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Gender differences in the trade-off between objective equality and efficiency

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Abstract

Generations of social scientists have explored whether males and females act differently in domains involving competition, risk taking, cooperation, altruism, honesty, as well as many others. Yet, little is known about gender differences in the trade-off between objective equality (i.e., equality of outcomes) and efficiency. It has been suggested that females are more equal than males, but the empirical evidence is relatively weak. This gap is particularly important, because people in power of redistributing resources often face a conflict between equality and efficiency. The recently introduced Trade-Off Game (TOG) – in which a decision-maker has to unilaterally choose between being equal or being efficient – offers a unique opportunity to fill this gap. To this end, I analyse gender differences on a large dataset including N=6,955 TOG decisions. The results show that females prefer objective equality over efficiency to a greater extent than males do. The effect turns out to be particularly strong when the TOG available options are "morally" framed in such a way to suggest that choosing the equal option is the right thing to do.

Keywords: trade-off game, gender, equality, efficiency

1 Introduction

After the 2016 Central Italy earthquake, which destroyed dozens of small mountain villages, killed hundreds of people, and left tens of thousands of other people homeless, the Italian Government found itself in the middle of a fundamental conflict. MPs had to decide in which areas to build temporary houses to host the survivors who had lost their houses. These temporary accommodations were meant to host the survivors for a relatively long time, estimated to about 10 years, while waiting for the reconstruction of their houses. For this reason, the survivors had a strong preference for having these temporary houses built as near as possible to where they used to live before the quake. The conflict emerged because this "equal" solution, which would have satisfied all the survivors to the same extent, was impracticable from the Government point of view: eliminating the rubbles in a reasonable time frame, reaching nearly inaccessible mountain villages with the trucks, and build, in each of these villages, a relatively small number of houses (some of these villages had only 20 inhabitants), would have exponentially inflated the cost and the time needed for the intervention. From the point of view of the Government, the most "efficient" solution was to select one single area and build all the temporary houses in this area. However, this solution was perceived to be highly unequal from the survivors: it would have satisfied some of them (those who happened to live near the selected area), and it would have dissatisfied others (those who happened to live far).

This is only one example of the tension between equality and efficiency. A more classical case is taxation: according to Okun's "leaky bucket" argument, taxation is inefficient, as administering the tax has a cost for the institution implementing the tax (Okun, 2015). The problem is, in fact, much deeper and relies in the often-unavoidable discrepancy between the natural and the equal distributions of resources: the natural distribution of resources is often unequal, and creating equality is often costly. This generates a fundamental conflict between equality and efficiency. People in power of resource distribution often face this conflict. For this reason, understanding what individual factors affect this trade-off is a problem of primary importance across social sciences. In this paper, I focus on one particular but important factor: the gender of the decision maker.

Why gender? On the one hand, Choshen-Hillel and Yaniv (2011) and Choshen-Hillel and Yaniv (2012) have developed and tested a theory according to which people's relative preference for equality or social welfare depends on their level of agency, that is, "the capacity, condition, or state of acting or of exerting power" (Webster's dictionary): agentic people tend to prefer efficiency over equality to a greater extent than non-agentic people do. On the other hand, social role theorists have long argued that males are, on average, more agentic than females (Eagly, 1987; Eagly & Wood, 1999). Putting these two observations together suggests that males should tend, on average, to prefer efficiency over equality to a greater extent than females do. Here, I test this hypothesis in the domain of "objective equality".

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1.1 Principles of equality

Social scientists have been debating about what it means to distribute resources in an equal manner for decades, giving rise to several theories of equality.

One useful classification has been proposed by Eckhoff (1974), according to which there are five basic principles of equality: *objective equality*, refers to a situation in which each recipient receives the same amount; *relative equality* (often called *equity*), refers to a situation in which each recipient receives in proportion of their input; *subjective equality* refers to a situation in which each recipient receives in proportion to their needs; *rank order equality* refers to a situation in which each recipient receives in proportion to their status and position; *equality of opportunity* refers to a situation in which all recipients are put in the same conditions to reach a goal. See Cook & Hegtvedt (1983) for a review.

Although I acknowledge the importance and relevance of all principles of equality, in this paper I will be concerned only with the first one, objective equality. Although limited, this notion of equality is particularly relevant in many real-life situations, specifically those in which the recipients are virtually indistinguishable. Not surprisingly, the notion of objective equality is the one that has been studied the most by economists. Fehr and Schmidt (1999) introduced a utility function according to which people get a disutility any time their monetary payoff is above or below the payoff of other players. Bolton and Ockenfels (2000) studied a utility function according to which people have a preference for receiving a payoff as close to the average payoff as possible. Although these two utility functions make different predictions in case of three (or more) players (Engelmann & Strobel, 2004), they both predict that players receive a disutility every time their monetary payoff departs from the objectively equal distribution of money.

