

# **Financial Support, Moral Hazard, and Other-regarding Preferences**

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## **Abstract**

In this paper, we provide evidence of moral hazard in an incentivized laboratory experiment. We show that individuals cut down prevention expenditures as soon as adverse outcomes become less severe. Furthermore, based on a general model of other-regarding preferences, we hypothesize that the strength of this moral hazard effect is attenuated by the intensity of other-regarding preferences. We test this prediction in a treatment with the very same financial incentives for effort provision, which we implement, however, with the help of financial support provided voluntarily by another individual. In this case, moral hazard can no longer be detected. Moreover, differences in how individuals adjust prevention to the strength of financial incentives are significant between both treatments. We quantify these differences and discuss the implications of our results for charitable giving specifically and the provision of financial support in general.

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## 1. Introduction

Moral hazard is one of the key forms of information asymmetry and has received a lot of attention in economics (e.g., Pauly, 1968; Smith & Goodwin, 1996; Dionne et al., 2013). Moral hazard arises when one party can take hidden actions that affect (contractual) outcomes relevant to other parties (Mas-Colell et al., 1995). The term originates in the insurance literature where it refers to the impact of insurance in distorting incentives (Winter, 2013). *Ex ante*, individuals facing the risk of loss can generally take actions to reduce the risk, e.g. invest in prevention to reduce the probability of loss or invest in loss reduction to reduce the severity of loss (Ehrlich & Becker, 1972). With insurance, however, a portion of the loss is covered by the insurer so that the benefits of risk reduction are no longer completely internal to the individual resulting in reduced precautions (Shavell, 1979; Holmstrom, 1979). *Ex post*, once a loss has occurred, insurance coverage increases the consumption of goods or services covered under the policy (Pauly, 1968; Zeckhauser, 1970; Ma & Riordan, 2002). There is ample empirical evidence of the former in property-liability insurance, such as automobile insurance or crop insurance (e.g., Dionne et al., 2013; Smith & Goodwin, 1996), while some evidence of the latter has been reported in health insurance (Zweifel & Manning, 2000).

Moral hazard also arises in situations where individuals receive financial support in case of a loss (“free” insurance coverage). Examples of financial support are governmental disaster relief programs and private donations after the occurrence of a natural catastrophe (e.g., Barnett, 1999; Brown & Minty, 2006; Zagefka et al., 2011), the financial support provided by a partner or other family member to people who lose their job (e.g., Fafchamps & Lund, 2003; Skoufias & Parker, 2006), or charity given to people who fall on hard times (e.g., List, 2011). As with insurance, anticipation of financial support will generally result in reduced precautions. Raschky et al. (2013) find that governmental relief programs crowd out the demand for private insurance. In a laboratory experiment, Bixter and Luhmann (2014) document moral hazard in the form of increased risk taking of their participants as soon as other experimental subjects have to participate in the potential losses. In the vast majority of cases, moral hazard results in inefficiency because first-best outcomes are no longer obtained.

This paper provides further evidence of moral hazard. Moreover, we show that moral hazard is less pronounced in a situation where financial support is provided voluntarily by other participants, even if financial incentives for effort are exactly identical. We show that this finding is consistent with a model of other-regarding preferences. Intuitively, if recipients of support associate its source with an individual, they are more likely to factor the giver’s well-being

into their own objective function. Then, overall incentives for precautions are higher than in the absence of other-regarding preferences despite the fact that financial incentives are unchanged. The reason is that an increased risk of loss also hurts the giver.

We test these effects in a controlled laboratory experiment with two separate treatments. In one treatment, financial incentives are given by experimental design. In the other treatment, they are implemented with the help of financial support, which is provided voluntarily by another participant. Recipients are aware of this differential implementation, and we argue that other-regarding preferences can only be present in the latter treatment. The participants' behavior is consistent with moral hazard only if incentives are provided by design. More specifically, the better off individuals are in the low-outcome state, the less they invest in loss prevention *ex ante*. If, however, the improvements in the low-outcome state are due to the voluntary provision of financial support by another individual, moral hazard cannot be detected and the relationship between the size of support and the preventive investment is significantly less negative than in the other treatment.

One of the main implications of our results is that the implementation of financial support is an important design variable that can reduce the inefficiency arising from moral hazard in the giver-receiver relationship. Our findings also provide an economic efficiency rationale for the existence of so-called "godparenthood" programs<sup>1</sup>, in which recipients know about the voluntary nature of their associated donor's financial support. Furthermore, we conjecture that it might be easier to find potential donors and that donors might make more generous contributions if it can be convincingly argued that moral hazard is less of an issue. More generally, our results have implications for decision makers who aspire to design effective provision of financial support.

The structure of the paper is as follows: in Section 2 we review related literature. In Section 3 we describe the experimental design and its implementation. We present our predictions in Section 4 and our experimental results in Section 5. In Section 6 we discuss the practical implications and limitations of our study and derive conclusions.

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<sup>1</sup> In a "godparenthood" program individuals (donors) take over the "godparenthood"/sponsorship for others (recipients). In general, each donor takes over the "godparenthood" for one recipient. Also, the recipient knows about her donor and the voluntary nature of her donor's support.

## 2. Related Literature

Although studied in many fields of economics, moral hazard still appears to be most salient in the insurance literature where it was first discussed. Theoretically, if individual behavior is not observable, insurance coverage will lead to a distortion in risk-reducing investments resulting in moral hazard, see Winter (2013) for a survey. Empirical evidence abounds. For example, Dionne et al. (2013) analyze French data on car insurance and document moral hazard among inexperienced drivers. Abbring et al. (2008) find evidence of moral hazard in the Dutch car-insurance market using dynamic methods. Cohen and Dehejia (2004) investigate a panel of 50 U.S. states and the District of Columbia and find that the adoption of compulsory automobile insurance leads to an increase in traffic fatalities. Besides car insurance, there is evidence of moral hazard in crop insurance. Smith and Goodwin (1996) report that insured farmers use fewer chemical products to protect their harvest than farmers who do not have crop insurance coverage. Similarly, Coble et al. (1997) find evidence of moral hazard in crop insurance in years when production is poor, but not in years when growing conditions are favorable. Quiggin et al. (1993) confirm the presence of moral hazard in crop insurance and discuss policy implications for the design of insurance contracts. Further evidence of moral hazard is reported in unemployment insurance where an increase in unemployment benefits increases claims amounts and the duration of unemployment (Krueger and Meyer, 2002; von Wachter et al., 2011), and in disability insurance where an increase in disability insurance benefits tends to lower participation in the labor force (Gruber, 2000; Marie and Vall-Castello, 2012).<sup>2</sup>

These results are by and large confirmed in laboratory experiments. In Berger and Hershey (1994), a fraction of each individual's endowment is added to a common pool from which losses are paid. The authors observe that this sharing mechanism lowers the participants' propensity to invest in self-protection. Biener et al. (2014) find experimental evidence of moral hazard in the context of low-income insurance in the Republic of the Philippines. In Bixter and Luhmann (2014), individuals can choose between a safe and a risky option. They find that, as soon as another participant is forced to participate in the potential losses of the risky option, this induces increased risk taking, which is indicative of moral hazard.

