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# Trust and trustworthiness after negative random shocks

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## ABSTRACT

We investigate experimentally the effect of a negative endowment shock in a trust game to assess whether different causes of inequality have different effects on trust and trustworthiness. In our trust game there may be inequality in favor of the second mover and this may (or may not) be the result of a negative random shock (i.e., the outcome of a die roll) that decreases the endowment of the first-mover. Our findings suggest that inequality leads to differences in behavior. First-movers send more of their endowment and second-movers return more when there is inequality. However, we do not find support for the hypothesis that the cause of the inequality matters. Behavior after the occurrence of a random shock is not significantly different from the behavior when the inequality exists from the outset. Our results highlight that we have to be cautious when interpreting the effects on trust and trustworthiness of negative random shocks that occur in the field (e.g., natural disasters). Our results suggest that these effects are largely driven by the inequality caused by the shock and not by any of the additional characteristics of the shock like saliency or uncertainty.

Keywords: Trust game, endowment heterogeneity, random shocks, inequality aversion, experimental economics.

JEL Codes: C91, D02, D03, D69.

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## 1. Introduction

It is well established that trust and trustworthiness are important elements that influence the economic performance of a particular society (Knack & Keefer 1997, Zak & Knack 2001, Guiso et al. 2004, Bjørnskov 2012, Horváth 2013, Algan & Cahu 2013). Trust and trustworthiness are also essential in interpersonal economic interactions, especially those that are characterized by incomplete contracts (Chen 2000, Anderhub et al. 2002, Engle-Warnick & Slonim 2006). It is therefore essential to study factors that can potentially affect the levels of trust and trustworthiness. For instance, the circumstances in which many economic decisions are made are not always static and stable. Negative random shocks often occur, including human-made calamities (e.g., wars), natural disasters (e.g., earthquakes), or personal shocks (e.g., losing a job during the recent crisis of COVID-19). These negative shocks can affect the wealth of decision-makers and as a result they are likely to influence the levels of trust and trustworthiness. Our goal in this paper is to investigate how trust and trustworthiness respond to negative random shocks that affect the wealth of individuals.

Because identifying the effects of a shock on trust and trustworthiness is difficult and unlikely in the field, we investigate this question in a controlled laboratory setting. We use a variation of the two person trust game in Berg et al. (1995).<sup>1</sup> In our innovative design both the first and the second-mover receive initially the same endowment but the occurrence of a negative random shock – in this case, the roll of a die – can cause the first-mover's endowment to be drastically reduced. First movers experience this reduction in their endowment before they make the decision how much to send. We compare the behavior in these two treatments – with and without the occurrence of the shock – with two baseline treatments: one where both players have the same initial endowments but there is no chance of a shock, and another where the first-mover has a lower endowment but does so from the outset, meaning that in the latter version the difference in the endowments is not the result of a random event. Our experimental design allows us to separate the effect on trust and trustworthiness of the (possibility of a) shock from the effect of the inequality it generates. Identifying these differential effects is a relevant question given that mere inequalities are shown to have an effect on cooperation and pro-social behavior (Zelmer 2003, Tavoni et al. 2011, Hargreaves-Heap et al. 2016; Camera et al. 2020).

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<sup>1</sup> In this game, first-movers decide how much of their endowment to send to a second-mover. The amount sent is tripled by the experimenter. The second-mover receives the tripled amount and has to decide how much of this to return to the sender.

In the trust game, the effect of inequality on trust and trustworthiness will depend on the direction of the inequality. In our experiment it is always the first-mover who is – or is not – going to be comparatively worse off before making their decision. If the second-mover is inequality averse (Fehr & Schmidt 1999, Bolton & Ockenfels 2000) we would expect them to return more if the endowment of the first-mover is lower. The first-mover's decision is influenced by several factors and therefore a little bit harder to understand. Cox (2004) shows that in a trust game, the first-mover decision whether to send money (and how much) is influenced by both strategic and altruistic aspects (see also McCabe et al. 2003, Bohnet & Zeckhauser 2004, Ashraf et al. 2006 and Kanegaretman et al. 2009). The strategic consideration depends on the first-mover being aware of the second-mover being more likely to return more in the case of inequality and would result in the first-mover sending more. On the other hand, under the influence of altruistic considerations, a comparatively poorer first-mover is less likely to send money to the second-mover, as any amount sent will increase the inequality.