1.2 Literature review

This work explores gender differences in the trade-off between objective equality and efficiency.

Generally speaking, gender differences in human behaviour have attracted generations of social scientists, who have used economic games to explore whether males and females act differently in a number of domains, including competition (Gneezy, Niederle & Rustichini, 2003; Niederle & Vesterlund, 2007; Gneezy, Leonard & List, 2009), risk taking (Powell & Ansic, 1997; Byrnes, Miller & Schafer, 1999; Charness & Gneezy, 2012), cooperation (Rand, 2017), altruism (Engel, 2011; Rand et al., 2016; Brañas-Garza et al., 2018), honesty (Capraro, 2018; Gerlach, Teodorescu & Hertwig, 2019; Abeler, Nosenzo & Raymond, in press), as well as many others (Sunden & Surette, 1998; Croson & Gneezy, 2009; Friesdorf, Conway & Gawronski, 2015). Yet, relatively little is known about gender differences in the trade-off between objective equality and efficiency.

A set of previous studies looked at the development of preferences for objective equality and efficiency from childhood to adolescence. The starting point of this literature is the observation that children develop preferences for objective equality quite early in their lives (Blake & McAuliffe, 2011; Shaw & Olson, 2012), but adults tend to prefer efficiency over objective equality (Charness & Rabin, 2002; Engelmann & Strobel, 2004; Capraro, Smyth, Mylona & Niblo, 2014). In agreement with this view, several authors have observed a decrease in objective equality preferences from 8 to 19 years old, accompanied by an increase in efficiency considerations (Fehr, Glätzle-Rützler & Sutter, 2013; Martinsson, Nordblom, Rützler & Sutter, 2011; Meuwese, Crone, de Rooij & Güroğlu, 2015), as well as in relative equality (Almås, Cappelen, Sørensen & Tungodden, 2010). Interestingly, this increase in efficiency considerations from childhood to adolescence appears to be stronger for boys than for girls (Almås et al, 2010; Martinsson, Nordblom, Rützler & Sutter, 2011; Meuwese et al. 2015). Since little girls and little boys have similar preferences for objective equality (Blake & McAuliffe, 2011; Shaw & Olson, 2012), this differential development of preferences for efficiency from childhood to adolescence suggests that adult females might end up preferring objective equality over efficiency to a greater extent than adult males do.

However, a series of experiments, from different research groups and using different empirical techniques, provide only weak evidence for this hypothesis. Dickinson and Tiefenthaler (2002) let participants make a series of decisions about how to divide resources among three players. These resources would lead to different monetary payoffs. Among the available resource allocations, three of them were particularly salient: one allocation corresponded to the equal distribution of resources; one option corresponded to the equal allocation of monetary payoffs; one allocation corresponded to the maximum total monetary payoff. Dickinson and Tiefenthaler found that females were more likely than males to choose the distribution of resources that corresponded to the equal monetary payoff. Choshen-Hillel and colleagues have explored the trade-off between objective equality and efficiency in several works (Choshen-Hillel & Yaniv, 2011; Choshen-Hillel & Yaniv, 2012; Choshen-Hillel, Shaw & Caruso, 2015; Shaw, Choshen-Hillel and Caruso, 2016; Choshen-Hillel, Lin & Shaw, 2019). However, they did not report gender differences.[1] Kariv, Lee, List and Price (2016) conducted a set of modified dictator game experiments with varying price of giving and where the recipient is a charity chosen by the dictator. The authors did

[1]Choshen-Hillel has confirmed in a private conversation that they also find that females are more likely than males to choose the objectively equal allocation of money. Therefore, their results are consistent with those presented in the current work.

not explicitly pit objective equality against efficiency, but, in their structural model, they estimated a parameter ϱ that was meant to take into account this trade-off. They found no gender differences in this parameter. Stieglitz, Gurven, Kaplan and Hopfensitz (2017) studied gender differences in the trade-off between objective equality and efficiency among Tsimane spouses.[2] They found that females tended to be less social welfare maximising only when distributing money, and not when distributing meat. Moreover, this gender difference in money distribution was not driven by increased concern for objective equality, but from increased concern for altruism. Olschewski, Dietsch and Ludvig (2019) have a treatment in which objective equality is pitted against efficiency, but they do not report the effect of gender.