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<sup>2</sup> The evidence mentioned so far is on *ex ante* moral hazard, i.e., insurance induced changes of pre-loss behavior. *Ex post* moral hazard in turn refers to changes in the insured's behavior conditional on a loss (Pauly, 1968), e.g., overconsumption of goods and services covered under the insurance policy. Our paper focuses on the former.

The last paper already suggests that individuals anticipate the receipt of financial support in case of inferior outcomes, and factor it into their decision making. Financial support plays a pivotal role in the form of governmental disaster relief programs and private donations after the occurrence of a natural catastrophe (e.g., Barnett, 1999; Brown & Minty, 2006; Zagefka et al., 2011), as financial support provided by a partner or other family member to people who lose their job (e.g., Fafchamps & Lund, 2003; Skoufias & Parker, 2006), or in the form of charity given to people who fall on hard times (e.g., List, 2011). In the existing literature there is a strong focus on the donors of financial support. Recently, researchers have studied the role of intertemporal preferences, procrastination and commitment (Breman, 2011; Knowles and Servátka, 2015), income effects (Erkal et al., 2011; Chowdhury and Jeon, 2014), peer pressure and relative status (Cox et al., 2007; Meer, 2011), intrinsic motives (Deb et al., 2014), the measurement of the value of a contribution (Echazu and Nocetti, 2015), the perceived worthiness and race of the recipient (Fong and Luttmer, 2011), and matching (Karlán et al., 2011) for giving behavior, see also Konow (2010). The economic analysis of giving behavior is cast within the realm of altruism and social preference theories (Andreoni and Miller, 2002; Charness and Rabin, 2002; Fehr and Schmidt, 2006) such as pure altruism (Becker, 1974), inequality aversion (Fehr and Schmidt, 2006; Bolton and Ockenfels, 2000), impure altruism (Andreoni, 1989, 1990), and conditional altruism (Konow, 2010).

Our paper argues that other-regarding preferences are equally important when considering the recipients of financial support, and more specifically when it comes to moral hazard problems. As Rabin (1993) points out people have a propensity to reciprocate, i.e. be nice to those who treat them fairly but to punish those who hurt them (see also Falk and Fischbacher, 2006). Berg et al. (1995) confirm that reciprocity appears to be a basic element of human behavior, see Dohmen et al. (2009) for a survey. Under such preferences we would expect individuals to react favorably to the provision of financial support by other individuals. This conjecture is not limited to the notion of reciprocity but can be extended to other forms of other-regarding preferences such as altruism. We contribute to the literature by providing further evidence of the presence of other-regarding preferences. Furthermore, we show how and to what extent they can help mitigate inefficiencies arising from moral hazard. As such, other-regarding preferences can become instrumental in the efficient provision of financial support. To the best of our knowledge, we are the first to analyze these effects.

### 3. Experimental Design

We conducted a laboratory experiment in which participants were randomly allocated to either the role of “subject X” or “subject Y”. Subject Y individuals were endowed with EUR 5 and participated in a lottery that pays EUR 10 (state A) with a probability of  $p(e)$  and nothing (state B) with a probability of  $(1 - p(e))$ . In state B, subject Y individuals received an amount  $\lambda \in [\text{EUR } 0; \text{EUR } 10]$ , which varied between participants, as compensation for not winning the EUR 10.<sup>3</sup> This amount can be interpreted as financial support or free insurance, even though the experiment was neutrally framed (i.e., the terms “support” or “insurance” were not mentioned to the participants). Higher amounts of  $\lambda$  correspond to more generous financial support. After subjects Y observed this amount, they determined the probability distribution over states A and B by specifying an effort level. In the experiment, they did this by choosing the corresponding cost of effort, which were deducted from their initial endowment. The relationship between the selected effort level, the associated cost of effort, and the resulting probability distribution is presented in Table 1.

Effort Level	1	2	3	4	5	6	7	8	9
Costs of Effort (in EUR)	0.00	0.20	0.60	1.20	1.80	2.40	3.20	4.00	5.00
Marginal Costs of Effort (in EUR)	0.00	0.20	0.40	0.60	0.60	0.60	0.80	0.80	1.00
Probability of State A (in Percentage Points)	10	20	30	40	50	60	70	80	90
Probability of State B (in Percentage Points)	90	80	70	60	50	40	30	20	10

Table 1: Effort level, cost of effort and probability distribution

The cost of effort is increasing in the effort level and so is the probability of the high-outcome state. In line with Fehr and Falk (1999), we used a cost function with increasing marginal cost of effort.

We implemented two treatments in our experiment, which exclusively differed with respect to the provision of financial support. In **treatment 1**,  $\lambda$  was a voluntary donation made by another individual (subject X). In this treatment subjects were randomly matched into pairs consisting of one subject X and one subject Y. All subjects X were endowed with EUR 20 and were told that their matched subject Y was endowed with EUR 5 and would participate in a lottery in which she faced a probability  $p(e)$  of winning EUR 10 and a counterprobability of  $(1 - p(e))$  of winning nothing. Subject X had the option to make a transfer  $\lambda \in [\text{EUR } 0;$

<sup>3</sup> 10 Euro correspond to approximately \$12.