The experimental evidence on the effects of inequality in the trust game largely confirms that first-movers send more in the case where they have a smaller endowment than the second-mover (Lei & Vesely 2010, Hargreaves-Heap et al. 2013, Calabuig et al. 2016, Rodriguez-Lara 2018). Although some papers find no significant effects of disadvantageous inequality (Anderson et al. 2006, Brühlhart & Usunier 2012). Richer second-movers in these studies generally send back less, except in Smith (2011) where these second-movers actually return more (see also Ciriolo (2007), Xiao & Bichieri 2010, or Jordahl (2009) for other papers that look at the effect of endowment heterogeneity on the levels of trust and trustworthiness). The closest papers to ours in this literature is Fehr et al. (2018), who vary the source of the inequality in the trust game by rewarding first- and second-movers differently depending on their performance in a real-effort task. One crucial aspect that makes our approach distinct from theirs is that in our environment the level of endowments is initially given or the result of a random shock. We deliberately focus on a setting in which subjects are never responsible for the inequality.<sup>2</sup> To the best of our knowledge our paper is one of the first to incorporate the possibility of a negative random that affects the endowment of the first-mover to determine how different sources of inequality affect behavior in the trust game. The only other exception we know is Bejarano et al. (2018), who examine this question in a situation where the negative random shock can decrease the endowment of the second-mover. Their results indicate that first-movers send less to second-movers who have a lower endowment, but only when the inequality is the result of a negative random shock.

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<sup>2</sup> The extent to which subjects are held responsible for the level of inequality can have an effect, for instance in prosocial behavior. See, among others, Konow (2000), Cherry et al. (2002), Cappelen et al. (2007, 2013), Rodriguez-Lara & Moreno-Garrido (2012), Durante et al. (2014), Deffains et al. (2016), Akbaş et al. (2019).

The authors argue that people may respond differently to inequalities that are initially given than to inequalities that are caused by a shock because the later may be more salient than the former.

Our research also draws on the literature on risk preferences and reference points. There are a number of studies that investigate whether prior events influence subsequent risk-taking, in particular if people exhibit more or less risky behavior after suffering a loss (Thaler & Johnson, 1990). According to standard economic theory, small losses should not affect individuals' risk preferences (Rabin 2000). However, there are numerous examples of people exhibiting more risk averse behavior after suffering a loss (Weber & Zuchel 2005, Cameron & Shah 2015, Imas 2016, Deng et al. 2018), and there are also examples of people exhibiting more risk-seeking behavior after suffering a loss or other types of negative shocks. Liu et al. (2010) observe this effect in Taiwanese stockbrokers. Page et al. (2014) find evidence for it in Australian homeowners affected by a flood, while Herrmann & Steward (1957) and Andrade & Iyer (2009) confirm that after observing losses subjects were more prone to take risks in lab experiments.

In the trust game, there is little empirical support for the hypothesis that trust is a risky decision, as most of the studies conclude that risk preferences do not predict behavior in the trust (see, among others, Eckel & Wilson (2004), Ashraf et al. (2006), Kanegaretman et al. (2009), Fehr (2009), Houser et al. (2010), Slonim and Guillen 2010, Ben-Ner & Halldorsson (2010)).<sup>3</sup> Yet, some authors think about the decision of the first-mover in terms of social risk. If first-movers perceive that trusting is a risky decision (Bohnet & Zeckhauser 2004, Bohnet et al. 2008) we will expect the negative random shock affecting their endowment to decrease the level of trust so as to minimize the possibility of “betrayal aversion”. This result would be in line with evidence from survey data; e.g., Alesina and La Ferrara (2002) show that recent traumatic experiences and income disparity are associated with lower trust. Similarly, Kristoffersen (2018) finds that negative financial shocks lead to lower trust, while Ananyev & Guriev (2019) find that trust was lower in regions in Russia that were more affected by a decrease in GDP (see Jordahl 2009 for a survey).<sup>4</sup>

In the trust game, there is also evidence for what is called “principled trustfulness” (Fetchenhauer & Dunning 2012). If first-movers refrain from sending money to second movers, there is a negative signal of distrust, thus people may be more willing to take risk in trust games than in lotteries (Fetchenhauer

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<sup>3</sup> The papers of Schechter (2007) and Chetty et al. (2020) are only two exceptions we know in this literature.