Other papers have explored gender differences in resources distribution, using choices that do not directly pit objective equality against efficiency. Andreoni and Vesterlund (2001) conducted a series of dictator game experiments with varying cost-to-benefit ratio. In doing so, they found that, when the benefit of the altruistic action is greater than its cost (and thus it maximises efficiency), males give more than females; conversely, when the benefit of the altruistic action is smaller than its cost, males give less than females. Herne and Suojanen (2004) let participants choose among four different alternatives, an utilitarian one (which maximises average and total payoff), a Rawlsian one (which maximises the floor payoff), and two mixed distributions, one with maximum average payoff and constant range, and one with maximum average payoff and constant floor). Males were more likely to choose the utilitarian choice, while females were more likely to choose the Rawlsian one. Fehr, Naef and Schmidt (2006) analysed gender differences in situations in which the decision-maker has to choose between three allocations of money: one that maximises efficiency, one that minimises inequality (but it is not objectively equal), and one that maximises the payoff of the worse-off player. Females were more likely than males to choose the option that minimises inequality. Martinsson, Nordblom, Rützler and Sutter (2011) found that females were more difference averse than males, whereas males were more socially efficient; however, in their study, objective equality is not pitted against efficiency. Durante, Putterman and Van der Weele (2014) implemented a tax-game in which participants had to choose which tax to implement in a group of twenty tax-payers. They conducted several treatments and found that, overall, females were more pro-redistribution than males, even when redistribution is associated to an efficiency loss. However, in their baseline, they found no significant gender differences, but only a slight trend, according to which the average tax implemented by females was 4 percentage points higher than the average tax implemented by males. Kamas and Preston (2015) conducted an experiment in which subjects had to choose among three alternatives. They classified subjects into "self-interested", "inequity averse", and "total social surplus maximisers". They found no gender differences in self-interest, but they found that females were more likely to be inequity averse and males were more likely to be total social surplus maximisers. However, also in this case, inequity aversion did not coincide with objective equality. Cetre, Lobeck, Senik and Verdier (2019) conducted an experiment in which participants had to choose between two projects that brought different monetary payoffs. They found that females were less likely to choose the high inequality but efficient project, compared to men, but only when they had to choose under the veil of ignorance. As in the previous cases, none of the allocations corresponded to objective inequality.[3]

In summary, while previous research seems to be in line with the view that adult females prefer objective equality to a greater extent than adult males do, the evidence is relatively weak and further work is needed to test this hypothesis.

1.3 The present research

Here I report the largest-to-date test of gender differences in the trade-off between objective equality and efficiency.

I measure the trade-off between objective equality and efficiency using the recently introduced Trade-Off Game (TOG; Capraro and Rand, 2018; Tappin & Capraro, 2018). In the TOG, one decision-maker has to choose between two allocations of money that affect the decision-maker itself as well as two other people: one allocation equalises the payoff of the three players; the other allocation is a Pareto improvement and, consequently, it maximises the sum of the payoffs of the three players. The other two people do not make any choice: they are simply paid according to the decision-maker's choice.

Here I analyse all the TOG experiments that my collaborators and I have conducted since we introduced this game. This is a large dataset containing N=6,955 observations, divided in 30 experimental treatments, collected among US based participants, recruited on Amazon Mechanical Turk (AMT). This dataset offers an excellent occasion to study gender differences in the trade-off between objective equality and efficiency, not only because of its largeness, but also because of the variety of its experimental treatments, which allows me to explore the role of two potential moderators of theoretical and practical importance.

[2]Tsimane is a semi-sedentary forager-horticulturalist population that lives in the Amazon in Bolivia.

[3]A few more papers explored how people distribute resources in the context of strategic games, in which the final distribution does not depend only on the choice of a single individual, but it depends on the profile of strategies played by two or more players (e.g., Cochard, Couprie & Hopfensitz, 2018; Zhang, Deng & Zhu, 2017). Although interesting, these papers do not allow to study gender differences in *preferences*, because participants' actions do not depend only on their preferences, but also on the beliefs about the behaviour of the decision-makers involved in the interaction.

The first moderator is whether efficiency is aligned with self-interest. In real-life decisions, sometimes, but not always, the equal choice is costly also for the decision-maker. Since males are known to be more self-interested than females, at least in dictator games (Engel, 2011; Rand et al., 2016; Brañas-Garza et al., 2018), it is important to test whether gender differences in the trade-off between objective equality and efficiency, if existing, are actually driven by gender differences in the weight that people place on self- versus other-interest. The current dataset is ideal to test for this moderator, because in 10 out of the 30 treatments (N=2,619) the equal option is costly for the decision maker. (See the Method section for details about the payoffs.)

