The Scandinavian
Journal of Economics

Scand. J. of Economics 119(4), 962–986, 2017
DOI: 10.1111/sjoe.12200

Contract Choice: Efficiency and Fairness in Revenue-Sharing Contracts*

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Abstract

We present a simple principal–agent experiment in which the principals are allowed to choose between a revenue-sharing, a bonus, and a trust contract, to offer to an agent. Our findings suggest that a large majority of experimental subjects choose the revenue-sharing contract. This choice turns out to be not only the most efficient but also, at the same time, fair. Overall, the distribution of earnings is only mildly skewed towards the principal. We conclude that, under revenue-sharing contracts, concerns for fairness can be closely associated with the use of monetary incentives.

Keywords: Bonus contract; incentive contract; lab experiment; moral hazard; trust

JEL classification: *C*91; *J*41; *M*52

I. Introduction

In this paper, we use an experiment to compare how principals choose among three different contract types: revenue-sharing contracts, bonus contracts, and trust contracts. Contract choice is clearly important from the perspective of the efficiency of any transactions that involve principals and agents; yet, to our knowledge, only a limited number of experimental studies directly compare different types of contracts, and none has looked at

*We thank Enrique Fatas, David Masclet, Anders Poulsen, Klaus Schmidt, two anonymous reviewers, and participants of presentations in Cologne and Norwich for advice. The experimental instructions and other appendices are available online. The experiment was programmed using Z-Tree (Fischbacher, 2007) and the experimental dataset is available from the first author.

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the combinations of contracts we consider. We find that revenue-sharing contracts are a particularly useful contract to consider as part of the menu of choices offered to the principal. Revenue-sharing contracts are used extensively in sharecropping (Allen and Lueck, 1992), the video rental industry (Dana and Spier, 2001), gate revenue sharing in sports (Szymanski and Kesenne, 2004), law, accounting, and architecture firms (Greenwood and Empson, 2003), among other professions. These are evidently contracts of potentially general interest.

In a trust contract, the principal pays a fixed wage to the agent and requests an effort level. As the fixed wage is paid before the agent decides on an effort level, the agent has no incentive for exerting the requested effort. In the bonus contract, in addition to the fixed wage and requested effort, the principal announces a voluntary bonus that she is willing to pay if the exerted effort is equal to or exceeds the requested effort. As this announcement is not binding, there is still no incentive to exert effort. However, Fehr *et al.* (2007) find that when offered the choice between an enforceable monitoring contract and a non-enforceable bonus contract, most principals (roughly 90 percent) preferred the bonus contract. Additionally, the effort exerted by the agents and the average payoff for both the principals and the agents were higher in bonus contract than in monitoring contract settings (Fehr *et al.*, 2007). The interpretation by Fehr *et al.* (2007) of their findings is that the bonus contract was preferred to the monitoring contract because of fairness concerns. However, it is possible that a contract that contained the opportunity of fining could have been perceived as a hostile act itself, and that it might send the agent a signal of distrust (see Frey, 1998; Fehr and Rockenbach, 2003; Dickinson and Villeval, 2008).[1] This, in turn, could have increased the likelihood of shirking, by generating a self-fulfilling prophecy of distrust (see Bacharach *et al.*, 2007). In contrast, in an experiment employing revenue-sharing contracts, where a principal defines a fixed wage and additionally offers the agent a share of the total (gross) revenue, Anderhub *et al.* (2002, p. 24) found that principals "clearly recognize the agency problem and react accordingly" by developing incentive-compatible and profit-maximizing contracts. However, a significant proportion of the principals also take concerns of fairness into account, in the sense of providing larger than the predicted shares of the total revenue to the agents. In principle, a contract that *ex ante* reduces the risk for the principal could be quite attractive to a risk-averse principal, and

[1] More generally, the contract choice can provide important information to the employee regarding the employer (e.g., Falk and Kosfeld, 2006) or even the behavior of other employees (Danilov and Sliwka, 2013), which in turn can have either positive or negative effects on the intrinsic motives of agents. Bowles and Polania-Reyes (2012) provide a systematic review of what they identify as the four crowding-out mechanisms of intrinsic incentives.

contracts based on revenue sharing or bonuses would not have the negative connotations of distrust of a monitoring contract with fines.

Our experiment builds on the work of Anderhub *et al.* (2002) and Fehr *et al.* (2007) by providing principals with the option to choose among a revenue-sharing contract, a bonus contract, or a trust contract.[2] The trust and bonus contracts we have used are similar to those in Fehr *et al.* (2007). In the revenue-sharing contract, a principal defines a non-negative fixed wage and, additionally, offers the agent a share of the total (gross) revenue. The revenue-sharing contract implicitly assumes that effort and revenue are observable and verifiable. Although, under such circumstances, it would also be possible to write a "forcing contract", which requires agents to exert the efficient effort level and would punish them severely if they were to deviate, offering such a contract can be perceived as a signal of distrust by the agents (irrespective of the preferences of the principal).[3] The revenue-sharing contract allows fairness concerns to be expressed by offering a generous share of the total revenue to the agent. Hence, a principal can express social preferences in both the bonus contract and the revenue-sharing contract, if they choose to do so.

Our key finding is that principals tend to choose revenue-sharing contracts over alternatives, in both one-shot and repeated games, and the revenue-sharing contracts that they choose make agents, on average, no worse off in absolute terms than if a different contract had been chosen. In relative terms, agents overall received as much as 47 percent of the earnings. In the repeated games, switches from bonus or trust contracts to revenue-sharing contracts are Pareto superior for a majority of both principals and agents. Therefore, efficiency and fairness complement each other.[4]

Our results are, in spirit, connected to Chan (2006), who presented a trust game experiment showing that both efficiency and equity can matter, and to Güth *et al.* (1993), who devised a multi-period ultimatum game where efficiency and fairness can complement each other. Undoubtedly, there are contexts where the tension rather than complementarity between efficiency and fairness is a real one (e.g., Bone *et al.*, 2004; Ackert *et al.*,

[2] As discussed further below, the trust contract can be seen as a special case of both the bonus and revenue-sharing contracts. However, we choose to present it as an explicit option to control for any potential pressure the principals might have felt on using all the mechanisms available in each contract (given that they have chosen it).

[3] See Bowles and Polania-Reyes (2012) for a review of crowding-out mechanisms on preferences.

[4] While following a different approach, there is some parallelism with Murdock (2002), who presents a model combining intrinsic incentives and efficiency in contract design. Conversely, Prendergast (2008) suggests selecting agents by their preferences. Other researchers have pointed out that monetary incentives might work, but that their effectiveness depends on the degree of the agents' intrinsic motivation (Boly, 2010) or the size of the monetary incentives (James, 2005).

2007). Our claim of complementarity is one that applies to a contract design environment where revenue sharing is an option.

The remainder of this article is structured as follows. In Section II, we present the theoretical predictions, the experimental design, and the hypotheses. In Section III, we provide the results of the experiment. In Section IV, we offer a discussion of the results. We conclude in Section V. The Online Appendices include more details on experimental parameters and predictions (Online Appendix A), experimental instructions (Online Appendix B) as well as more experimental results and further econometric analysis (Online Appendices C, D, and E).

II. Experimental Design and Hypotheses

Experimental Design

In our experiment, a principal, *the employer*, hires an agent, *the employee*, to carry out production. For every unit of effort e the agent exerts, the principal receives 150 experimental currency units (ECUs). In other words, the total revenue is given by $R(e) = 150e$. The agent bears an effort cost of $C(e) = e + e^2$ with $e \in \{0, 1, \ldots, 19, 20\}$. Subjects have a fixed role of either principals or agents, and this was common knowledge. The experiment is divided into five games and has 10 rounds in total. In each round, both the principal and the agent receive initial endowments of 3,000 ECUs. The purpose of the endowments was to ensure that neither the agent nor the principal could make any losses. The differences across games are in the type of employment contract the principal can offer to the agent (i.e., a trust contract, a bonus contract, a revenue-sharing contract, or a choice among the three), and whether the game is repeated (which allows for reputation building) or one-shot. In each game, principals are matched with a different agent, and this is also common knowledge. Games are in one of two possible orders, described in Figure 1, and are explained below.