EUR 10] to subject Y conditional on the occurrence of state B in the lottery. This transfer decision had to be made before subject Y's effort choice and before the resolution of uncertainty. The transfer was then deducted from subject X's endowment only if state B occurred. No transfer could be made for the case that state A occurs. It was made clear to each subject X that subject Y would first observe the transfer and afterwards choose an effort level. Table 2 provides an overview over the transfers made by subject X individuals.<sup>4</sup>

Transfer (in EUR) = Financial Support	Frequency	Percent	Cumulative
0	15	27.78	27.78
1	5	9.26	37.04
1.2	1	1.85	38.89
1.8	1	1.85	40.74
2	1	1.85	42.59
2.2	1	1.85	44.44
2.5	2	3.70	48.15
3	2	3.70	51.85
3.2	2	3.70	55.56
3.33	1	1.85	57.41
4	6	11.11	68.52
5	10	18.52	87.04
6	1	1.85	88.89
7	3	5.56	94.44
7.5	1	1.85	96.30
10	2	3.70	100.00
Total	54	100.00	

Table 2: Overview of transfers made by subject X individuals<sup>5</sup>

In **treatment 2**,  $\lambda$  was implicitly included in the experimental design. In this treatment all participants were assigned the role of subject Y and there were no pairs. The subjects were told that, if state B occurred, they would receive EUR  $\lambda$ .<sup>6</sup> In order to compare the behavior of

<sup>4</sup> Treatment 1 is a modified dictator game with subject X being the dictator and subject Y being the recipient. About a quarter of subjects X transferred nothing to their matched subject Y. Most subjects X transferred some positive amount that was smaller than or equal to half of the maximum transferable amount. Only very few subjects X decided to transfer more than half of the maximum transferable amount. Overall, the giving behavior of subjects X is in line with that of participants in other dictator-game experiments (e.g., Engel, 2011).

<sup>5</sup> The mean transfer equals 2.99 Euro and is identical to the median. The standard deviation equals 2.69 Euro.

<sup>6</sup> For the exact wording of both treatments, see Appendix A.

subject Y individuals across the two treatments, we assigned this role to the same number of participants in both treatments. In the second treatment, the  $\lambda$  amounts were the same as in the first treatment: 15 subjects received EUR 0, five subjects received EUR 1, one subject received EUR 1.2, and so on. This ensures that the financial incentives for effort provision are exactly identical in the two treatments. The only difference is that in treatment 1 financial incentives are implemented with the help of support provided *voluntarily* by another individual while in treatment 2 they arise by design and do not involve another individual.

Using a between-subjects design, we allocated subject Y individuals randomly to either treatment 1 or treatment 2. They were fully informed about the experimental design of the treatment they were allocated to, so they knew how the financial incentives they faced came about and whether another individual was involved or not. However, subject Y individuals were not informed about the existence of the other treatment.

The experiment was conducted in the Munich Experimental Laboratory for Economic and Social Sciences (MELESSA) from November 2014 to January 2015 with the experimental software *z-tree* (Fischbacher, 2007). The participants were recruited online through the Online Recruitment System for Economic Experiments (ORSEE), which was developed by Greiner (2004). Each subject received a show-up fee of EUR 4 and could additionally earn money in the experiment. The participants' decisions in the experiment determined how much they actually earned. The money was paid by the laboratory.

To ensure identical financial incentives for effort provision in both treatments, we conducted treatment 1 first. In that treatment, after arriving at the experimental laboratory, the participants were randomly allocated to a seat in front of a computer and matched into pairs. In each pair, one participant was subject X and the other was subject Y. The matched subjects were not introduced to each other and did not know with whom they had been paired. Each transfer that was made by a subject X to her matched subject Y in treatment 1 was randomly assigned to one of the subjects participating in treatment 2. In both treatments, all instructions were shown on the computer and all participants could take as much time as they needed to read the instructions and ask as many questions as they wanted. After the participants had read the instructions, they all had to answer individually some questions that verified whether they comprehended the procedure of the experiment, their options, and how the payoffs were determined. The questionnaire aimed to ensure that all subjects understood the experiment. The subjects could only start the experiment once they had answered all questions correctly.



In total, 162 individuals participated in the experiment. Of those, 108 were randomly allocated to treatment 1 and 54 were randomly allocated to treatment 2. All participants in the second treatment were assigned the role of subject Y. In the first treatment, 54 participants were randomly assigned the role of subject Y and 54 participants were randomly assigned the role of subject X. Sixty percent of the participants were female and 40 percent were male. The vast majority of the participants (91 percent) were students at the Ludwig-Maximilians-Universität München. The average age of the subjects who participated in the experiment was 25 years; the minimum age was 18 and the maximum age was 69.

#### 4. Predictions

##### *The General Case*

To derive testable hypotheses from economic theory we model subject Y's choice of effort in an adapted expected-utility framework where we allow for other-regarding preferences. Experimental evidence suggests that oftentimes agents are not purely self-interested (for a review, see Camerer, 2003). In our setup subject X foregoes wealth in state B to help out subject Y. Consistent with positive reciprocity would be that subject Y, after observing that subject X is so kind to offer financial support, would reciprocate by factoring in subject X's well-being into her effort choice. Also, the notion of altruism lends itself to the conjecture that subject X's well-being is relevant to subject Y because as soon as a positive amount of financial support is provided, subject X's distribution over terminal wealth depends on subject Y's decision. Our model is consistent with any mechanism along which other-regarding preferences might operate, and as such offers a unified perspective.

Assume that subject Y's preferences over own consumption are described by an increasing and non-convex utility function  $u(\cdot)$  over income,  $u' > 0$  and  $u'' \leq 0$ . Subject Y chooses effort level  $e$ , which determines the probability of state A to be  $p(e)$ , the probability of state B to be  $(1 - p(e))$ , and comes at a monetary cost of  $c(e)$ .<sup>7</sup> Consistent with the experimental setup we assume  $p' > 0$  and  $p'' \leq 0$ , i.e., the probability of the good state increases at a non-increasing rate, and  $c' > 0$  and  $c'' \geq 0$ , i.e., the cost of effort increases at a non-decreasing rate. Furthermore, subject Y obtains  $\lambda$  from subject X in state B. As explained previously, this can activate other-regarding preferences whose intensity we identify with parameter  $\alpha$ . Subject X's well-being is measured by an increasing utility function  $v(\cdot)$  over income,  $v' > 0$ .

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<sup>7</sup> To facilitate the use of calculus we assume effort to be continuous rather than discrete as in the experimental design. This is to simplify the exposition.