<sup>4</sup> We study behavior in the trust game, but the interested reader can consult, among others, Glaeser et al (2000) or Aksoy et al. (2018) for the relationship between the behavior in this game and survey-based measures of trust.

& Dunning 2012, Dunning et al. 2019, Fetchenhauer et al. 2020). As Bejarano et al. (2018) argue, the occurrence of the shock can indeed make the inequality more salient. Thus first-movers may want to show signs of "principled trustfulness" after being decreased their endowment. This, in turn, would imply that first-movers will trust more after suffering the negative random shock, a behavior that is also consistent with the idea that first-movers would expect for second-movers to return relatively more after they have suffered the shock because the inequality becomes more salient.

Our paper is also related to field studies that investigate how negative random shocks (for instance, natural disasters) influence the levels of trust and trustworthiness (Castillo & Carter 2011, Fleming et al. 2014, Veszteg et al. 2015, Andrabi & Das 2016, Cassar et al. 2017, Calo-Blanco et al. 2017). This literature has produced mixed results to date. Cassar et al. (2017) find that villages affected by a tsunami in Thailand exhibit higher levels of trust and trustworthiness than non-affected villages. Fleming et al. (2014) show that trust does not differ between areas that were and were not affected by an earthquake in Chile, but that trustworthiness was indeed lower in the affected regions. Given that occurrence of negative random shocks do often lead to inequalities and that inequalities influence behavior, it seems crucial to tease apart the effect of the negative random shock from the inequality this shock generates.

Overall, our paper seeks to answer the following questions: how do negative random shocks affect trust and trustworthiness? Given that the occurrence of negative random shocks can result in inequality, does the source of inequality matter? The rest of the paper is organized as follows. Section 2 describes the experimental design and procedures, and Section 3 presents our hypotheses. We report our findings in Section 4. Section 5 concludes with a brief summary and discussion.

## **2. Methods**

Subjects participated in a paper-and-pen version of the trust game in Berg et al. (1995). First- and second-movers were seated in different rooms and were randomly assigned one of the two roles. All subjects received their initial endowment in a sealed envelope. First-movers were asked to decide the amount of money they wanted to send (if anything) to the second-mover they were randomly matched with. The amount sent by first-movers was tripled by the experimenter and then given to the second-movers. After receiving the resulting amount, second-movers were asked to decide how much of the amount they received to send back (if anything) to their matched first-mover. We used

Experimental Dollars (E\$) in our experiment. These were converted to actual dollars at the end of each session at a rate of 1 E\$ to \$0.50.

In the experiment we use a 2x2 between-subject design, varying the level of endowments (Equal vs. Unequal) and the source of the inequality (Baseline vs. Shock). In the Baseline-Equal treatment both first- and second-movers started with an endowment 21 E\$. In the Baseline-Unequal treatment first-movers started with 7 E\$ and the second-movers with 21 E\$. In the treatments where a shock was possible both players started with an endowment of 21 E\$. After they received their endowment, but before they made their decision, the experimenter rolled a die in front of each first-mover individually. If the number was odd the first-mover kept their total endowment (Shock-Equal). If it was even, 14 E\$ were deducted from their endowment, leaving them with 7 E\$ (Unequal-Shock). Both players knew the endowment of the other player and whether they had suffered a negative shock or not before making their decisions. First-movers made the decision how much to send after learning the outcome of the die roll. Second-movers learned about the outcome of the die because first-movers recorded this on an “outcome card” that was put inside the envelope they sent to second-movers. Table 1 summarizes our treatments.

	<b>N</b>	<b>First-mover Endowment</b>	<b>Second-mover Endowment</b>
<b>Baseline-Equal</b>	52	21 E\$	21 E\$
<b>Baseline-Unequal</b>	53	7 E\$	21 E\$
<b>Shock-Equal</b>	42	Starts with 21 E\$ and keeps all of this because the die rolled an odd number	21 E\$
<b>Shock-Unequal</b>	54	Starts with 21 E\$ but loses 14 E\$ and ends up with an endowment of 7 E\$ because the die rolled an even number	21 E\$

*Note.* N refers to the number of pairs in each treatment.