In an exogenous trust contract setting (TC-ex), the principal chooses the size of a fixed wage F, where $F \in \{0, 1, \ldots, 2{,}999, 3{,}000\}$, and suggests

Sessions 1–6	Round 1 TBR	Round 2–7 TBR-r	Round 8 TC-ex	Round 9 BC-ex	Round 10 RSC-ex
Sessions 7–12	Round 1 TC-ex	Round 2 BC-ex	Round 3 RSC-ex	Round 4 TBR	Round 5–10 TBR-r

Fig. 1. Sequential structure of the experiment

Notes: In the games TC-ex, BC-ex, and RSC-ex, the contracts could not be chosen but were set exogenously to be a trust, bonus, and revenue-sharing contract, respectively. TBR and TBR-r represent one-shot and repeated contract choice settings, respectively.

an effort level to the agent that is not binding. Then the agent is informed about the offered contract, and decides to accept or reject the contract. If the contract is rejected, then both receive only their initial endowments of 3,000 ECUs. If the agent accepts the contract, he receives the fixed wage and decides on an effort level. Afterwards, both the agent and the principal are informed about their earnings.

In an exogenous bonus contract setting (BC-ex), in addition to the fixed wage and suggested effort, the principal announces the size of a non-binding bonus B, where $B \in \{0, 1, \ldots, 2{,}999, 3{,}000\}$, that she might pay to the agent if satisfied by his effort level. Afterwards, the agent is informed about the offered contract, and if the contract is accepted, he decides on an effort level. After being informed about the agent's effort level, the principal decides the bonus she wants to give to the agent, if any. Finally, both the agent and the principal are informed about their earnings.

In an exogenous revenue-sharing contract setting (RSC-ex), the principal chooses the fixed wage, suggests an effort level, and offers a share S, where $S \in \{0.00, 0.01, \ldots, 0.99, 1.00\}$ of the total (gross) revenue that will be given to the agent. Afterwards, the agent is informed about the offered contract, and if he accepts the offered contract, he decides on an effort level. Finally, both the agent and the principal are informed about their earnings.

In a one-shot trust–bonus–revenue-sharing game (TBR), there is an additional first step in which the principal can choose which of the three possible contracts to offer (i.e., the trust, the bonus or the revenue-sharing contract). After the principal has chosen contract type, she proceeds with selecting the parameters of the relevant contract and offers it to the agent, as in the previous games.

The repeated trust–bonus–revenue-sharing game (TBR-r) is identical to the TBR but is repeated for six rounds with the same co-player.

Theoretical Predictions

In the following, we derive hypotheses under two scenarios: (i) when the agent is self-interested and (ii) when the agent is inequality averse. Because the principal has a first-mover advantage, whether she is inequality averse or self-interested does not alter the theoretical predictions. Hence, in the following, we assume that the principal is narrowly self-interested.

The principal chooses between the three contracts, explained below, and makes an offer to the agent. If the agent accepts the contract, he could then choose his desired effort level. Three different contract types are available to the principals: the trust contract (TC), the bonus contract (BC), and the revenue-sharing contract (RSC). The agent's gross profits in the cases of a TC, BC, and RSC are respectively defined as $\pi^{\mathrm{A}}_{\mathrm{TC}} = F$, $\pi^{\mathrm{A}}_{\mathrm{BC}} = F + B$, and $\pi^{\mathrm{A}}_{\mathrm{RSC}} = F + S \cdot R(e)$.

For all three contract types, a narrowly self-interested agent will only accept a contract if he is at least not worse off by accepting it. Hence, the agent's participation constraint can be written as $T(e) - C(e) \geq 0$, where $T(e)$ is the transfer the principal needs to provide to the agent as compensation for exerting effort at a cost $C(e)$. As the principal wishes to minimize the transfer to induce participation, she will set it just large enough to make the agent participate in the contract (i.e., at the point where $T(e) = C(e)$). The principal's profit is defined as $\pi^{\mathrm{P}} = R(e) - T(e)$, where $R(e)$ is the total revenue generated and $T(e)$ is the transfer to the agent. Given the revenue and cost functions introduced above, maximizing the principal's profit with respect to e results in $e = 74.5$. The experimental parameters only allow $e \in \{0, 1, \ldots, 19, 20\}$, and so this maximization problem has a corner solution of $e^* = 20$.[5]

Having identified the participation constraint and the profit-maximizing effort level, the following step is to show why, given the assumption that both the principal and the agent are rational and narrowly self-interested, the only contract that can satisfy the incentive compatibility constraint is the RSC.[6]

Replacing $T(e)$ with the revenue-sharing contract's specific transfer of $T_{\mathrm{RSC}} = F + S \cdot 150e$ results in the incentive compatibility constraint: $\forall e : F + S \cdot 150e^* - e^* - e^{*2} \geq F + S \cdot 150e - e - e^2$. Given that the agent would exert an effort greater than zero if $\pi^{\mathrm{A}}(e^*) \geq \pi^{\mathrm{A}}(e)$ is satisfied, the agent would, as a worst case, accept $\pi^{\mathrm{A}}(e^*) = \pi^{\mathrm{A}}(e)$. Maximizing the agent's profit $\pi^{\mathrm{A}}_{\mathrm{RSC}} = F + S \cdot 150e^* - e^* - e^{*2}$ with respect to e^*, inserting the optimal effort level $e^* = 20$ and solving for S, results in $S = 0.273$ (i.e., narrowly self-interested agents would react with $e^* = 20$ to any share $S \geq 0.27$). Hence, the principal will set $S = 0.27$ and $F = 0$.

In a trust contract, the principal offers the agent an unconditional fixed wage F and suggests that the agent provides an effort level e^{s}. However, if the agent accepts this offer, the suggested effort level e^{s} cannot be enforced by the principal. Consequently, the principal's monetary payoff resulting from a trust contract $TC(F, e^{\mathrm{s}})$ is defined as $R(e) - F$, whereas the agent earns $F - C(e)$. Under the assumption of self-interest, the principal will never offer a positive fixed wage and the agent will never exert any effort.

In a bonus contract, the principal offers a fixed wage F and suggests an effort level e^{s}. However, unlike the TC, the principal also announces the payment of a bonus $B \in \{0, 1, \ldots, 2{,}999, 3{,}000\}$ if the agent delivers the suggested effort level. After the agent's effort choice, the principal has

[5] The decision to have a corner solution has been made deliberately, expecting that it will be easier for subjects in the role of principals to identify e^* if that is a corner rather than an interior point. In other words, the choice for a corner solution was made to reduce complexity.

[6] This assumes that both principals and agents are payoff maximizers.

the opportunity to pay the agent a voluntary bonus in addition to the fixed wage F. Neither the agent's effort level e nor the principal's bonus payment B are enforceable. In addition, the principal is not restricted by the initially announced bonus (i.e., she can pay a bonus smaller than, equal to, or larger than the one initially announced). Similar to the above, if both principal and agent are self-interested, then the principal will never pay a fixed wage or bonus, and the agent will always choose an effort level of zero.