Notice that in our model as well as in the experiment the process by which subject Y forms beliefs about subject X's preferences is irrelevant as long as we accept that subject Y assumes subject X to prefer more money over less. With these specifications subject Y's objective function is given by

$$EU(e) = p(e)u(15 - c(e)) + (1 - p(e))u(5 + \lambda - c(e)) \\ + \alpha[p(e)v(w) + (1 - p(e))v(w - \lambda)].$$

$\alpha = 0$  corresponds to a purely self-interested subject and  $\alpha > 0$  to a subject with other-regarding preferences because she cares about subject X's well-being in choosing her effort level.<sup>8</sup> Optimal effort is determined by the respective first-order condition:

$$EU_e = p'[u_A - u_B] + \alpha p'[v_A - v_B] - c'[pu'_A + (1 - p)u'_B] = 0.$$

The marginal benefit consists of two components; the first term measures the expected-utility impact of increasing the probability of the high-wealth state whereas the second term captures the fact that subject X is better off if the likelihood of the donation being paid out decreases. With other-regarding preferences, this is appreciated by subject Y. The third term is the marginal cost of effort which is due to the fact that effort is costly and hence reduces consumption utility in both states of the world. We assume that the second-order condition holds.<sup>9</sup>

First, observe that

$$EU_{e\alpha} = p'[v_A - v_B] > 0,$$

i.e. the intensity of other-regarding preference is positively associated with the optimal level of effort. Intuitively, the more subject Y cares about the well-being of subject X, the more effort she will exert to prevent subject X from having to follow through with the promised financial support. Technically, an increase in  $\alpha$  induces an increase in the second component of the marginal benefit of effort whereas the first component and the marginal cost remain unchanged. We call this a level effect because we expect the chosen effort levels to be higher in the presence of other-regarding preferences than in their absence, *ceteris paribus*.

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<sup>8</sup> Notice that we assume separability between expected utility over own consumption and over the donor's well-being. This allows for a parametric approach to identify the strength of positive reciprocity.

<sup>9</sup> As is well known in the literature on self-protection, the second-order condition does not hold generically. In our set-up a sufficient condition is  $2 \frac{p'}{1-p} \leq \frac{c''}{c'} - \frac{p''}{p'}$ , which is consistent with the condition developed in Jullien et al. (1999).

The experiment tests the influence of financial incentives on individuals' effort choices. Technically we can obtain this effect by analyzing the cross-derivative of expected utility with respect to effort and the size of the financial support. This yields the following expression:

$$EU_{e\lambda} = -p'u'_B + \alpha p'v'_B - c'(1-p)u''_B.$$

The first term is negative indicating that the better the low-wealth state, the less it pays to avoid it (incentive effect). The second term is positive because, with more generous financial support, it pays more to avoid the low-income state as subject X's well-being is more affected by having to pay out the donation (other-regarding effect). The third term is positive indicating that more comprehensive financial support makes the individual richer in the low-wealth state which reduces the marginal cost of effort (wealth effect). The overall sign is ambiguous but it is reasonable to assume that the incentive effect dominates the other-regarding and the wealth effect. Loosely speaking a sufficient condition for this is that absolute risk aversion is below an endogenous threshold which is governed by assumptions on effort technology.<sup>10</sup> According to the implicit function rule the overall effect of a change in the size of financial support on effort provision is given by  $de/d\lambda = -EU_{e\lambda}/EU_{ee}$ . Under the assumptions made so far this expression is negative indicating that agents exert less effort with more generous financial support (moral hazard). Said differently, our assumptions suggest that the decrease in financial incentives to provide effort outweighs the increase in non-financial incentives to provide effort once financial support becomes more comprehensive, so that overall we would expect moral hazard to prevail.

Let us now investigate how the intensity of other-regarding preferences modulate the moral hazard effect. Intuitively, one could conjecture that other-regarding preferences are negatively associated with moral hazard, i.e., if we increase their intensity, moral hazard is attenuated because subject Y cares about subject X's well-being more. Indeed, when inspecting  $EU_{e\lambda}$ , it becomes evident that, as we increase  $\alpha$ , this cross-derivative also increases so that it becomes less negative. However, this only captures the partial effect of positive reciprocity on the comparative statics of effort with respect to financial support. In addition, individuals with stronger other-regarding preferences will also select a different level of effort to begin with (level effect). This needs to be reflected in our analysis. Under suitable assumptions on risk preferences and effort technology, this intuition is confirmed and an increase in the intensity of other-regarding preferences flattens the effect of financial support on effort provision. This

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<sup>10</sup> A similar condition arises in the comparative statics of optimal effort with respect to the size of a loss, i.e., the difference between incomes in the two states of the world, see Hofmann and Peter (2015).

is referred to as a sensitivity effect because essentially effort choice becomes less sensitive to changes in the level of financial support when the intensity of other-regarding preferences is increased. We provide the technical details in Appendix B.

### *Risk Neutrality*

Allowing for risk aversion considerably broadens the applicability of our model but also complicates the technical analysis and requires to develop a set of sufficient conditions to determine the impact of other-regarding preferences on effort provision and on the intensity of the moral hazard effect. This can already be seen by inspecting  $EU_{e\lambda}$ , where risk aversion adds a positive wealth effect countervailing the negative incentive effect. This difficulty is also consistent with results in the literature on prevention where the role of risk aversion is indeterminate and hinges on assumptions on the prevention and cost technology, see Courbage et al. (2013) for a survey.

In this subsection we show that risk neutrality considerably simplifies the technical analysis. As a result and due to continuity, the conjectured relationships between other-regarding preferences, effort provision and the strength of the moral hazard effect carry over to situations where risk aversion is not too large. Assuming both subject X and Y to be risk-neutral yields the following first-order condition:

$$EU_e = (10 - \lambda + \alpha\lambda)p' - c' = 0.$$

The second-order expression is given by

$$EU_{ee} = (10 - \lambda + \alpha\lambda)p'' - c'' = c' \left( \frac{p''}{p'} - \frac{c''}{c'} \right).$$

It is obtained by using the first-order condition and it is negative under the assumptions presented on the effort and cost technology. With the help of the implicit function rule it holds that

$$\frac{de}{d\lambda} = \frac{(1 - \alpha)p'}{EU_{ee}} < 0,$$

resulting in the prediction that more generous donations result in a reduction in effort provision as long as  $\alpha < 1$ . Notice that it is natural to assume that individuals place greater weight on their own consumption utility than on that of other individuals. Finally we obtain that

$$\frac{\partial de}{\partial \alpha d\lambda} = \frac{-p'EU_{ee} - 2\lambda(1-\alpha)p'p'' + \lambda(1-\alpha)(p')^2 \frac{EU_{eee}}{EU_{ee}}}{EU_{ee}^2},$$

which is non-negative if  $\alpha < 1$ ,  $p''' \leq 0$  and  $c''' \geq 0$ . Therefore, the level effect and the sensitivity effect are derived with ease in such a simplified specification.