The second moderator is the frame of the trade-off game. Real-life decision problems, especially in political debate, are not formulated with a neutral language, but are often framed with a morally loaded language meant to suggest the right thing to do. Therefore, understanding whether gender differences in the trade-off between objective equality and efficiency, if existing, depend on the moral frame of the game is of practical interest. The current dataset is ideal also to test for this moderator, because 10 treatments (N=2,585) are framed using a language that suggest that being equal is the right thing to do, whereas 8 treatments (N=1,782) are framed in such a way to suggest that being efficient is the right thing to do. (See the Method section for details.)

2 Method

2.1 The Trade-Off Game

As a measure of the trade-off between objective equality and efficiency, I adopt the Trade-Off Game (TOG; Capraro & Rand, 2018; Tappin & Capraro, 2018). In the TOG, one decision-maker has to unilaterally choose between two allocations of money that affect the decision-maker itself and two other players. One allocation equalises the payoff of the three players; the other allocation is a Pareto improvement. The other two players have no active role and they are only paid according to the decision-maker choice.

2.2 The dataset

I analyse N=6,955 US based participants recruited on AMT (females = 46.1%). All these participants played the TOG as decision-makers. About one month after participation, they are paid a bonus according to their choice; they also receive a bonus as recipients in a TOG played with other two randomly selected participants. To build this dataset, I started from the 30 TOG treatments for which I have the data. These are *all* the treatments that my collaborators and I have conducted so far, including pilots and failed treatments. In case of multiple observations (as determined by looking at the Turk IDs and the IP addresses), I kept only the first observation (as determined by the starting date of the experiment). Consequently, these 6,955 observations come from 6,955 different Turk IDs and IP addresses. The 30 treatments can be classified in five main *non-disjoint* groups, which I detail below. *Non-disjoint* means that the same observation can be classified in different groups. I refer the reader to Table 1 for a short summary of the treatments.

Trade-Off Games in which efficiency and self-interest are aligned (10 treatments, N=2,619). The equal allocation is [13 13 13], that is, each player receives \$0.13; the efficient allocation is [15 23 13], that is, the decision maker receives \$0.15, Player B receives \$0.23, and Player C receives \$0.13.

Trade-Off Games without the previous "selfish confound" (20 treatments, N=4,336). In most treatments, the equal allocation is [13 13 13], while the efficient allocation is [13 23 13]. In some treatments (treatments = 23, 24, 25, 26 in the dataset; see Table 1) the available allocations are [5 5 5] vs. [5 10 5].

Trade-Off games with comprehension questions (9 treatments, N=2,855). Participants are asked two comprehension questions: (i) "What choice should you make if you want all players involved to get the same payoff?" (ii) "What choice should you make if you want to maximize the total group payoff (i.e., the sum of your bonus plus the bonuses of Players A and B)?" In the TOGs with comprehension questions, I include in the analysis only participants who responded to both comprehension questions correctly.

Trade-Off games in the "equal frame" (10 treatments, N=2,585). The equal option is presented with a positively loaded language and/or the efficient option is presented with a negatively loaded language. The frames have been implemented in several different ways depending on the study. For example, Capraro and Rand's (2018) Study 1 labels the equal choice as the "nice" choice and the efficient choice as the "non nice" choice. Capraro and Rand's (2018) Study 3 labels the equal choice as the "more fair" choice and the efficient choice as the "less fair" choice. Tappin and Capraro (2018) label the equal option as the "fair" choice and the efficient choice as "Option 2". In the same study, another treatment labels the equal option as "Option 1" and the efficient option as "unfair". All these manipulations had the effect of making participants more likely to choose the equal allocation. Effect sizes were independent of the particular manipulation being used. Moreover, Capraro and Rand's (2018) Study 4 shows that this labelling technique has the effect of changing participants' perception of what is the morally right thing to do.

TABLE 1: List of the studies included in the meta-analysis. More details for each study can be found in the dataset published along with this article. The column Comprehension is equal to Yes if, in the corresponding study, participants are asked comprehension questions; the column Selfish is equal to Yes if, in the corresponding study, the efficient option and the self-interested option are aligned; the other columns are self-explanatory.