Now we discuss inequity-averse agents. In this paper, we understand inequity-averse agents to have a utility function as defined in Fehr and Schmidt (1999). Note that this utility function defines an agent's utility

$$U^{\mathrm{A}} = \pi^{\mathrm{A}} - \alpha \cdot \max\left(\pi^{\mathrm{P}} - \pi^{\mathrm{A}}, 0\right) - \beta \cdot \max\left(\pi^{\mathrm{A}} - \pi^{\mathrm{P}}, 0\right), \tag{1}$$

where π^{A} and π^{P} denote the monetary payoffs for agents and principals, respectively. The parameters α and β describe the degree to which the agent dislikes being worse off and better off than the principal, respectively.

For revenue-sharing contracts, if the agent cares not only about his own income but also about the principal's income, then the participation threshold for the share of 0.27 shifts upwards. Considering that both principals and agents would receive their endowments of 3,000 ECUs if no contract was formed, an agent would accept a contract and exert an effort greater than zero only if $U^{\mathrm{A}}[\pi^{\mathrm{A}}(e=1), \pi^{\mathrm{P}}(e=1)] > U^{\mathrm{A}}(\pi^{\mathrm{A}} = 3{,}000,\ \pi^{\mathrm{P}} = 3{,}000)$. Because $\pi^{\mathrm{A}}_{\mathrm{RSC}} = F + S \cdot 150e - e - e^2$ and $\pi^{\mathrm{P}}_{\mathrm{RSC}} = 150e - F - S \cdot 150e$, we can rewrite the agent's utility as $U^{\mathrm{A}}_{\mathrm{RSC}} = F + S \cdot 150e - e - e^2 - \alpha[150e - F - S \cdot 150e - (F + S \cdot 150e - e - e^2)]$, with

$$\begin{aligned} FOC &: e = \frac{(300\alpha + 150)S - 1 - 151\alpha}{2\alpha + 2} \\ SOC &: -2\alpha - 2 < 0\ \forall \alpha > -1. \end{aligned} \tag{2}$$

Substituting the envy parameter $\alpha = 1$, we obtain the simpler first-order condition (FOC) $e = (450S - 152)/4$.[7] The participation constraint is satisfied if $e \geq 1$, which is the case for all shares $S \geq 0.343$. Thus, if principals make offers to inequity-averse agents, the minimum offered share that they can expect to be accepted, and that consequently results in $e > 0$, is 0.343.[8] By calculating S for $e = 20$ in the FOC above, we find that a principal,

[7] For example, Blanco *et al.* (2011) estimate the parameter to be $\alpha = 0.93$, $\beta = 0.38$, which is very close to Fehr and Schmidt (1999), whose parameter distributions used means of $\alpha = 0.85$, $\beta = 0.32$.

[8] Note that a Fehr–Schmidt utility function is non-differentiable at $\pi^{\mathrm{P}} = \pi^{\mathrm{A}}$. For finding the participation constraint, we only consider the case of $\pi^{\mathrm{P}} > \pi^{\mathrm{A}}$ as the payoff-maximizing principal will always earn more than the inequity-averse agent by choosing the contract parameters accordingly.

in order to ensure that the agent exerts an effort of $e = 20$, should set the offered share to $S \geq 0.52$. Because the principal's payoff linearly increases in $e \forall S < 1$, the principal's payoff is also maximized by $e = 20$, even if the agent is inequality averse.[9]

For trust contracts, it is obvious that a payoff-maximizing agent should respond with $e = 0$ to the fixed wage F. However, if the agent is inequality averse, this behavior of complete agent inactivity is no longer optimal – for either the principal or the agent – and there is scope for Pareto improvement. Because the agent is inequality averse (and thus dislikes earning less and also, to a lesser extent, earning more than the principal), the agent will not free-ride on any positive fixed wage, but will choose his effort level according to any positive F. The principal anticipates this behavior by choosing F such that the agent's effort choice maximizes the principal's payoff. Thus,[10]

$$F = \frac{(149\beta + 151\alpha + 2)e - 150\beta + (\alpha + \beta)e^2}{2\alpha + 2\beta}. \tag{3}$$

Substituting $\alpha = 1, \beta = 0.35$, and (as it makes the payoff-maximizing principal always best off) $e = 20$ results in the optimal offer: $F = 1{,}701$.

For bonus contracts, similarly to trust contracts, if the agent is inequity averse, a self-interested principal would pay a fixed wage of 1,701 ECUs and the agent will best respond with an effort of 20. Furthermore, the principal will not pay a bonus (i.e., $B = 0$).

Regarding the choice between trust and bonus contracts, using a bonus contract allows the principal to reduce the risk she faces from a shirking agent (Fehr *et al.*, 2007), for instance by paying half now and half after effort is observed. Consequently, principals might prefer bonus contracts to trust contracts. A complementary intuition stems from the fact that the TC is a subset of the BC; that is, a principal could always choose the BC and pay solely a fixed wage. Therefore, choosing the BC provides greater flexibility for the principal.

[9] In Online Appendix A, we also discuss predictions under the assumption of inequity-averse agents using a utility function as proposed by Charness and Rabin (2002). The resulting predictions are qualitatively similar to the ones under a Fehr and Schmidt (1999) utility function, and they are robust against a generous variation of the parameters reported in Charness and Rabin (2002).

[10] This value of F indicates the threshold that makes agents indifferent between exerting e or $e - 1 \; \forall e \geq 1$. It takes into account that agents dislike not only being worse off than principals, but also being better off than principals. It also follows that inequity-averse agents will accept any trust contract and produce $e > 0$ for all $F \geq 58$. Thus, in contrast to pure payoff-maximizing agents where trust and bonus contracts can never satisfy the participation constraint, both contracts can satisfy it for inequity-averse agents.

Hypotheses

Here we provide a summary of the theoretical predictions for each of the three contracts, under the assumptions of (i) both principal and agent are self-interested, and (ii) the principal is self-interested but the agent is inequity averse. Under the assumption of self-interest, the revenue-sharing contract is the only contract that can be devised in an incentive compatible manner. In the one-shot bonus or trust contracts, there is a zero fixed wage, zero effort, and (in the case of the bonus contract) a zero bonus. Conversely, by choosing a suitable revenue share for the agent, the agent puts in more effort, and both principal and agent earn higher profits. In addition, even if the agent is inequity averse, the revenue-sharing contract remains the most suitable choice for the principal. Consequently, we expect the following.

Hypothesis 1. *Principals prefer the revenue-sharing contract over the bonus or trust contracts.*

Hypothesis 2. *Agents provide more effort, and therefore the revenue will be higher, in revenue-sharing contracts than in bonus or trust contracts.*

Hypothesis 3. *In bonus contracts, principals will not meet their announced bonus payments (if any).*

Hypothesis 4. *In revenue-sharing contracts, principals offer incentive-compatible contracts, and specifically the lowest feasible incentive-compatible share of 0.27.*

Under rational self-interest, we should observe a 60 : 40 split of the profits in favor of the principal. However, it is possible that distributional fairness might come into play and, if so, we might find a more equal distribution than the profit-maximizing prediction.

Hypothesis 5. *In revenue-sharing contracts, under the assumption of rational self-interested agents, the overall profits are distributed in a ratio of* 60 : 40 *between principals and agents – to the disadvantage of the latter.*

Experimental Sequence

Subjects read the instructions and then filled out a short questionnaire for the purpose of checking their understanding; explanations of any incorrect answer were provided by the software. The three practice games, identical to the TC-ex, BC-ex, and RSC-ex games, were played to help the subjects familiarize themselves with the experiment. The participants could ask questions at the end of each practice round.