## 5. Results

### *Statistical Analysis*

In Figure 1 we plot the cost of effort chosen by subject Y individuals against the outcome if state B of the lottery obtains. This is labeled as financial incentive on the x-axis because the outcome in state B relative to state A will determine the incentives for effort provision. As explained earlier, these financial incentives for effort provision were completely identical across both treatments.

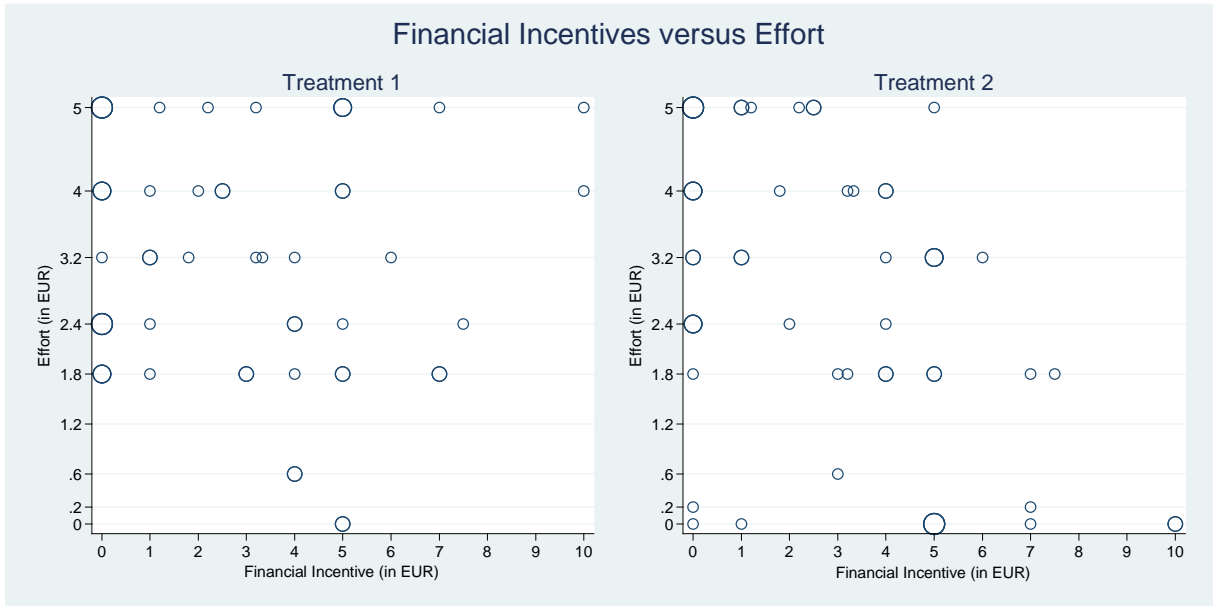


Figure 1: Scatterplot of the costs of effort chosen by subjects Y against the financial incentives

As discussed, moral hazard materializes when there is a negative correlation between the low-wealth outcome and the effort chosen by subjects Y. In section 4 we argued that subjects Y reactions to financial incentives might depend on the intensity of other-regarding preferences. We conjecture that other-regarding preferences are more likely to be present in treatment 1, where financial incentives are implemented with the help of financial support provided voluntarily by another experimental subject, and unlikely to play a role in treatment 2, where finan-

cial incentives are given by design, without reference to another individual. In the following we only analyze whether subject Y individuals react differently towards financial incentives in treatment 1 than in treatment 2.

In total 78 subjects faced a situation where the lottery outcome in state B was different from zero. For the 39 subjects in treatment 1 this implies that subject X's distribution over terminal wealth is affected by their choice of effort. While Pearson's correlation coefficient shows no significant correlation between the outcome in state B and the cost of effort in treatment 1 ( $\rho_P = -0.0081$ ,  $p = 0.9612$ ), there is a significant negative correlation ( $\rho_P = -0.5631$ ,  $p = 0.0002$ ) in treatment 2. We additionally calculate Spearman's rank correlation and Kendall's Tau to corroborate this evidence. Unlike Pearson's correlation coefficient, these two measures are able to account for non-linear relationships. We find a negative relationship between the outcome in state B and subject Y's effort provision in treatment 2 but not in treatment 1 also when using these two measures of rank correlation.<sup>11</sup> Whereas all signs indicate that subject Y individuals reduce effort when the low-wealth state improves, this relationship is only significant in treatment 2 where financial incentives are provided by design. As soon as another individual is involved in the implementation of financial incentives, the null of no moral hazard can no longer be rejected.

In a second step we will investigate whether the behavior of subject Y individuals is significantly different between the two treatments. To this end we use the method of Zou (2007). According to Zou (2007), the confidence interval for the difference between two independent correlations with the correlation coefficients  $r_1$  and  $r_2$  is given by  $[L, U]$  with

$$L = r_1 - r_2 - \sqrt{(r_1 - l_1)^2 + (u_2 - r_2)^2}$$

$$U = r_1 - r_2 + \sqrt{(u_1 - r_1)^2 + (r_2 - l_2)^2},$$

where  $[l_1, u_1]$  is the confidence interval for the correlation coefficient  $r_1$  and  $[l_2, u_2]$  is the confidence interval for the correlation coefficient  $r_2$ . The 95% confidence interval for the difference between the two Pearson correlation coefficients equals  $[0.142; 0.928]$ . The 95% confidence interval for the difference between the two Spearman rank correlations (Kendall's Taus) equals  $[0.095; 0.876]$  ( $[0.062; 0.637]$ ). All confidence intervals exclude the value zero. Hence, we can reject the null hypothesis that financial incentives have the same effect on ef-

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<sup>11</sup> Spearman's rank correlation (Kendall's Tau) between the lottery outcome in state B and the cost of effort equals  $\rho_S = -0.042$  ( $\tau = -0.0351$ ) with the p-value being  $p = 0.7995$  ( $p = 0.740$ ) in treatment 1. In treatment 2, however, there is a significant negative correlation for both Spearman's correlation ( $\rho_S = -0.5474$ ,  $p = 0.0003$ ) and Kendall's Tau ( $\tau = -0.3846$ ,  $p < 0.0001$ ).

fort provision by subject Y individuals in both treatments. They react significantly differently to financial incentives when they arise by experimental design than when they involve voluntary provision of financial support by another individual.