Treatment	Frame	Comprehension	Selfish	Paper
1	efficient	No	No	Tappin & Capraro (2018)
2	equal	No	No	Tappin & Capraro (2018)
3	equal	No	No	Tappin & Capraro (2018)
4	efficient	No	No	Tappin & Capraro (2018)
5	equal	No	Yes	Capraro & Rand (2018)
6	equal	No	Yes	Capraro & Rand (2018)
7	equal	No	Yes	Capraro & Rand (2018)
8	equal	No	Yes	Capraro & Rand (2018)
9	efficient	No	Yes	Capraro & Rand (2018)
10	efficient	No	Yes	Capraro & Rand (2018)
11	efficient	No	Yes	Capraro & Rand (2018)
12	efficient	No	Yes	Capraro & Rand (2018)
13	efficient	No	No	Capraro, Rodriguez-Lara & Ruiz-Martos (2020)
14	equal	No	No	Capraro, Rodriguez-Lara & Ruiz-Martos (2020)
15	equal	No	Yes	Capraro (2018)
16	efficient	No	Yes	Capraro (2018)
17	neutral	Yes	No	unpublished
18	neutral	No	No	unpublished
19	neutral	No	No	unpublished
20	neutral	No	No	unpublished
21	neutral	No	No	unpublished
22	neutral	No	No	unpublished
23	equal	Yes	No	Capraro, Jordan & Tappin (2020)
24	equal	Yes	No	Capraro, Jordan & Tappin (2020)
25	neutral	Yes	No	Capraro, Jordan & Tappin (2020)
26	neutral	Yes	No	Capraro, Jordan & Tappin (2020)
27	equal	Yes	No	Capraro, Jordan & Tappin (2020)
28	equal	Yes	No	Capraro, Jordan & Tappin (2020)
29	neutral	Yes	No	Capraro, Jordan & Tappin (2020)
30	neutral	Yes	No	Capraro, Jordan & Tappin (2020)

Trade-Off games in the "efficient frame" (8 treatments, N=1,782). The efficient option is presented with a positively loaded language and/or the equal option is presented with a negatively loaded language. The frames have been implemented in several different ways, depending on the study. For example, Capraro and Rand's (2018) Study 1 labels the efficient choice as the "nice" choice and the equal choice as the "non nice" choice. Capraro and Rand's (2018) Study 3 labels the efficient choice as the "more generous" choice and the equal choice as the "less generous" choice. Tappin and Capraro (2018) labels the efficient option as the "generous" choice and the equal choice as "Option 2". In the same study, another treatment labels the efficient option as "Option 1" and the equal option as "ungenerous". All these techniques had the effect of making participants more likely to choose the efficient allocation. Effect sizes were independent of the particular manipulation being used. Moreover, Capraro and Rand's (2018) Study 4 shows that this labelling technique