The 10 payoff-relevant rounds were then played, consisting of one round of TC-ex, BC-ex, RSC-ex, and TBR each, plus a TBR-r game of six

Table 1. *Theoretical predictions*

	Fixed wage (ECUs)	Bonus	Share	π_P (ECUs)	π_A (ECUs)	U_P	U_A
Both principal and agent are self-interested							
Revenue-sharing contract	0	–	0.27	5,190	3,390	5,190	3,390
Bonus contract	0	0	–	3,000	3,000	3,000	3,000
Trust contract	0	–	–	3,000	3,000	3,000	3,000
Principal is self-interested and agent is inequity averse							
Revenue-sharing contract	0	–	0.52	4,440	4,140	4,440	3,840
Bonus contract	1,701	0	–	4,299	4,281	4,299[a]	4,263
Trust contract	1,701	–	–	4,299	4,281	4,299[a]	4,263

[a]If, in addition to the agent, the principal also had inequity-averse preferences, these utility values would change to 4,293 (for both the BC and the TC), and yet the optimal contracts remain unchanged.

Notes: This table summarizes the theoretical predictions for each of the three contracts under the assumption of narrow self-interest and inequity-averse preferences, using a utility function as in Fehr and Schmidt (1999). For the RSC under narrow self-interest, this results in a 60 : 40 split in favor of the principal (i.e., [5190/(5190 + 3390)]/[3390/(5190 + 3390)]).

rounds. The order of games was counterbalanced, as indicated in Figure 1. At the end of the experiment, each participant was paid anonymously. All participants were informed at the start of the experiment that a random lottery payment mechanism would be used to determine payments (i.e., one of the 10 payoff-relevant rounds was randomly chosen and the participants were paid according to their performance in the randomly selected round).[11] The ECUs earned in the randomly selected round were converted into pounds at the rate of £0.004 per ECU. A total of 144 students from the University of East Anglia were recruited for the experiment via ORSEE (Greiner, 2004). The experiment lasted approximately one hour and 30 minutes and participants earned on average £15.46.

III. Results

A total of 144 subjects participated in the experiment, which was conducted at the Centre for Behavioural and Experimental Social Science (CBESS) at the University of East Anglia. In the following subsections, we consider the contract choice by the principal, the corresponding effort by the agents, whether the principals honored their bonus promises when a bonus contract was selected, and what the data tell us about efficiency and fairness.[12]

[11] The random lottery system is a standard mechanism employed in the experimental methodology to control for wealth effects while not distorting the marginal incentives in each task; for a methodological discussion, see Cubitt *et al.* (1998).

[12] For a detailed summary of descriptive statistics, see Table C1 in the Online Appendix.

Table 2. *Percentages of chosen contracts*

	TBR	TBR-r
TC	4.17%	4.40%
BC	20.83%	20.83%
RSC	75.00%	74.77%

Notes: All differences between contract types are highly significant in Wilcoxon tests (all $p < 0.01$ for both TBR and TBR-r). Specifically, TC versus RSC, $p < 0.001$ for TBR and TBR-r; BC versus RSC, $p < 0.001$ for TBR and TBR-r; TC versus BC, $p = 0.007$ for TBR and $p < 0.001$ for TBR-r.

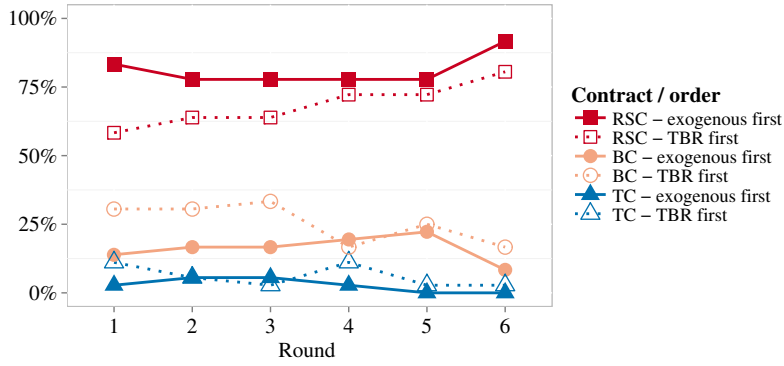

Fig. 2. Percentage of chosen contracts over time in repeated contract choice settings (TBR-r) [Colour figure can be viewed at wileyonlinelibrary.com]

Notes: TC, BC, and RSC indicate the trust, bonus and revenue-sharing contracts, respectively. The lines labeled "TBR first" only contain observations from subjects who first were confronted with the games TBR and TBR-r before playing games with exogenously imposed contracts (TC-ex, BC-ex, and RSC-ex). Conversely, "exogenous first" indicates that subjects first faced exogenously imposed contracts before giving the principals the choice over contract types (see Figure 1 for a description of both orders). If participants were exposed to the exogenous contract settings before making decisions in TBR and TBR-r games, then they were significantly more likely to choose RSC and less likely to choose BC, once they were offered the choice to do so (Wilcoxon tests $p = 0.020$, $p = 0.001$, and $p < 0.001$ for TC, BC, and RSC, respectively). However, in terms of revealed effort levels, we find no order effect for all three contract types (Wilcoxon tests $p = 0.069$, $p = 0.763$, and $p = 0.362$ for TC, BC, and RSC choices in all TBR-r rounds, respectively).

Contract Choice

In this subsection, we consider the choice of contract by the principals.

Result 1. *When given the option to choose between the three contracts, both in the one-shot (TBR) and the repeated games (TBR-r), three choices out of four were in favour of the revenue-sharing contract (RSC). The bonus contract (BC) was preferred to the trust contract (TC).*

Table 2 presents the percentage of chosen contracts in the TBR and TBR-r treatments, and Figure 2 shows how the proportions evolve over time in the TBR-r. More generally, in line with Hypothesis 1, the revenue-sharing

contract was the most preferred contract by principals, being selected 75 percent of the time, against 21 and 4 percent of choices for the bonus contract and the trust contract, respectively. These differences are all significant in Wilcoxon tests.[13] Table 2 also shows that the distribution of choices is virtually indistinguishable between TBR and TBR-r.

As participants in the TBR-r games repeatedly made choices about contracts and contract parameters (principals), accepting or rejecting contracts and setting effort levels (agents), we also analyzed behavioral changes over time. As shown in Figure 2, there is an upward trend in choice of the RSC in the TBR-r from, in aggregate, 71 percent in the first round to 86 percent in the last round. A multilevel Probit regression with subjects nested in sessions on the likelihood of choosing the RSC confirms the statistically significant positive time trend ($p < 0.001$). Furthermore, if participants were exposed to the exogenous contract settings before making decisions in TBR and TBR-r games (in sessions 1–6), they were significantly more likely to choose RSC and less likely to choose BC, once they were offered the choice to do so. It seems that principals learned about the advantages of the RSC in the exogenous contract settings and were happy to choose it, on average, over 81 percent of the time, as opposed to 66 percent of the time when they were not forced to use all contracts once before selecting their contract of choice (see Figure 2). However, in terms of revealed effort levels, we find no significant evidence for an order effect for all three contract types. This is confirmed by regression analysis (see Table 4). Figure 3 indicates which contract parameters principals chose for each of the available contracts. In contracts with more than one parameter (i.e., BC and RSC), the contract parameters were negatively correlated. This suggests that they were used as complements (i.e., principals traded off the offered fixed wage against the announced bonus and the revenue share in BC and RSC, respectively).

Table 3 shows that a large majority of the principals earned less by switching from the RSC to either TC or BC, and while half of the agents earned more from the principal switch from RSC to BC, none did so from the switch to RSC to TC. Online Appendix D provides details on the contract parameters chosen by principals (separated by game), and Online Appendix E provides details on the evolution of contract choices over time.

Effort Levels

In this subsection, we consider the choice of effort by agents.

[13] In this paper, all non-parametric test statistics were calculated on session-level means per game (TC-ex, BC-ex, RSC-ex, TBR, or TBR-r), unless stated otherwise. All p-values in the paper are two-tailed unless otherwise specified.