One can argue that the intensity of other-regarding preferences might depend on the generosity of the provider of financial support which we can identify by looking at the amount of financial support. Subject Y individuals' other-regarding preferences might be more pronounced when they receive a high amount of financial support than when financial support is low. This reasoning lends itself to differential predictions depending on the size of financial support. To test for such differences, we split our sample in subjects whose outcome in state B is below average and in subjects whose outcome in state B is at the average or above.<sup>12</sup>

For those subjects who received a below average amount, we do not find any significant correlation between the financial incentive and the effort provision of subjects Y in either treatment.<sup>13</sup> However, for those individuals whose outcome in state B is at the average or above, we find a significant negative correlation between the outcome in state B and the effort provision of subjects Y in treatment 2 (Person's correlation coefficient equals  $\rho_P = -0.4587$ ,  $p = 0.0141$ ; Spearman's rank correlation equals  $\rho_S = -0.4264$ ,  $p = 0.0237$ ; Kendall's Tau equals  $\tau = -0.2698$ ,  $p = 0.020$ ) but not in treatment 1 (Person's correlation coefficient equals  $\rho_P = 0.2713$ ,  $p = 0.1626$ ; Spearman's rank correlation equals  $\rho_S = 0.2194$ ,  $p = 0.2620$ ; Kendall's Tau equals  $\tau = 0.1349$ ,  $p = 0.249$ ). In order to test whether the difference in the correlation coefficients between treatment 1 and treatment 2 are statistically significant, we again applied Zou's method and find a significant difference for all three correlation coefficients (the 95 percent confidence interval for the difference between the two Pearson correlation coefficients (Spearman's rank correlations) {Kendall's Taus} equals  $[0.169; 1.111]$  ( $[0.115; 1.067]$ )  $\{[0.08; 0.73]\}$ ). Hence, while subject Y individuals do not react differently to financial incentives in both treatments for below-average outcomes in state B, we find a significant difference in the reaction of subject Y individuals to financial incentives in both treatments when lottery outcomes are above average. This provides further evidence for our main result that moral hazard is present in situations of individual effort choice but less so as soon as financial incentives involve the voluntary provision of financial support by another individual. Furthermore, the results from splitting the sample in half show that the effects obtained earlier are

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<sup>12</sup> The average outcome if state B obtains equals 3 EUR and is identical to the median.

<sup>13</sup> Pearson's correlation coefficient equals  $\rho_P = 0.228$  ( $p = 0.2625$ ) in treatment 1 and  $\rho_P = 0.2922$  ( $p = 0.1475$ ) in treatment 2. Spearman's rank correlation equals  $\rho_S = 0.2008$  ( $p = 0.3252$ ) in treatment 1 and  $\rho_S = 0.3171$  ( $p = 0.1145$ ) in treatment 2. Kendall's Tau equals  $\tau = 0.1323$  ( $p = 0.280$ ) in treatment 1 and  $\tau = 0.1877$  ( $p = 0.124$ ) in treatment 2.

driven by the behavior of individuals who receive above-average financial support. This is consistent with our hypothesis that the intensity of other-regarding preferences is stronger the more generous the giver.

As discussed in section 4 there might not only be a sensitivity effect between financial incentives and effort provision of subjects  $Y$  but also a level effect. In the presence of other-regarding preferences we would expect the average effort level to be higher than in the absence of such preferences. Again, we exploit the differential intensity of other-regarding preferences which might be triggered by more or less generous giving behavior. The average cost of effort for individuals who face average or higher than average outcomes in state B equals  $\bar{e} = 2.79$  EUR in treatment 1 and  $\bar{e} = 1.95$  EUR in treatment 2. While this is qualitatively as expected, the difference is statistically significant only at the 10% level (the test statistic of the Wilcoxon rank-sum test equals  $z = 1.915$  and the p-value equals  $p = 0.0554$ ). Subjects who faced a below average outcome in state B chose an average effort of  $\bar{e} = 3.46$  in treatment 1 and  $\bar{e} = 3.48$  in treatment 2. This difference is not significant at common significance levels (the test statistic of the Wilcoxon rank-sum test equals  $z = -0.563$  and the p-value equals  $p = 0.5736$ ).

Finally, we conduct a multivariate analysis by estimating a tobit regression model. The tobit model is suitable because the effort level as well as the cost of effort is bounded from above and below by definition. As explanatory variables we include the treatment, the lottery outcome if state B obtains to identify the financial incentive individuals face, and an interaction term between the treatment and the financial incentive variable. We also include the subjects' gender and age as controls. The results of the tobit model are given in Table 3.



Tobit Model	
VARIABLES	Effort
Treatment 2	2.360** (1.047)
Financial Incentive	0.039 (0.148)
Treatment 2 * Financial Incentive	-0.751*** (0.230)
Female	0.420 (0.486)
Age	0.028 (0.025)
Constant	2.081** (1.002)
Observations	78

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 3: Tobit model for the effort provision by subjects Y

The significant negative effect of the interaction term between the treatment and the financial incentive backs our previous results. As a robustness check, we also applied an OLS regression and an ordered probit regression. The results remain stable over all model specifications, see Appendix C.

### *Discussion*

Our results show that there is a significant difference in the reactions of subjects Y to the provision of financial incentives in the two treatments. As outcomes in the low-wealth state become more favorable, individuals reduce their effort level significantly when financial incentives are provided by design. This behavior is consistent with moral hazard. However, as soon as financial incentives involve the voluntary provision of financial support by another individual, moral hazard can no longer be detected. Furthermore, differences between the two treatments are significant. When splitting the sample in half, we find that our results are driven by the differential behavior of individuals who experience financial support that is relatively generous as compared to the rest of the sample. We argue that such differences might originate from the fact that the strength of other-regarding preferences is higher in giver-receiver relationships with a generous giver.

In treatment 1, subject X individuals decided how much financial support they want to provide to their matched subject Y. They were able to decide how generously they wanted to

treat subject Y, and subject Y individuals could see how generous their matched subject X was before selecting an effort level. We surmise that subject Y individuals who felt treated generously by their matched subject X were reluctant to choose low effort levels because this would increase the likelihood of subject X suffering from their generosity. In treatment 2 in turn financial incentives were provided by design and it is harder to make the case for other-regarding preferences. In such a situation subject Y individuals maximized expected utility by choosing a low effort level when as soon as the difference between the low-wealth and the high-wealth state becomes smaller to save on cost of effort.