**Table 1.** Summary of the treatments.

A total of 402 students (with no previous experience in similar experiments) participated in our experiment. We followed Bejarano et al. (2018) in determining the sample size. The experimental sessions were conducted at the Economic Science Institute (ESI) Chapman University between May 2014 and May 2018. We ran 17 sessions with 24 participants (i.e., 12 pairs) in most of the sessions.



### 3. Hypotheses

The main question we want to answer is whether trust and trustworthiness are influenced by the occurrence of negative random shocks that cause inequality. To this end, we look at whether trust and trustworthiness are different in unequal situations where inequality is the consequence of a shock and compare this with cases where inequality exists from the outset.

From a theoretical viewpoint, with participants assumed to be selfish-profit maximizers, no participant would return anything as a second-mover and, using backward induction, nor would a first-mover send anything. This prediction is in sharp contrast with the observed behavior in the experimental literature. Assuming that individuals are inequality averse we would expect second-movers to return more in situations where they start out with a higher endowment than the first-mover. Furthermore, assuming that first-movers are strategically aware of this, this suggest that first-movers will send out a bigger proportion of their endowment. This would lead to the prediction that inequality will make the first-movers send more and the second-movers return more. On the other hand, there is also the possibility that altruistic motives explain the decision of the first-movers. First-movers may refrain from trusting if their endowment is lower than the endowment of second-movers. This is because any amount sent by first-movers in the unequal treatments will increase the existing inequality. We posit our first hypothesis in its null form as follows:

**Hypothesis 1:** *Inequality does not affect the proportion sent or the proportion returned*

Our goal is to compare behavior in unequal situations depending on whether the inequality in favor of the second-mover is the result of a negative shock that decreased the endowment of the first-movers or this inequality existed from the outset because first-movers initially received a lower endowment than second-movers. There are two ways of thinking about the possible effects of the negative shock for the first-mover. First, the shock may make the inequality more salient. And, with greater salience, we expect a bigger effect of the inequality aversion: the second-mover returning relatively more and the first-mover sending more. Additionally, first-movers may want to send more after suffering the shock to show signs of “principled trustfulness”. In both cases, we would expect that the inequality that is caused by the shock will increase trust and trustworthiness, compared with the inequality that existed from the outset. On the other hand, thinking about the first-mover decision in terms of social risk and betrayal aversion, we can expect for the negative shock to have a decreasing effect on the proportion sent. We posit our second hypothesis in its null form as follows:

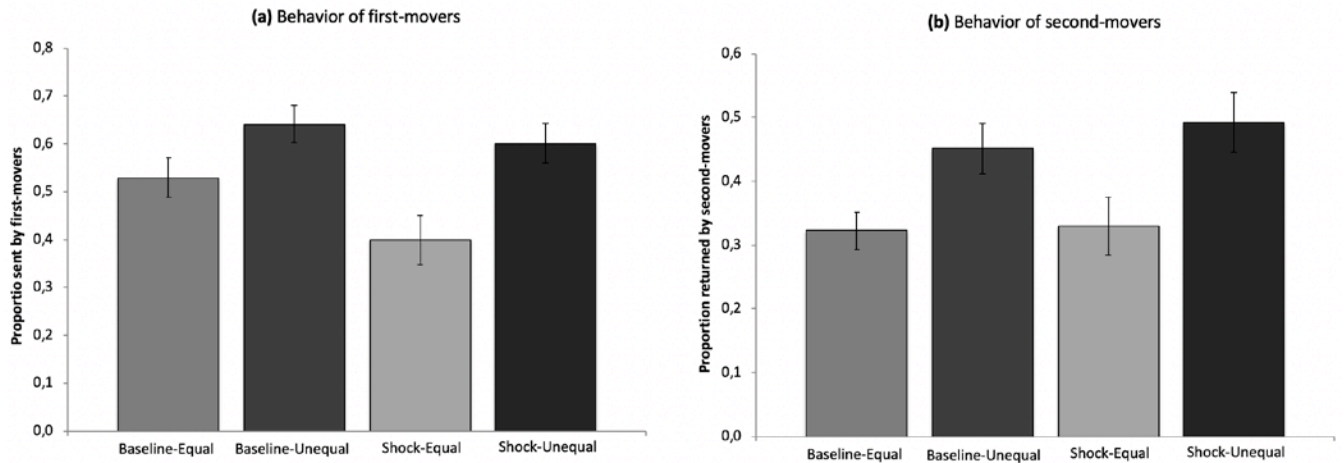
**Hypothesis 2:** *Inequality caused by a shock makes no difference in the behavior of first-movers, compared with the same inequality if it existed from the outset.*