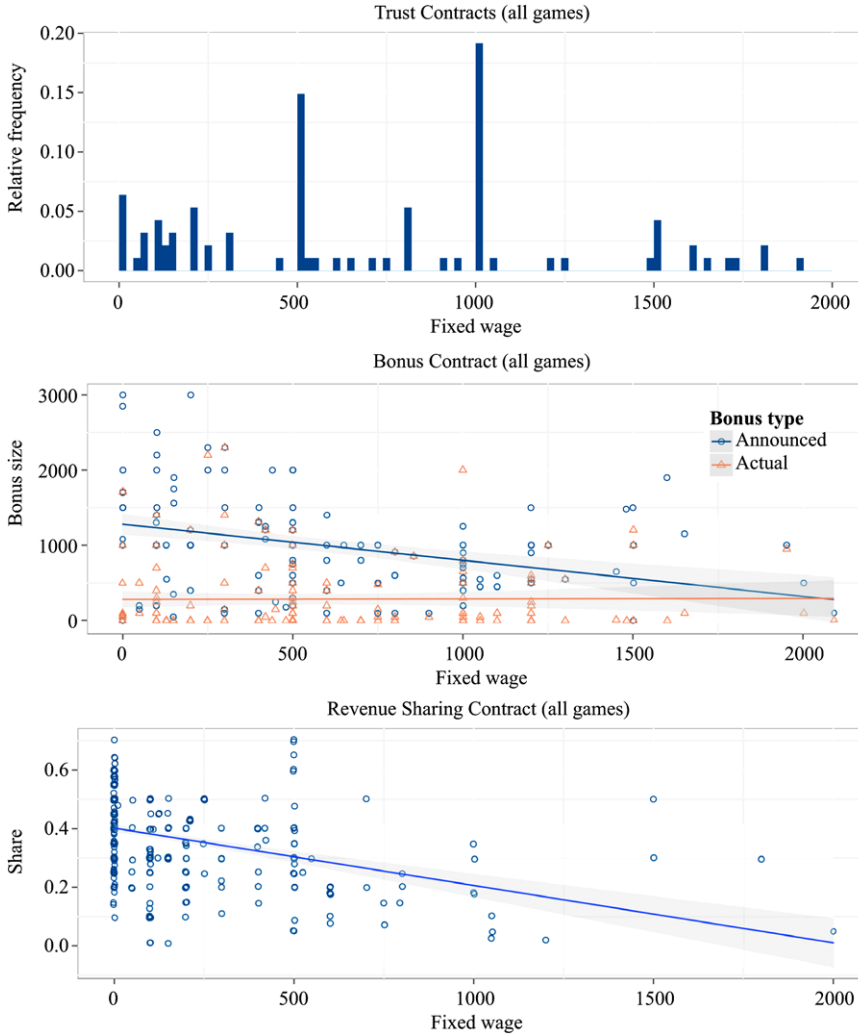

Fig. 3. Visualization of contract parameters chosen by the principal [Colour figure can be viewed at wileyonlinelibrary.com]

Notes: The top panel presents a histogram of fixed-wage offers for all TCs. The middle panel depicts a scatterplot of the announced bonuses (circles) and actual bonuses (triangles) against the corresponding fixed wages for all BCs. The announced bonuses are strongly negatively correlated with the fixed-wage offers (Spearman: $\rho = -0.393$, $p < 0.001$). However, there is a much weaker and even positive correlation between the bonuses actually paid and the offered fixed wages (Spearman: $\rho = 0.105$, $p = 0.049$). The bottom panel shows a scatterplot of the offered shares against the fixed wage in all RSCs. The negative correlation between share and fixed wage (Spearman: $\rho = -0.431$) is highly significant ($p < 0.001$). The gray areas in the middle and bottom panels represent 95 percent confidence intervals.

Table 3. *Proportion of switches between contracts that resulted in improved outcomes*

			Higher individual profits		Higher total revenue of principal–agent pair
			Principal	Agent	
TC	→	BC	50.0%	50.0%	75.0%
TC	→	RSC	77.8%	55.6%	88.9%
BC	→	TC	60.0%	20.0%	20.0%
BC	→	RSC	72.7%	69.7%	63.6%
RSC	→	TC	25.0%	0.0%	0.0%
RSC	→	BC	34.6%	50.0%	26.9%

Notes: This table is based on data from rounds 2–6 of TBR-r games. Only contract switches were considered (i.e., if principals chose a different contract in round $t-1$ than in round t). The differences in the principals' profits are highly significant for both switching from TC to RSC and from BC to RSC (Wilcoxon tests $p = 0.013$ and $p = 0.005$, respectively). Although switching to the RSC from either TC or BC also made at least 55.6 percent of agents better off, the average increase in agents' profits is not significant ($p = 0.450$ and $p = 0.672$ for TC → RSC and BC → RSC, respectively).

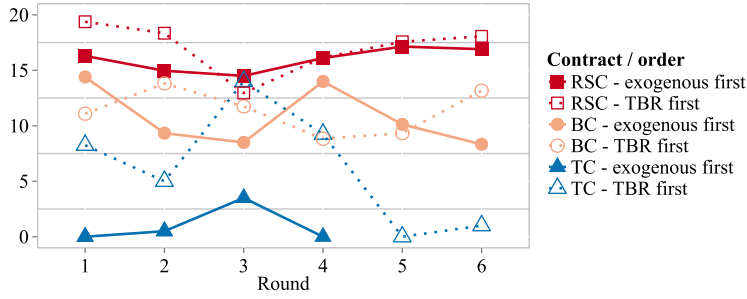

Fig. 4. Average effort by contract type over time in repeated contract choice settings (TBR-r) [Colour figure can be viewed at wileyonlinelibrary.com]

Notes: TC, BC, and RSC indicate the trust, bonus and revenue-sharing contracts, respectively. The lines labeled "TBR first" only contain observations from subjects who first were confronted with the games TBR and TBR-r before playing games with exogenously imposed contracts (TC-ex, BC-ex, and RSC-ex). Conversely, "exogenous first" indicates that subjects first faced exogenously imposed contracts before giving the principals the choice over contract types (see Figure 1 for a description of both orders). Note that in the condition "TC-exogenous first" not a single principal chose TC in rounds 5 or 6 (hence these observations are missing from the figure).

Result 2. *Effort levels were, on average, 60 percent higher in revenue-sharing contracts relative to bonus contracts. Effort levels were 50 percent higher when a bonus contract was used than a trust contract.*

The average effort level across all games under revenue-sharing, bonus, and trust contracts are 16.18, 10.06, and 4.9, respectively. Figure 4 illustrates the average effort over time and Table 4 presents regressions with agents' effort as the dependent variable. In line with Hypothesis 2, the

Table 4. *Determinants of agents' effort for accepted contracts*

	All (1)	All (2)	RSC only (3)	BC only (4)
BC	3.951*** (0.889)	8.711*** (1.761)		
RSC	9.015*** (1.034)	13.38*** (1.417)		
Suggested effort	0.489*** (0.0884)	0.0454 (0.0931)	0.397 (0.218)	0.245 (0.143)
Fixed wage	−0.0000241 (0.000838)	0.00481*** (0.00129)	−0.000246 (0.00118)	0.00347* (0.00145)
Exogenous contract	−1.449 (1.007)	0.895 (2.043)	−1.223 (1.099)	−2.801 (1.795)
Game TBR	−0.812 (0.865)	−1.889 (2.093)	−1.007 (0.818)	−3.367 (2.899)
Overall round	−0.0388 (0.115)	−0.0469 (0.113)	−0.0872 (0.117)	−0.107 (0.226)
Round within game TBR-r	−0.0455 (0.156)	−0.0441 (0.154)	−0.0767 (0.159)	−0.245 (0.408)
BC × fixed wage		−0.00328 (0.00213)		
BC × suggested effort		0.468** (0.154)		
RSC × fixed wage		−0.00743*** (0.00161)		
RSC × suggested effort		0.762*** (0.221)		
Exogenous contract × BC		−3.466 (2.221)		
Exogenous contract × RSC		−1.884 (2.097)		
Game TBR × BC		−0.736 (3.175)		
Game TBR × RSC		1.413 (1.961)		
Share			7.931*** (2.281)	
Incentive compatible share			3.000* (1.150)	
Announced bonus				0.00503*** (0.000960)
Constant	8.205*** (0.896)	3.270* (1.555)	15.71*** (0.768)	8.421*** (1.481)
Observations	656	656	418	155
Adjusted R^2	0.376	0.402	0.237	0.176