## **6. Conclusion**

We study moral hazard in an incentivized laboratory experiment. When adverse outcomes become less severe, individuals cut down prevention expenditures consistent with moral hazard. We hypothesize that this moral hazard effect is attenuated by the presence of other-regarding preferences. To test this, we compare a treatment where financial incentives are provided by design to a treatment where they involve the voluntary provision of financial support by another individual. As soon as another individual is involved, the null of no moral hazard can no longer be rejected, which is consistent with our general model of other-regarding preferences. Furthermore, differences in how individuals adjust effort levels to the financial outcomes they face are significant between both treatments. When splitting the sample in half, we find that these differences are driven by the behavior of recipients who experience generous financial support.

Our results differ from the results in Bixter and Luhmann (2014) where subjects received financial support because other experimental subjects were forced to participate in their losses. They find evidence of moral hazard, which suggest that the voluntary nature of financial support in our setup plays a crucial role. Furthermore, these different findings are indicative of the fact that our results are driven more by positive reciprocity than by pure altruism. In Bixter and Luhmann (2014) and in our paper individuals know that their behavior affects others and that increased risk taking or reduced precautions raise the likelihood of others experiencing a loss in wealth. If individuals were purely altruistic, both setups should lend themselves to the same conclusion about moral hazard. In our paper, however, the givers provide financial support voluntarily, which can activate positive reciprocity in the recipients. This is not the case when the participation in losses is involuntary because then no behavior of the pro-

vider of financial support is present. Against this background, our results strengthen the evidence of positive reciprocity.

Our results have a variety of practical implications, especially in the context of charity. Charity might have adverse effects on the recipients' incentive to exercise precautions. The principle of charity is based on the idea that people with altruistic preferences are willing to transfer money to other people who suffered a major loss or have fallen on hard times. If the potential recipients of charity anticipate the donors' altruistic preferences and the prospective transfer of aid in case the former suffer a loss, they might reduce their costly effort to prevent a loss or to compensate it adequately (Buchanan, 1975; Coate 1995). In that sense, charity might be understood as a donation of free insurance coverage. For example, an enormous amount of charitable donations is commonly collected after a natural catastrophe and given to those afflicted (e.g., Brown & Minty, 2006; Zagefka et al., 2011). This money helps victims lessen the severity of their loss. The literature shows that when people expect that they will receive financial support in case they suffer a loss, they refrain from buying insurance (e.g., Goodwin & Rejesus, 2008; Kousky et al., 2013; Raschky et al., 2013). This, however, has an adverse effect on efficiency (Coate, 1995). In that respect, charity might also have adverse effects and lead recipients to commit moral hazard.

Our results indicate that people are reluctant to commit moral hazard when financial assistance is voluntarily donated to them directly by other people. This result has implications for individuals who want to help others but are concerned that their donation may lead the recipient to make less effort to prevent situations that will put him or her in need. Our findings can mitigate this concern and motivate skeptics to give to charity. It may also be valuable for organizations that collect money for charitable purposes because it describes the circumstances that promote moral hazard among recipients. If charitable organizations ensure that recipients are informed that the money they receive is voluntarily donated by other individuals, this should help prevent moral hazard.

Furthermore, our analysis provides an economic rationale for godparenthood programs and calls on charitable organizations and charitable systems to ensure that the recipients of charity are aware that these gifts were voluntarily given by others. Failing to do so could lead the recipients of charity to think that the donations are made by the organization, rather than by individuals—an assumption that, as we have seen, might have adverse efficiency consequences.

When discussing the real-world implications of our results, it is necessary to bear in mind that this study has some of the common limitations of laboratory experiments in economics. First, although a laboratory setting makes it possible to analyze the impact of one variable on another variable while holding all interfering factors constant, people may react differently within a laboratory than they would in real life. With regard to this point, Benz and Meier (2008) find that pro-social behavior in the lab and in the field are significantly correlated. Based on this result, we believe that our results have sufficient external validity to be applicable in the field.

Second, the vast majority (91 percent) of the subjects who participated in our experiment were students. Levitt and List (2007) show that the behavior of students is not significantly different from that of other groups of subjects with respect to social preferences. If anything, students appear to be a little more selfish than a representative sample of the general population (Dohmen et al., 2009; Bellemare, Kröger, & van Soest, 2008). However, since students are typically younger and better educated than the general population, the results of our experiment might have been different if the participants had been a representative sample of the general population. Third, although the experiment was incentivized and participants earned on average about EUR 17 for 30 minutes of their time, which is considerably more than a student would typically earn in 30 minutes by doing another job, the participants might have nevertheless behaved differently if the stakes had been higher. Some researchers who examined whether an increase in stakes changes social behavior found that such changes are small (e.g., Cameron, 1999; Fehr, Fischbacher, & Tougareva, 2002).

Finally, in treatment 1 of our experiment, individuals were randomly matched into pairs and did not know with whom they were matched, so everyone was anonymous. In contrast, in many real-life situations donors and recipients may know each other. In our setting, we found no evidence of moral hazard when recipients received a voluntary transfer from an anonymous individual. We would expect this result to be even more pronounced if the donors and the recipients knew each other, as there is plenty of literature showing that the lower the social distance between individuals, the stronger their social behavior (e.g., Bohnet & Frey, 1999; Charness & Gneezy, 2008; Chen & Li, 2009). However, how anonymity affects moral hazard in the context of charity and insurance would be an interesting path for future studies to explore.


## Appendix

### Appendix A - Decision situation in the experiment

#### Treatment 1:

**Participant X has made a donation of 4.00 Euros in the case that State B occurs.**

Therefore, your payment situation can be depicted as follows:

 Participant Y	<b>State A</b> 15 Euros minus your chosen investment
	<b>State B</b> 9 Euros minus your cho- sen investment

Please now choose an investment. Each investment results in specific costs for your account and determines the probabilities of State A and State B. The relationship between the investment and the respective probabilities of State A and State B can once again be found in the table below.