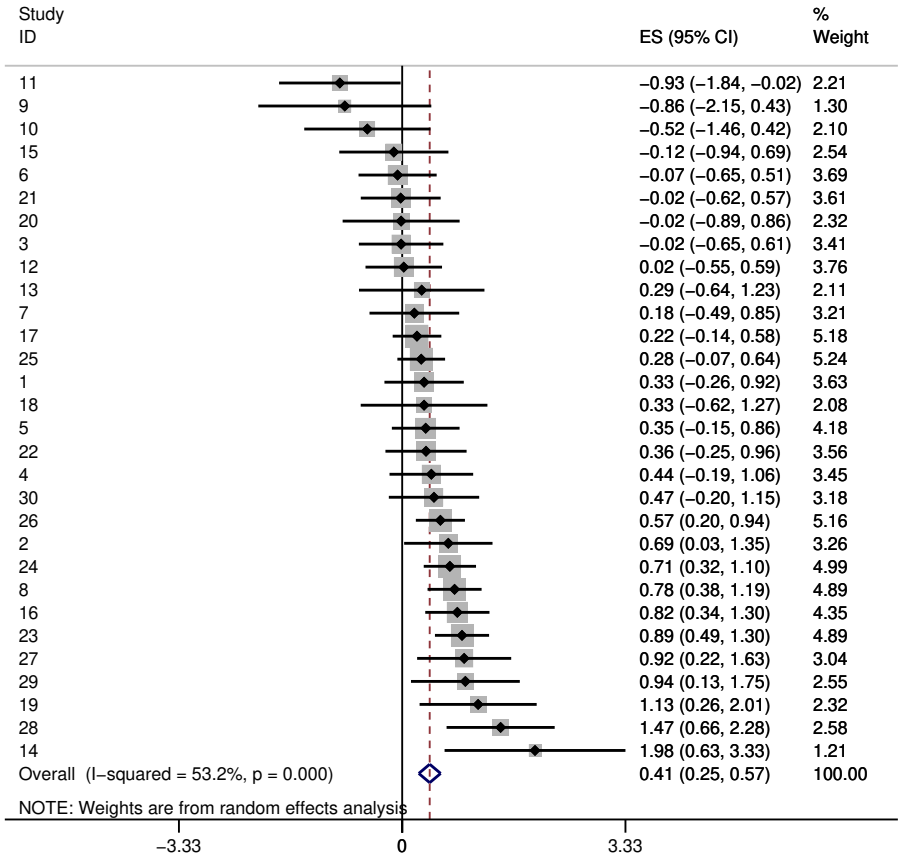

FIGURE 1: Forest plot of random-effects meta-analysis of the effect of gender on Trade-Off game choice.

has the effect of changing participants' perception of what is the morally right thing to do.

Trade-Off games in the "neutral frame" (10 treatments, N=2,334). One option is called "Option 1", the other one is called "Option 2".

3 Variables

I define two individual-level variables: *equal_choice* is a dummy variable that is equal to 1 if the corresponding individual chooses the equal option in the TOG; *female* is a self-explanatory dummy variable. Through these variables, I build the key treatment-level variables needed for the meta-analysis: for each treatment, *coeff_logit* and *error_logit* represent, respectively, the coefficient and the standard error of logit regression predicting *equal_choice* as a function of *female*.[4] Apart from these two, there are three more treatment-level variables: *efficient_selfish* is a dummy variable equal to 1 if, in the corresponding treatment, the efficient choice maximises the payoff of the decision-maker; *comprehension* is a dummy variable equal to 1 if the corresponding treatment contains comprehension questions; *frame* is a categorical variable equal to 1 if the corresponding treatment is framed such that the efficient choice is presented as being the morally right thing to do, equal to −1 if the corresponding treatment is framed such that the equal choice is presented as being the morally right thing to do, and equal to 0 if the corresponding treatment is neutrally framed.

4 Results

As a first step of the analysis, I look at the overall effect of *female* on *equal_choice*. To do so, I conduct random-effects meta-analysis. The results, shown in Figure 1, clearly show a significant overall effect such that females prefer objective equality over efficiency to a greater extent than males do (effect size = 0.411, 95% CI = [0.248, 0.574], Z=4.94, $p < 0.001$). There is also significant evidence of heterogeneity across studies in the true size of this effect (heterogeneity chi-squared = 61.94, $p < .001$, variation in effect size attributable to heterogeneity = 53%).

[4]The results remain qualitatively the same when using OLS or probit. In the paper, I report only the results using logit regression, because the dependent variable is binary. In the dataset published along with this article, one can find the coefficients and the errors needed for the meta-analysis also with the other regressions. These are named *coeff_ols* (*coeff_probit*) and *error_ols* (*error_probit*).