Notes: The baseline condition for the estimations in Columns 1 and 2 was TC in the game TBR-r. Columns 3 and 4 were estimated using only RSC and BC observations, respectively. The table contains coefficients of linear regressions with standard errors clustered at subject level in parentheses. All variables that were interacted with BC or RSC (i.e., fixed wage, announced bonus, suggested effort, share, incentive compatible share, exogenous contract, and exogenous games first) were subtracted from their means before estimating the models. Tables C5 and C6 in the Online Appendix contain the results of multilevel models (to additionally control for session level non-independence) and tobit regressions (to control for data censoring at 0 and 20), respectively. These results are very close to those presented here (both qualitatively and quantitatively). BC and RSC are dummies for the bonus and the revenue-sharing contract, respectively. TBR and TBR-r indicate one-shot and repeated games with endogenous contract choice by the principal. The dummy incentive compatible share is one if the principal offered a share ≥ 0.27, the lowest share that satisfied the incentive compatibility constraint, and zero otherwise. Exogenous contract is a dummy for TC-ex, BC-ex, and RSC-ex games, and the dummy exogenous games first control for order effects. ***, **, and * indicate statistical significance at the 0.1, 1, and 5 levels, respectively.

effort levels chosen by the agents in revenue-sharing contracts were significantly higher than in bonus or trust contracts. This is true for the overall sample and for each of the games separately (Wilcoxon $p < 0.05$). The regression coefficient on the RSC dummy is significant, implying, other things being equal, an increase in effort in revenue-sharing contracts by at least around nine points relative to the trust contract. The coefficient of the RSC dummy is also statistically significantly higher than the coefficient of the BC dummy. That is, the regression analysis confirms that the RSC results in more effort than the BC (F-test, $p < 0.001$), which itself results in more effort than TC. Effort levels were significantly higher with bonus contracts than with trust contracts. This is true for the overall sample, for the exogenously set games and for TBR-r ($p < 0.05$ for each of the tests). In TBR, the difference between bonus and trust contracts was not statistically significant, because of the very small number of observations[14] of TC ($p = 0.26$). The results in Table 4 imply that suggested effort positively affected actual effort.[15] Other contract details mattered as well: in the BC, effort increased with the size of the announced bonus; in the RSC, it increased with the revenue share offered to the agent, particularly if incentive compatible (i.e., the offered share was greater than or equal to 0.27). Overall, increasing the fixed wage significantly increased effort. However, this result is driven by trust and bonus contracts. Analyzing revenue-sharing and bonus contracts separately (see Columns 3 and 4 in Table 4) indicates that a higher fixed wage only slightly increased effort in BC, whereas it did not have any effect on effort under revenue-sharing contracts.

Honoring Bonus Payments

Result 3. *In the bonus contract, the majority of principals pay bonuses, but less than they announced to pay.*

In line with Hypothesis 3, in over 81 percent of all bonus contracts, principals did not honor their initial bonus announcements.[16] Figure 5 shows how the actual bonus payments were conditioned on revealed effort – while there was always a gap between actual and announced bonus payments, mean actual bonus payments were lowest when agents produced less than the suggested effort. In a further regression analysis (in the Online Appendix), we show that, in line with previous literature (e.g., Fehr and

[14] The number of times TC, BC, or RSC were selected in the TBR is 3, 15, and 54, respectively.

[15] Unlike actual effort, suggested effort did not change across treatments, and tended to be close to the maximum of 20 (see Table C1 in the Online Appendix).

[16] They matched it in only around 16 percent of the cases, and provided a higher bonus in fewer than 3 percent of the cases.

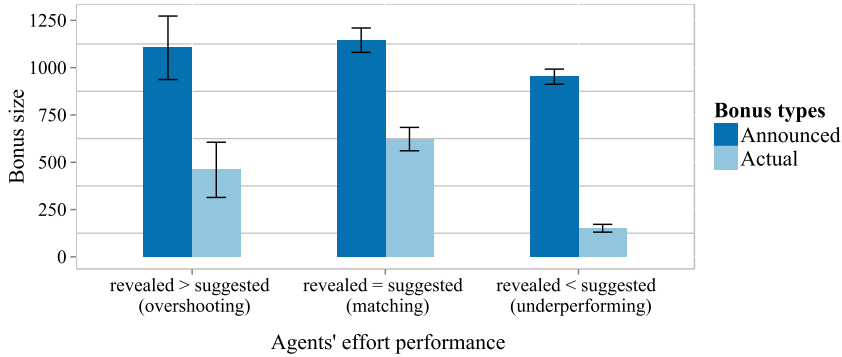

Fig. 5. Conditioning of actual bonus payments on revealed effort [Colour figure can be viewed at wileyonlinelibrary.com]

Notes: The figure shows mean actual bonus payments depending on whether the revealed effort was higher than, the same as, or lower than the suggested effort. Agents were punished with significantly lower bonus payments when they exerted less effort than suggested (Wilcoxon $p < 0.001$). Error bars denote standard errors.

Schmidt, 2000, 2004; Fehr *et al.*, 2007), in the bonus contract, the bonus actually paid was a positive function of revealed effort. Specifically, we find that each extra unit of effort led to around 34 ECUs in extra bonus.[17]

Efficiency and Fairness in Revenue-Sharing Contracts

In this subsection, we consider the extent to which revenue-sharing contracts met considerations of efficiency and fairness.

In line with Hypothesis 2, the revenue-sharing contract was the most efficient contract. The average total revenue was 2,238 ECUs in RSC-ex versus 1,302 ECUs in BC-ex and 738 ECUs in TC-ex (Wilcoxon tests, $p < 0.01$ in all cases). In the TBR, mean total revenue was 2,389, 1,420, and 200 ECUs when the revenue-sharing, bonus, and trust contracts were chosen, respectively. In the TBR-r, the corresponding values are 2,476, 1,690, and 200 ECUs for the revenue-sharing, bonus, and trust contracts, respectively. In both TBR and TBR-r, the average total revenue is highest for revenue-sharing contracts (one-sided Wilcoxon tests: TBR, RSC versus BC $p = 0.025$ and RSC versus TC, $p = 0.006$; TBR-r, RSC versus BC $p < 0.001$ and RSC versus TC $p < 0.001$). The average total revenue was not significantly different between TBR and TBR-r rounds (for all contract types, $p > 0.4$).[18] As shown by Table 3, in a majority of cases, ranging

[17] The Online Appendix (see Table C3) includes a linear regression (multilevel, mixed effects) model, estimated with random intercepts on subjects nested in sessions, in which no other variable is statistically significant.

[18] For descriptive statistics on revenues including standard errors, please see Table C4 in the Online Appendix.

