076	–0.076		–0.076	–0.075
		(0.24)	(0.24)		(0.17)	(0.19)
Non Monetary[(g)]			–0.003			–0.003
			(0.27)			(0.20)
N Offers	1517	1517	1517	1517	1517	1517
N SMD	16	16	16	16	16	16

Notes. Robust standard errors in parentheses. ***p < 0.001, **p < 0.01, and *p < 0.05. Reference: [(a)] Standard method, [(b)] between [(c)] One role, [(d)] Standard procedure, [(e)] Lab, [(f)] paid according to action, [(g)] Monetary.

Table 6: Data and variables used in the meta-analysis

Name of authors	Country	Game	Role	Monetary	Gain	Loss	Both Role	Within	Strat. Method	Prepaid Both Treat	Prepaid Loss
Antinyan et al. 2022	U.K	dictator	A	y	19.00	32.00	n	n	n	n	n
Antinyan et al. 2022b	U.K	dictator	A	y	33.00	50.33	n	n	n	n	n
Baquero et al. 2013	Germany	ultimatum	B	y	40.32	46.51	n	y	y	n	n
Baquero et al. 2013	Germany	ultimatum	A	y	46.13	52.20	n	y	y	n	n
Baquero et al. 2013	Germany	dictator	A	y	37.28	40.74	n	y	y	n	n
Berger et al. 2012	Germany	ultimatum	A	n		48.00	n	n	n	n	n
Berger et al. 2012	Germany	ultimatum	A	n		47.00	n	n	n	n	n
Berger et al. 2012	Germany	ultimatum	A	n		47.00	n	n	n	n	n
Buchan et al. 2005a	USA	ultimatum	B	y	29.70	37.30	y	y	y	n	n
Buchan et al. 2005a	USA	ultimatum	A	y	39.40	42.20	y	y	y	n	n
Buchan et al. 2005China	China	ultimatum	B	y	37.20	39.10	y	y	y	n	n
Buchan et al. 2005China	China	ultimatum	A	y	55.00	57.20	y	y	y	n	n
Buchan et al. 2005Japan	Japan	ultimatum	B	y	28.10	35.50	y	y	y	n	n
Buchan et al. 2005Japan	Japan	ultimatum	A	y	50.10	54.10	y	y	y	n	n
Buchan et al. 2005USA	USA	ultimatum	B	y	44.40	50.40	y	y	y	n	n
Buchan et al. 2005USA	USA	ultimatum	A	y	49.10	52.10	y	y	y	n	n
Camerer et al. 1993	USA	ultimatum	A	y	42.20	44.40	n	n	n	n	n
Cochard et al. 2020	France	dictator	A	y	25.90	33.10	n	n	n	n	n
Cochard et al. 2020	France	dictator	A	y	21.90	25.60	n	n	n	n	n
Cochard et al. 2020b	France	dictator	A	y	49.70	54.80	n	n	n	n	n
Cochard et al. 2020b	France	dictator	A	y	43.90	40.60	n	n	n	n	n
Davis et al. 2012	Switzerland	dictator	A	y	25.00	23.00	n	y	n	n	n
Davis et al. 2012p	Switzerland	dictator	A	n		48.00	n	y	n	n	n
Davis et al. 2012p2	Switzerland	dictator	A	n		48.00	n	y	n	n	n
Davis et al. 2012time	Switzerland	dictator	A	n	34.00	35.00	n	y	n	n	n
Doll et al. 2017t1	Germany	ultimatum	B	n	38.48	40.28	n	n	y	n	n
Doll et al. 2017t1	Germany	ultimatum	A	n	47.35	49.18	n	n	y	n	n
Doll et al. 2017t2	Germany	ultimatum	B	n	35.77	42.72	n	n	y	n	n
Doll et al. 2017t2	Germany	ultimatum	A	n	47.05	46.95	n	n	y	n	n
Erkut 2022	Netherlands	dictator	A	y	15.00	11.00	n	n	n	n	n
Erkut 2022tone1	Netherlands	dictator	A	n	34.00	39.00	n	n	n	n	n
Erkut 2022tone2	Netherlands	dictator	A	n		32.25	n	n	n	n	n
Guo et al. 2013	China	ultimatum	B	y	25.36	32.14	n	y	n	n	n
Hietaniemi, 2016	Finlande	ultimatum	B	y	18.14	35.48	n	y	y	n	n
Hietaniemi, 2016	Finlande	dictator	A	y	29.27	37.51	n	y	y	n	n
Hietaniemi, 2016	Finlande	ultimatum	A	y	49.16	50.36	n	y	y	n	n
Lee et al. 2019	South Korea	dictator	A	n		46.13	n	n	n	n	n
Leliveld et al. 2009	Netherlands	dictator	A	y	33.73	46.04	n	n	n	n	n
Liu et al. 2020	China	dictator	A	y	47.80	46.40	n	y	n	n	n
Lusk and Hudson. 2010	USA	ultimatum	A	y	44.90	41.70	n	n	n	n	n
Neumann et al. 2017	Germany	ultimatum	B	y	36.40	40.40	y	y	y	y	n
Neumann et al. 2017	Germany	ultimatum	A	y	41.56	44.06	y	y	y	y	n
Neumann et al. 2018	Germany	dictator	A	y	35.60	32.80	n	n	n	n	y

Neumann et al. 2018	Germany	ultimatum	A	y	46.70	42.90	n	n	n	n	y
Noussair and Stoop. 2015	Netherlands	dictator	A	n		37.00	n	n	n	n	n
Noussair and Stoop. 2015	Netherlands	dictator	A	n		31.00	n	n	n	n	n
Noussair and Stoop. 2015	Netherlands	ultimatum	A	n		46.00	n	n	n	n	n
Noussair and Stoop. 2015	Netherlands	ultimatum	A	n		40.00	n	n	n	n	n
Pradana et al. 2017	Switzerland	dictator	A	n		30.00	n	n	n	n	n
Pradana et al. 2017	Switzerland	ultimatum	A	n		42.00	n	n	n	n	n
Story et al. 2015	U.K.	dictator	A	y	49.00	46.00	n	y	n	n	n
Story et al. 2015	U.K.	dictator	A	n		47.50	n	y	n	n	n
Thunström, 2019	USA	dictator	A	y	41.80	61.30	n	n	n	n	n
Thunström, 2019b	USA	dictator	A	y	41.10	47.23	n	n	n	n	n
Windrich et al. 2022	Germany	ultimatum	A	y	46.67	41.64	n	n	n	n	y
Windrich et al. 2022	Germany	dictator	A	y	36.55	30.75	n	n	n	n	y
Wu et al. 2014	China	ultimatum	B	y	22.43	28.49	n	y	n	n	n
Yang et al. 2022	China	ultimatum	B	y	25.96	31.00	n	n	n	n	n
Yavneali 2016	Israel	ultimatum	A	y		47.00	n	n	n	n	n
Yavneali 2016	Israel	ultimatum	A	y		48.40	n	n	n	n	n
Yin et al. 2017	China	dictator	A	y	24.65	35.71	n	y	n	n	n
Zhou and Wu. 2011a	China	ultimatum	B	y	24.68	32.63	n	y	n	n	n
Zhou and Wu. 2011b	China	ultimatum	B	y	22.76	27.80	n	n	n	n	n
Zhou and Wu. 2011c	China	ultimatum	B	y	19.13	23.30	n	y	n	n	n
Zhou and Wu. 2011d	China	ultimatum	B	y	22.71	28.92	n	y	n	n	n