## 4. Results

We follow previous literature look at the proportion sent by first-movers and the proportion returned by second-movers to measure of the levels of trust and trustworthiness (e.g., Chaudhuri & Gangadharan 2007, Cox 2004, Eckel & Wilson 2011, Johnson & Mislin 2011, Cooper & Kagel 2013). Figure 1 displays the behavior of first-movers (left panel) and that of second-movers (right panel) in each treatment. Table 2 presents the descriptive statistics.

	Baseline-Equal	Baseline-Unequal	Shock-Equal	Shock -Unequal
<b>First-movers</b>				
Proportion sent (std. dev)	0.53 (0.29)	0.64 (0.28)	0.40 (0.32)	0.60 (0.30)
Median proportion sent	0.38	0.57	0.33	0.57
Proportion sending nothing	0	0	0.09	0.02
Proportion sending everything	0.21	0.28	0.17	0.28
Number of obs.	52	53	42	54
<b>Second-movers</b>				
Proportion returned (std. dev)	0.32 (0.214)	0.45 (0.286)	0.33 (0.278)	0.49 (0.347)
Median proportion returned	0.33	0.38	0.31	0.50
Share returning nothing	0.11	0.09	0.10	0.09
Share returning everything	0	0.11	0.05	0.19
Number of obs.	52	53	38	53

**Table 2.** Summary statistics in each treatment.



**Figure 1.** Behavior of first-movers and second-movers in each treatment.

We find that the proportion sent by first-movers is higher in the unequal treatments, i.e., when the endowment of first-movers is relatively lower. This difference suggests that inequality that is disadvantageous for the first-mover results in higher trust. In fact, first-movers are more likely to trust fully by sending their whole endowment in the unequal treatments (see Table 2). The behavior of second-movers seems to be consistent with the idea of inequality aversion, in that they return a higher proportion in the unequal treatments.

To compare first-mover behavior across treatments, we perform a non-parametric analysis, using the Mann-Whitney test.<sup>5</sup> The results are presented in Table 3.

	First-mover	Second-mover
Baseline-Equal vs Baseline-Unequal	2.525 **	2.089**
Shock-Equal vs Shock-Unequal	3.142***	2.196**
Baseline-Unequal vs Shock-Unequal	0.846	0.637
Baseline-Equal vs Shock-Equal	2.421**	0.344

*Notes.* We report the Z-scores for the Man-Whitney (MW) test. Significance at \*\*\* 1% level, \*\* 5% level (for two-tailed analysis).

**Table 3.** Non-parametric analysis for the proportion sent by first-movers and the proportion returned by second-movers.

<sup>5</sup> These results presented in this section are robust when considering the rank-order test (Fligner & Pollicello 1981, Feltovich 2003) or the median test. The econometric analyses using OLS and Tobit regressions are available upon request and lead to the same results as well.

Firstly, looking at the overall effect of inequality of endowment, we find that first-movers send significantly more when there is inequality. The difference between the proportion sent by first-movers in the Baseline-Equal and the Baseline-Unequal is statistically significant (at the level of  $p = 0.012$ ). Likewise, the difference between the proportion sent in the Shock-Equal and the Shock-Unequal treatments is also statistically significant (at the level of  $p = 0.002$ ).<sup>6</sup>

**Result 1:** *Inequality, irrespective of its source, leads to higher trust. First-movers send a bigger proportion of their endowment in the unequal treatments.*

Next, we look at our main question, whether the effect of inequality is different when it is caused by a negative shock or when it existed from the outset. We do this by comparing the proportion sent in the Baseline-Unequal and the Shock-Unequal treatments. This difference is not statistically significant at any common significance level ( $p = 0.40$ ).

**Result 2:** *We find no evidence that the negative random shocks affect trust in a different way than preexisting inequalities. First-movers affected by a negative shock that decreases their endowment do not send a bigger or smaller proportion than those that started with a smaller endowment.*

Finally, we can also compare the behavior of first-movers in different situations of equality. The proportion of the endowment sent is statistically significantly bigger in the Baseline-Equal than in the Shock-Equal treatment (at the level of  $p < 0.015$ ). This difference presents an interesting result that we did not predict and seems to suggest that those who keep their endowment intact prefer not to send it to second-movers.