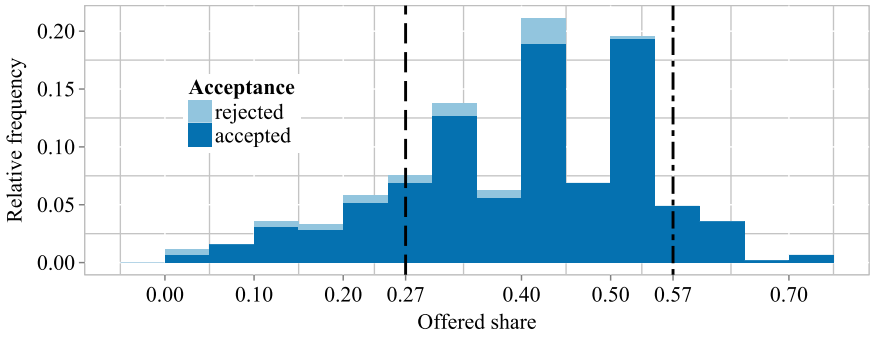

Fig. 6. Histograms of revenue shares offered by principals [Colour figure can be viewed at wileyonlinelibrary.com]

Notes: This figure includes observations of all revenue-sharing contracts, irrespective the actual setting (RSC-ex, TBR, and TBR-r). The vertical lines depict the lowest incentive-compatible share under self-interest (long-dashed line, at 0.27) and the share that results in an exact 50 : 50 split (dash-dotted line, at 0.57).

from 64 to 89 percent, depending on the combination, the total revenue of principal–agent pairs increased if the principal switched from BC or TC to RSC, and decreased in the opposite case.

Result 4. *Over 70 percent of offered revenue-sharing contracts were incentive compatible. However, offers tend to be higher than the lowest incentive compatible share of 0.27.*

Figure 6 shows the distribution of revenue shares offered and whether they were accepted or rejected by the agents. In line with Hypothesis 4, the majority of offered revenue-sharing contracts (70 percent) were incentive compatible.[19] Not a single principal chose a revenue share of exactly 0.27, the share predicted as the profit-maximizing one under narrow self-interest.[20] The mean offered share was 0.382 (median 0.4), and was not significantly different across RSC-ex, TBR, and TBR-r games (all Wilcoxon tests between games reveal $p > 0.4$). The shares actually offered were significantly higher than the lowest incentive-compatible share of 0.27, both for the full sample and for each game separately (sign tests, all $p < 0.05$). However, the offered shares were significantly lower than the inequity-averse prediction of 0.52, if 100 percent of agents are assumed to be inequity averse (sign tests, all $p < 0.001$).

Overall, about 7 percent of the revenue-sharing contracts were rejected. When the offered share was greater than or equal to 0.27, only 6 percent

[19] Specifically, 74, 83, and 78 percent of contracts offered were above 0.27 in RSC-ex, TBR, and TBR-r respectively.

[20] This is true for all RSC occurrences irrespective the game type (RSC-ex, TBR, and TBR-r). However, over 60 percent of the revenue-sharing contracts offered "round shares" (i.e., shares that had either 0 or 5 at the second decimal place).

of the contracts were rejected whereas 11 percent of offers with shares of less than 0.27 were rejected. With a fixed wage of 0, a share of 0.57 would result in an exact 50 : 50 split between principal and agent. For this reason, we divided the offered shares into three categories: the incentive-incompatible offers with $S < 0.27$; the offers that would lead to the agent earning more than an equal split $S > 0.57$; and the offers that lay in between $0.27 \leq S < 0.57$. Comparing the three areas of offered shares (i.e., $S < 0.27$, $0.27 \leq S < 0.57$, and $S \geq 0.57$), we found no statistical difference regarding the rate of rejections between the contract offers with $S < 0.27$ and $0.27 \leq S < 0.57$ (Wilcoxon $p = 1$). However, the rejection rates of contracts that offered $S \geq 0.57$ were significantly lower than for offers of either $S < 0.27$ or $0.27 \leq S < 0.57$ (Wilcoxon $p = 0.025$ and $p < 0.001$, respectively). The average rejection rates were 6 and 0 percent for $0.27 \leq S < 0.57$ and $S \geq 0.57$, respectively. In fact, the rejection rate for $S \geq 0.52$ – i.e., the predicted share for a population of 100 percent Fehr and Schmidt (1999) inequity-averse agents – was also 0 percent. The difference between rejection rates below and above 0.52 is significant (Wilcoxon $p = 0.002$).

The observed mean of offered shares of 0.382 could be explained by a number of factors. First, there is no large increase in rejection rate for offers above 0.27 and up to 0.52, and so there is reason to believe that principals might be offering a little over 0.27, not to reduce the likelihood of being rejected but rather out of fairness. This conjecture is consistent with the findings of Anderhub *et al.* (2002), which suggest that concerns for fairness Are the influential factor behind offers higher than the incentive-compatibility constraint. Second, the observed mean of 0.382 could be explained by the principals assuming that there is a distribution of the inequity-averse parameter in the population of agents who differ in the extent to which they are inequity averse.[21] Third, it is possible that offering larger shares increases the salience of the opportunity to benefit from contributing high effort levels.

Result 5. *Revenue-sharing contracts resulted in a fairer distribution of profits than the profit-maximizing prediction and this distribution is close to the prediction for inequity-averse agents. Nevertheless, welfare gains were mostly absorbed by the principals.*

[21] The goodness of fit of the model of Charness and Rabin (2002) is considered in the Online Appendix, and is inferior to that of Fehr and Schmidt (1999) for the specific set-up of this paper. It is less likely that the principals assumed a certain share of agents to be perfectly self-interested and the rest of the agents to be totally inequity averse, as this would have resulted in a binomial distribution of offered shares around 0.27 and 0.53 (depending on whether a principal believed that she was making an offer to a perfectly self-interested or entirely inequity-averse agent). However, our data do not support this interpretation (see Figure 6).

Table 5. *Predicted and observed distribution of profits resulting from revenue-sharing contracts*

		Profit	Share
Prediction			
Self-interest	Principal	5,190	60%
	Agent	3,390	40%
	Difference		20%
Inequity-averse agent	Principal	4,440	52%
	Agent	4,140	48%
	Difference		4%
Observation			
Results RSC-ex	Principal	4,206	53%
	Agent	3,741	47%
	Difference		6%
Results TBR	Principal	4,269	53%
	Agent	3,806	47%
	Difference		6%
Results TBR-r	Principal	4,359	54%
	Agent	3,786	46%
	Difference		7%

Notes: RSC-ex denotes an exogenously determined one-shot revenue-sharing contract. TBR and TBR-r represent contract choice situations in a one-shot and repeated game, respectively. Only accepted contracts are considered for the profits in the lower panel (Observation).

Because most revenue-sharing contracts have a revenue share for the agent of more than 0.27, as shown in Result 4, we would expect to observe a split that is more equal than 60–40 percent for the principal. Table 5 shows that this is indeed the case, with 53 percent going to the principal in the exogenous revenue-sharing contract (RSC-ex), 53 percent in the one-shot game selected revenue-sharing contracts (TBR), and 54 percent in the repeated game selected revenue-sharing contracts (TBR-r), percentages all significantly lower than 60 percent (Wilcoxon $p < 0.001$). We find no significant difference between RSC-ex, TBR, and TBR-r rounds (Wilcoxon $p > 0.2$). A comparison of our profit distribution with our theoretical predictions for inequity-averse agents or with empirical findings from other games suggests that a 53 : 47 or 54 : 46 split is quite close to the inequity-averse prediction of 52 : 48 (Güth *et al.*, 1982; Fehr and Schmidt, 1999).

Table 6 shows that the overall profits were higher in revenue-sharing contracts than in trust and bonus contracts. It also shows that the principals largely absorbed the surplus, earning 18 and 44 percent more in revenue-sharing contracts than in bonus and trust contracts, respectively. This higher efficiency applies across all games, and therefore explains why, when a choice was given, principals tended to choose revenue-sharing contracts.