Investment [e]	0 Euros	0.20 Euros	0.60 Euros	1.20 Euros	1.80 Euros	2.40 Euros	3.20 Euros	4.00 Euros	5.00 Euros
Probability of State A [p(e)]	10%	20%	30%	40%	50%	60%	70%	80%	90%
Probability of State B [(1-p(e))]	90%	80%	70%	60%	50%	40%	30%	20%	10%

#### **Reminder:**

If State A occurs, you receive 15 Euros minus your chosen investment. If State B occurs, you receive 9 Euros minus your chosen investment

**Please now choose an investment. Note that values of Euros and Cents in this program are separated by dots, not commas, as usual in German.**

Investment  Euro

Treatment 2:

Your payment situation can be depicted as follows:



**State A**  
15 Euros minus your  
chosen investment

**State B**  
9 Euros minus your cho-  
sen investment

Investment [e]	0 Euros	0.20 Euros	0.60 Euros	1.20 Euros	1.80 Euros	2.40 Euros	3.20 Euros	4.00 Euros	5.00 Euros
Probability of State A [p(e)]	10%	20%	30%	40%	50%	60%	70%	80%	90%
Probability of State B [(1-p(e))]	90%	80%	70%	60%	50%	40%	30%	20%	10%

Please choose one of the nine possible investments. **Please type in the investment as given in the table. Note that values of Euros and Cents in this program are separated by dots, not commas, as usual in German.**

**Your choice is relevant for your payment!**

Investment  Euro

## Appendix B – Technical Details for our Predictions

We show how changes in the intensity of other-regarding preferences influences the moral hazard effect. Recall that by the implicit function rule we obtain that  $de/d\lambda = -EU_{e\lambda}/EU_{ee}$  with

$$EU_{e\lambda} = -p'u'_B + \alpha p'v'_B - c'(1-p)u''_B$$

and

$$EU_{ee} = p''[u_A - u_B] - 2p'c'[u'_A - u'_B] + \alpha p''[v_A - v_B] - c''[pu'_A + (1-p)u'_B] + (c')^2[pu''_A + (1-p)u''_B].$$

Individuals who have stronger other-regarding preferences will place a greater weight on subject X's well-being in their effort choice. This has two implications for the moral hazard effect. *First*, with more pronounced other-regarding preferences a different effort level will be selected. *Second*, the fact that larger donations reduce subject X's well-being more receives greater attention when adjusting effort levels to larger donations. The first effect (level effect) is formalized via  $de/d\alpha = -EU_{\alpha e}/EU_{ee}$ , which is positive due to

$$EU_{\alpha e} = p'[v_A - v_B] > 0.$$

The second effect (sensitivity effect) is related to the sign of

$$EU_{\alpha e\lambda} = \alpha p'v'_B > 0.$$

For the net effect we have to use the quotient rule to understand how  $de/d\lambda$  reacts to changes in the intensity of other-regarding preferences. This yields the following expression:

$$\frac{\partial de}{\partial \alpha d\lambda} = -\frac{EU_{ee} \left( EU_{\alpha e\lambda} + EU_{ee\lambda} \frac{de}{d\alpha} \right) - EU_{e\lambda} \left( EU_{\alpha ee} + EU_{eee} \frac{de}{d\alpha} \right)}{EU_{ee}^2}.$$

Three cross-derivatives still need to be inspected. Notice that

$$EU_{ee\lambda} = -p''u'_B + 2p'c'u''_B + \alpha p''v'_B - c''(1-p)u''_B + (c')^2(1-p)u'''_B.$$

The first and fourth term are non-negative, the second and third non-positive, and the fifth one is indeterminate. Assuming that preferences are not imprudent ( $u''' \geq 0$ ) we can sign the fifth as non-negative. Note that by  $EU_{e\lambda} < 0$  we conclude that

$$\begin{aligned}
& -p''u'_B + 2p'c'u''_B + \alpha p''v'_B - c''(1-p)u''_B \\
& \geq u'_B \left( (-2p'c' - p''c'(1-p) + c''(1-p))r_u(B) - p''(1-p') \right),
\end{aligned}$$

where  $r_u(B)$  denotes absolute risk aversion of utility function  $u$  evaluated at wealth level  $B$ . From this we can see that sufficient conditions for  $EU_{ee\lambda}$  being non-negative are that  $p' < 1$  and that  $2p'/(1-p) < -p'' + c''/c'$ , which is slightly stronger than the sufficient condition for the second-order condition, see Footnote 5. Furthermore, we obtain that

$$EU_{\alpha ee} = p''[v_A - v_B] \leq 0.$$

The last term to be determined is

$$\begin{aligned}
EU_{ee} &= p'''[u_A - u_B] - 3p''c'[u'_A - u'_B] - 3p'c''[u'_A - u'_B] + 3p'(c')^2[u''_A - u''_B] \\
&+ \alpha p'''[v_A - v_B] - c'''[pu'_A + (1-p)u'_B] + 3c'c''[pu''_A + (1-p)u''_B] \\
&- (c'')^3[pu'''_A + (1-p)u'''_B].
\end{aligned}$$

Again this is a priori ambiguous but we can present sufficient conditions to sign this expression. If the agent is not imprudent ( $u''' \geq 0$ ) and the effort technology satisfies  $c''' \geq 0$ ,  $p''' \leq 0$  and  $-p''/p' \leq c''/c'$ , then we obtain a non-positive sign overall. Notice that the additional assumptions on the effort technology are compatible with the ones made earlier on. As a result we can conclude that  $\partial/\partial\alpha \ de/d\lambda$  is positive overall indicating that the net effect of an increase in the intensity of other-regarding preferences is that the moral hazard effect flattens out.



## Appendix C – Regression Results

OLS Model	
VARIABLES	Effort
Treatment 2	1.447* (0.727)
Financial Incentive	0.020 (0.108)
Treatment 2 * Financial Incentive	-0.471*** (0.154)
Female	0.404 (0.351)
Age	0.014 (0.017)
Constant	2.353*** (0.729)
Observations	78

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 3: OLS model for the effort provision by subjects Y

Ordered Probit Model	
VARIABLES	(1) Effort
Treatment 2	1.208** (0.536)
Financial Incentive	0.019 (0.075)
Treatment 2 * Financial Incentive	-0.383*** (0.119)
Female	0.254 (0.250)
Age	0.013 (0.013)
Cut1 (Constant)	-0.956* (0.540)
Cut2 (Constant)	-0.881 (0.537)
Cut3 (Constant)	-0.686 (0.530)
Cut4 (Constant)	0.045 (0.514)
Cut5 (Constant)	0.309 (0.512)
Cut6 (Constant)	0.829 (0.518)
Cut7 (Constant)	1.369** (0.535)
Observations	78

Standard errors in parentheses  
\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Table 3: Ordered probit model for the effort provision by subjects Y

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