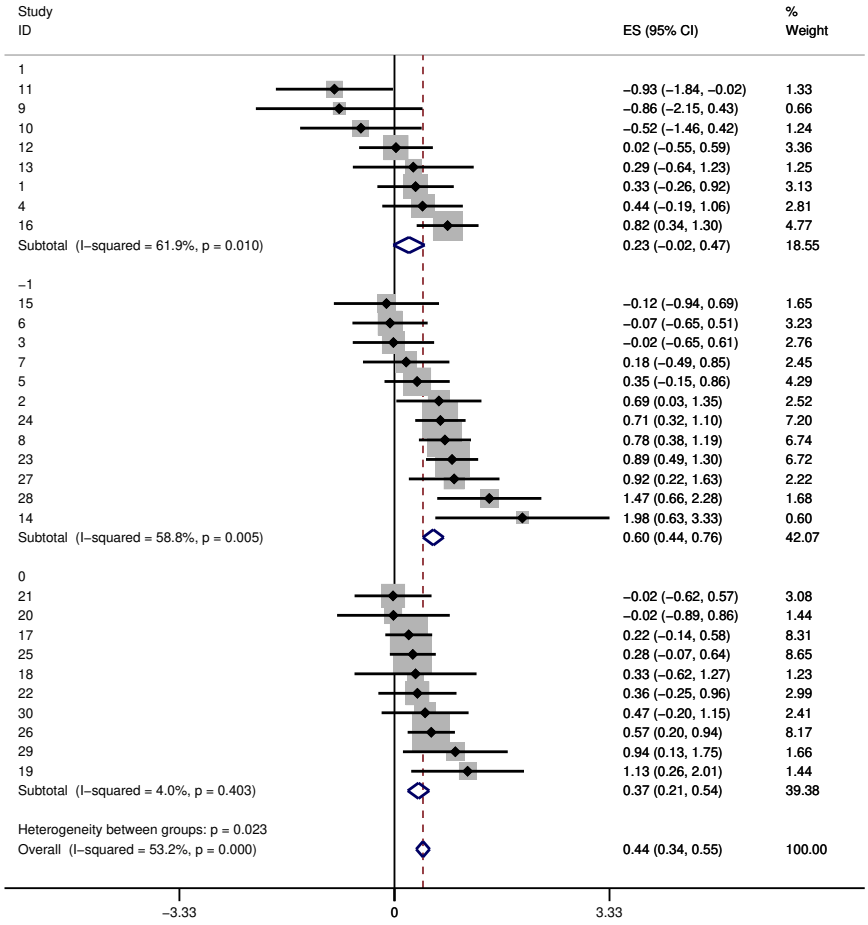

FIGURE 2: Forest plot of random-effect meta-analysis of the effect of gender on Trade-Off game choice across frames.

Next, I test whether these gender differences are robust after controlling for two potential confounds. The first possible source of confound is that, in some of the treatments, the efficient option is aligned with the payoff-maximising option. Since previous meta-analyses using the dictator game found that males are more self-interested than females (Engel, 2011; Rand et al., 2016; Brañas-Garza et al., 2018), it is in principle possible that gender differences in TOG choices are entirely driven by males being more self-regarding than females. To exclude this, I use meta-regression to test for the influence of the moderator *efficient_selfish* on *coeff*. The results show that *efficient_selfish* significantly affect the size of the gender effect (coeff=-0.384, p=0.046). However, the negative coefficient shows that gender differences in the TOG choices are actually partly driven by the *lack* of the selfish confound. Indeed, the effect of gender is *lower* in the TOGs in which efficiency and self-interest are aligned (overall effect size = 0.28), compared to when they are not (overall effect size = 0.51). The residual heterogeneity after accounting for *efficient_selfish* is 52%.

The second potential source of confound is comprehension. Since some of the TOG treatments contain comprehension questions while others do not, it is crucial to make sure that gender differences in TOG choices are not driven by participants not comprehending the decision problem. To this end, I use meta-regression to test for the influence of the moderator *comprehension* on *coeff*. The results show that comprehension does significantly affect the size of the gender effect (coeff = 0.368, p=0.044). However, its positive sign shows that the size of the gender effect is actually *higher* among participants who passed the comprehension questions (overall effect size = 0.58), compared to those to whom comprehension questions had not been asked (overall effect size = 0.32). The residual heterogeneity after accounting for *comprehension* is 50%.

I now move to the moderating role of framing the TOG using loaded language in such a way to suggest that one option is morally better than the other one. Since *frame* is a categorical variable, here I use subgroup meta-analysis, where the groups are defined by *frame* values. The forest plot in Figure 2 shows that the gender effect in TOG choices is higher in the equal frame (overall effect size = 0.60), compared to the neutral frame (overall effect size = 0.37), and the efficient frame (overall effect size = 0.23). Between groups

heterogeneity is statistically significant (p=0.023), suggesting that the gender effect in TOG choices does significantly differ across TOG frames. Looking at gender differences in TOG choices within each frame, the overall gender effect is marginally significant in the efficient frame (overall effect size = 0.225, 95% CI = [−0.018,0.468], Z=1.81, p=0.070), and highly significant both in the neutral frame (overall effect size = 0.372, 95% CI = [0.296,0.539]), Z=4.38, p<0.001) and in the equal frame (overall effect size = 0.602, 95% CI = [0.441,0.764]), Z=7.31, p<0.001).

Finally, I conduct a meta-regression to explore the effect of all three moderators together (*efficient_selfish*, *comprehension*, and *frame*). Here, only *frame* is marginally significant (coeff = −0.194, p = 0.084). The residual heterogeneity after accounting for all three moderators is 48%.

5 Discussion

To summarise, I reported the largest-to-date analysis of gender differences in the trade-off between objective equality and efficiency: N=6,955 (unique) observations collected among US based Turkers using the Trade-Off game (Capraro & Rand, 2018; Tappin & Capraro, 2018) as a measure of the trade-off between objective equality and efficiency, and divided in 30 treatments. The resulting meta-analysis provided evidence that females prefer objective equality over efficiency to a greater extent than males do.