Table 6. *Average and standard deviation of profits across contracts*

		Trust		Bonus		Revenue-sharing	
		Av. profit	SD	Av. profit	SD	Av. profit	SD
Exogenously determined	Principal	3,058 (46%)	720	3,657 (51%)	981	4,206 (53%)	757
	Agent	3,618 (54%)	500	3,505 (49%)	533	3,741 (47%)	467
	Total	6,675 (100%)	887	7,162 (100%)	1,086	7,947 (100%)	862
TBR	Principal	2,700 (44%)	173	3,582 (48%)	1,205	4,269 (53%)	577
	Agent	3,496 (56%)	3	3,663 (52%)	542	3,806 (47%)	410
	Total	6,196 (100%)	170	7,245 (100%)	1,190	8,075 (100%)	730
TBR-r	Principal	2,875 (42%)	1,076	3,733 (49%)	988	4,359 (54%)	651
	Agent	3,849 (58%)	668	3,755 (51%)	660	3,786 (46%)	428
	Total	6,725 (100%)	995	7,489 (100%)	1,136	8,145 (100%)	768

Notes: TBR and TBR-r represent contract choice situations in a one-shot and repeated game, respectively. The overall profits were significantly higher in revenue-sharing contracts than in trust contracts (Wilcoxon $p < 0.001$, $p = 0.011$, $p < 0.001$ in relation to exogenous contracts, TBR, and TBR-r, respectively) and bonus contracts (Wilcoxon $p < 0.001$, $p = 0.05$, $p < 0.001$ in relation to exogenous contracts, TBR, and TBR-r, respectively). Principals earn significantly more with revenue-sharing contracts: with respect to trust contracts, Wilcoxon $p < 0.001$, $p = 0.011$, $p < 0.001$ in relation to exogenous contracts, TBR, and TBR-r, respectively; with respect to bonus contracts, Wilcoxon $p = 0.004$, $p = 0.028$, $p < 0.001$ in relation to exogenous contracts, TBR, and TBR-r, respectively. The agents' profits are larger in RSC than in other contracts when it is exogenously imposed (BC $\leftrightarrow$ RSC, $p = 0.005$; TC $\leftrightarrow$ RSC, $p = 0.078$), but this is not the case for TBR (BC $\leftrightarrow$ RSC, $p = 0.508$; TC $\leftrightarrow$ RSC, $p = 0.036$) and TBR-r (BC $\leftrightarrow$ RSC, $p = 0.551$; TC $\leftrightarrow$ RSC, $p = 0.432$). In RSC, agents are almost no worse off: with respect to trust contracts, Wilcoxon $p = 0.078$, $p = 0.036$, and $p = 0.432$ in relation to exogenous contracts, TBR, and TBR-r, respectively; with respect to bonus contracts, Wilcoxon $p = 0.005$, $p = 0.508$, and $p = 0.551$ in relation to exogenous contracts, TBR, and TBR-r, respectively).

The agent's average profit was larger when a RSC was implemented when compared to a BC (Wilcoxon $p = 0.039$) and at least the same under TC (Wilcoxon $p = 0.089$). These differences are maintained under the exogenous contracts, but the results are not significant for TBR and TBR-r. In any case, these results suggest that the agents were at least no worse off in terms of earnings when an RSC was implemented. The share of the surpluses between principals and agents was almost the same under all three contract types, being very close to the inequity-averse prediction. In relative terms, agents were almost no worse off in revenue-sharing contracts than they were in the other contracts (3 percent relative to trust contracts and 4 percent relative to bonus contracts). In the TBR-r, switches from BC to RSC and from TC to RSC both resulted in higher profits for agents (in 56 and 70 percent of the cases, respectively; see Table 3).

IV. Discussion

In this paper, we have explored how monetary incentives and intrinsic motivation can complement each other in principal–agent settings. We asked principals to choose between using a bonus contract as in Fehr *et al.* (2007),

a revenue-sharing contract as in Anderhub *et al.* (2002), and a trust contract as a third option. In contrast to Fehr *et al.* (2007), who found that only 10 percent of the principals chose the enforceable monetarily incentivized contract, in our experiment on average over 75 percent of the principals chose such an option. Moreover, we find that revenue sharing was also more efficient than the bonus and trust contracts by leading the agents to exert 60 percent more effort in the RSC as in the BC. Consequently, more revenue was generated and, on average, both principals and agents earned more when a revenue-sharing contract was used. However, the majority of the additional output was absorbed by the principal. That being said, the distributions of profits were fairer than the theoretical predictions under self-interest and close to the inequity-averse prediction. Lastly, in line with Fehr *et al.* (2007), though on average principals reciprocated to positive effort levels with positive bonuses, some principals did not pay a bonus at all, and the majority of principals (81 percent) paid a bonus smaller than what they initially announced.

It is not surprising that principals tend to prefer the bonus contracts over the trust contracts. Bonus contracts reduce the relative risks for the principal compared to the trust contracts, by allowing them to pay a portion of the wage upfront and a portion after effort has been observed. Where the trust contract only requires a trusting principal, the bonus contract requires both players to show trust in each other. The revenue-sharing contract eliminates all risks of free-riding for both principal and agent, and this is achieved without providing negative connotations of distrust, as with a monitoring contract. We believe that these two motives might, to a great extent, explain the differences we observe between our study and that of Fehr *et al.* (2007), in which the bonus contract was the most preferred option. That said, we note that the revenue-sharing contract differs from the bonus contract, both in terms of the shape of the incentive mechanism and in terms of risk reduction. Thus, more research is clearly needed to separate out these alternative driving forces.

Our results are in line with the findings of Fehr *et al.* (2008) on the optimal allocation of property rights. In their study, two parties negotiate over the allocation of ownership rights before investing in a project. In one treatment, the two parties start with joint ownership and one of the two players (the principal) can decide to either sell her share or retain it. In another treatment, the principal is the sole owner and can either sell 50 percent of the firm (i.e., offer joint ownership) or offer a fixed wage to the second party. The majority of the principals (approximately 64 percent) preferred joint ownership, and similarly the agents responded with high investment levels. Our experiment has a different design as it provides a straight choice among a revenue-sharing contract, a fixed wage contract, and a bonus contract. There is also no restriction on the revenue share

that can be offered, making possible offer shares that are less attractive to inequity-averse agents. By providing a wider choice set and allowing revenue-sharing contracts that could be less attractive to inequity-averse agents, our experiment therefore provides a more general test of the success of revenue sharing than is provided by the settings of Fehr *et al.* (2008). An additional element of generality was that we tested our results, and found them robust to having a one-shot game set-up relative to a repeated game set-up.

It is a feature of having equal initial endowments that the difference between the payoff outcomes under equality and that under 100 percent self-interested agents is one between a 50 : 50 and 60 : 40 ratio in the revenue-sharing contract, even though the underlying behavior is one where the revenue share chosen by the principal ranges from 0.27 to 0.57. In future research, one could increase the gap between self-interested and inequity-averse predictions by suitable endowment changes as a robustness test of our results.

V. Conclusions

We have presented a simple principal–agent experiment in which the principals are allowed to choose between a revenue-sharing, a bonus, and a trust contract, to offer to an agent. Revenue-sharing contracts emerge as the contract preferred by a large number of principals when they are given this choice. They provide a "carrot" to agents, encouraging them to work more by receiving a share of the profits; this works in a way that the monitoring contract used by Fehr *et al.* (2007) does not, when offered as an alternative to bonus contracts. In other words, in incentive-compatible type of contracts, carrots appear to work better than sticks.

A key finding of our experiment is that revenue-sharing contracts have the advantage of being the most efficient form of contracts, while at the same time being fair. The distribution of earnings is only mildly skewed towards the principal. Indeed, in the repeated games, switches to revenue-sharing contracts led to Pareto improvements for a majority of both principals and agents. We conclude that under revenue-sharing contracts, concerns for fairness can be closely associated with efficiency and the use of monetary incentives.

Supporting Information

The following supporting information can be found in the online version of this article at the publisher's web site.

Online Appendix

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First version submitted September 2013;
final version received May 2016.