Analyzing the behavior of the second-mover, we again look first at the effect of inequality. Here we find that second-movers return more in the presence of inequality, in line with the idea of inequality-aversion. Second-movers return more in Baseline-Unequal than Baseline-Equal (at the level of  $p < 0.036$ ) and also in Shock-Unequal than Shock-Equal (at the level of  $p < 0.028$ ).<sup>7</sup>

**Result 3.** *Inequality leads to more trustworthiness. Second-movers return a bigger proportion in the unequal treatments.*

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<sup>6</sup> Using the pooled data, we also find that the proportion sent is higher in the unequal treatments ( $Z = 3.78, p < 0.001$ )

<sup>7</sup> Using the pooled data, we also find that the proportion returned is higher in the unequal treatments ( $Z = 3.14, p < 0.002$ )

Next, we assess whether the source of the inequality matters for second-movers. When we distinguish treatments according to whether the inequality is the result of a shock or not our findings are in line with those observed for first-movers: the proportion returned in the Baseline-Unequal treatment is not statistically different from the proportion returned in the Shock-Unequal treatment ( $p = 0.524$ ).<sup>8</sup>

**Result 4:** *We find no evidence that the negative random shocks affect trustworthiness in a different way than preexisting inequalities. Second-movers with a first-mover who is affected by a negative shock that decreases their endowment do not return a bigger or smaller proportion than those with a first-mover that started with a smaller endowment.*

Finally, we look for the effect of general uncertainty for the second-movers, by comparing proportion returned between Baseline-Equal and Shock-Equal treatments. This difference is not statistically significant at any common significance level ( $p = 0.73$ ).

Taken together, our findings indicate that inequality has a fundamental effect on the behavior in the trust game. However, we do not find evidence to support the idea that the cause of the inequality matters.

## 5. Discussion

This paper was motivated by the relative lack of experimental evidence regarding the effects of negative random shocks on the level of trust and trustworthiness. While there are some studies that investigate this question in the field, the occurrence of a negative random shocks that affect wealth is usually associated with a variation in the level of inequality and as such these papers cannot (and are not intended to) disentangle the effect of shock and the inequality it generates.

Using a version of the trust game we find that inequality – in the form of the first-mover having a smaller endowment than the second-mover – leads to the first-mover sending more and the second-mover returning more; i.e., inequality results in an increase in both trust and trustworthiness. We also show that the source of the inequality does not really matter for the levels of trust and

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<sup>8</sup> The reported results in Table 2 may suggest that the median return is higher in the Shock-Unequal than the Baseline-Unequal treatment, but this difference is not statistically significant at any common significance level ( $p = 0.12$ ), as already noted in footnote 5.

trustworthiness. Thus, our findings highlight that the occurrence of random shocks can influence trust and trustworthiness but the effects may not be different from the inequality it generates. This, in turn, implies that we need to be cautious when interpreting the effects that negative random shocks (e.g., natural disasters) have on behavior.

Our results complement a recent paper by Bejarano et al. (2018), who examine how negative random shocks affect trust and trustworthiness in a setting where second-movers may experience a shock that decreases their endowment. They find that the inequality decreases the trustworthiness (second-movers return less) but that this effect doesn't depend on the cause of the inequality. On the other hand, with regards to trust they observe that first-movers send less but only when the inequality is caused by the shock. So, in contrast to the current study, where the cause of the inequality doesn't appear to play a role, in Bejarano et al. (2018) it does. Comparing the two studies suggests that the nature of the inequality – is it caused by a shock or not – plays a role when the shock happens to someone else and not when the shock happens to the decision-maker themselves. Looking more closely at the attitudes and expectations of both a decision maker who isn't personally affected by the shock and a decision maker who is, would be a fruitful direction of future research to uncover why this is the case. In our view, it may be also worth investigating the effect that negative random shocks have on other domains. For example, there are papers that look at the effects of natural disasters on prosocial behavior (Castillo & Carter 2011, Rao et al. 2011, Calo-Blanco et al. 2017). In the light of our results, it seems important to investigate whether these shocks indeed lead to differences in behavior once we account for the possibility that they may have an effect on the level of inequality.

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