The meta-analysis also provided evidence of some heterogeneity among treatments. Part of this heterogeneity is explained by whether: (i) self-interest is aligned with efficiency; (ii) participants passed the comprehension questions; and (iii) the TOG options were framed with loaded instructions. Specifically, I found that gender differences are particularly strong when self-interest is *not* aligned with efficiency (indicating that gender differences are not simply driven by males being more self-interested than females); they are particularly strong among participants who responded to the comprehension questions correctly (indicating that gender differences are not simply driven by participants not understanding the game); and are particularly strong when participants play the TOG in the equal frame (suggesting that framing the instructions in such a way to make the equal allocation salient has the effect to further increase existing, baseline, gender differences – note that gender differences are present also in the neutral frame and, to a smaller extent, in the efficient frame). However, when exploring the effect of all these moderators together, it turns out that only frame has a marginally significant effect.

As detailed in the Literature Review section, some earlier papers have explored gender differences in resource allocations. However, only a handful of them have focussed on the trade-off between objective equality and efficiency, specifically. Some of them found females to prefer objective equality to a greater extent than males do, but others found no gender differences, or did not report gender differences. Therefore, although previous literature seems to suggest that females prefer objective equality to a greater extent than males do, the evidence was relatively weak. The current analysis, based on almost seven thousand unique observations, provide a strong test (and confirmation) of this hypothesis.

Related to the current study is also the literature on gender differences in judgments in hypothetical moral dilemmas. Previous research suggests that females are more averse than males to physically harm one person for the greater good (Fumagalli et al, 2010; Friesdorf et al, 2015; Capraro & Sippel, 2017). Although related, the current study differs from this line of research in two main dimensions: first, it involves no physical harm (and no economic harm); second, it concerns actual behaviour and not moral judgments in hypothetical dilemmas.

This work has, nevertheless, several limitations. The first one is that the dataset does not contain observations in which objective equality benefits the decision-maker. Since males are known to be more self-regarding than females (Engel, 2011; Rand et al., 2016; Brañas-Garza et al., 2018), the obvious prediction is that gender differences in the trade-off between objective equality and efficiency would decrease, and perhaps even reverse, if the equal allocation becomes beneficial for the decision-maker. Future work could test this hypothesis.

Similarly, a second limitation is that the dataset does not contain observations in which efficiency harms one of the players involved in the interaction. Exploring gender differences in this situation would be an important extension, because, in reality, efficiency often harms worse-off players. Previous research suggests that females are more averse than males to physically harm one person for the greater good (Fumagalli et al, 2010; Friesdorf et al, 2015; Capraro & Sippel, 2017). Although it is not obvious that gender differences in physical harm map onto gender differences in economic harm, this might suggest that, in case efficiency harms one of the players, gender differences in the trade-off between objective equality and efficiency might increase. Future research could test this prediction.

The third limitation concerns the stakes of the TOG, which, in all the treatments, are relatively small. Previous work suggests that stakes have little effect on people's behaviour in a number of economic games involving prosociality, at least when stakes are not too high (Forsythe et al., 1994; Carpenter, Verhoogen & Burks, 2005; Johansson-Stenman, Mahmud & Martinsson, 2005; Brañas-Garza et al., 2018; Larney, Rotella & Barclay, 2019); other studies have indeed found evidence that pro-sociality decreases at very high stakes (Carpenter et al., 2005; Andersen, Ertacç, Gneezy, Hoffman & List, 2011). To the best of my knowledge, there have been no studies exploring the stake effect on

the trade-off between objective equality and efficiency. Testing whether this trade-off varies as a function of the stakes and, if it does so, testing how this variation interacts with gender is an interesting direction for future research.

The fourth limitation is that this dataset does not allow to answer the question of *why* females prefer objective equality over efficiency to a greater extent than males do. At this stage of research, I can only speculate. An influential line of literature suggests that gender differences in behaviour are partly due to the different roles that males and females tend to occupy in society (Eagly, 1987; Eagly & Wood, 1999). Along these lines, one potential explanation for the current findings is that, from childhood to adolescent, females and males start differentiating their social roles, with females going to cover, on average, roles involving resource distributions, while males going to cover, on average, roles involving the creation of resources. With such a role division, it would be optimal to create resources efficiently (in order to maximise the total resource to be distributed) and then divide them equally (in order to minimise within-group conflicts). This logic could explain why adult males and females tend to display, on average, different preferences for resource distribution. Note that this framework is consistent with the theory developed and tested by Choshen-Hillel and Yaniv (2011, 2012), according to which agency is positively correlated with efficient choices. Exploring this and potentially other explanations is an important avenue for future research.

In sum, this work shows that females, on average, prefer objective equality over efficiency to a greater extent than males do. Future work should explore the causes and the boundaries of this effect.

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