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Does tax evasion affect firms' internal control? Some evidence from an experimental approach

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Does tax evasion affect firms' internal control? Some evidence from an experimental approach

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Abstract

The aim of this work is to analyze tax evasion as a factor that potentially affects internal control of firms as an application of the Chen and Chu's model (2005). For this purpose an experimental approach was employed. Treatments varied depending on whether agents were assumed to be risk-neutral or risk-averse. According to the gift-exchange game (Fehr et al., 1993), results show a positive relationship between wages offered by principal and efforts provided by agents. In general, higher wages lead to more costly effort provision. However, when evasion and risk aversion are introduced in the analysis individuals show opportunistic behaviors and they seem to be less willing to cooperate for the wealth of the firm.

KEYWORDS: tax evasion, firms, reciprocity, labor market.

JEL CODES: C90, C91, H26

1. Introduction

In a recent contribution on tax-evading literature, Chen and Chu (2005) present a formal analysis of an agency dilemma in a context of corporate income tax evasion. In particular, they underline the loss of internal control and inefficiency in production generated when a principal (owner of the firm) and an agent (manager of the firm) engage in evasion[1].

The Chen-Chu model provides the following results. First, if the manager is not punishable for evasion and he does not suffer any loss of utility (by compensating him exactly with the same wage he receives when there is no tax evasion), there is not a distortion in his efforts. Therefore the principal maximizes profits and decides the level of income to be declared to the tax authorities irrespective of the output realized (and consequently of the agent's efforts). Second, the former results no longer hold when the manager becomes liable for evasion. In this case, the principal has to remunerate the agent with a risk premium (in order to compensate him for any risk involved in evasion), regardless of whether the latter is caught or not. An efficient contract should guarantee that the principal bears all the risks for the agent. However, the contract cannot be based on an illegal action and on the different states of the world related to tax evasion. This generates incompleteness and prevents an efficient sharing of risks, which in turn causes a distortion of the manager's efforts and of the incentives he receives in order to participate in tax evasion.

As noted by Joulfaian (2000, p.1) "…empirical studies of tax evasion…have generally ignored businesses and primarily focused on individual tax compliance with the personal income tax…". Therefore a contribution to this area of research is timely.

In the present article, I focus on a principal-agent relationship in a context of tax evasion. According to the Chen-Chu model, I show that when there is evasion the introduction of an inefficient sharing of risks leads to different individuals' objectives in reaching firms' profit maximization. In particular, tax evasion influences manager's effort provision. Manager's effort, in turn, determines

[1] From now on "principal" and "owner" will be used interchangeably. The same will be done for "agent" and "manager". I also refer to the principal as "she" and the manager as "he".

production. Thus, firms' decisions on output are influenced by those on tax evasion. In addition, as suggested by Chen and Chu (2005) and unlike the case of individual tax evasion, the owner of a firm can decide not to evade taxes even if positive gains are expected from the illegal action because they has to consider the costs due to the efficiency loss of internal control.

Given the difficulties in field data collection in the case of tax evasion, this issue is analyzed using an experimental approach. Laboratory experiments represent nowadays an important source of data for economists. Experiment aims are not to reproduce faithfully a formal model or reality, but to create a design able to offer an analytic explanation of a specific situation and to answer the questions that motivate the research. Usually their designs are quite simple compared to the real world, and even simpler than (relevant) formal models. In a detailed review of the possibilities and limitations of game-theoretic aspects to analyze tax evasion, Torgler (2003) notes, among other elements, that "the strength of game theory is that it makes explicit strategic aspects of social interactions" (Torgler, 2003, p.284). Therefore, although experiments can be subject to some limitations since they are based on hypothetical scenarios (consequently casting doubts on the external validity of the results), they seem to be useful to provide information about individuals' behavior in particular contexts.

The study is organized as follows. Section 2 presents the adopted methodology and a detailed description of the experimental design. Section 3 analyzes the results and provides a discussion of them. Finally, a brief concluding paragraph presents some implications of the study and suggests some themes for further research.

2. Experimental methodology and design

2.1 Method and objectives

The experiment I present in this article considers a simulated labor market and different treatments (depending on whether evasion occurs or not) in which wages are determined by a principal (owner of the firm) according to a linear remuneration scheme.[2] In particular, I analyze a benchmark situation in which there is no evasion, and two other scenarios where the principal evades taxes and receives a penalty and the agent is either 'indirectly' liable for evasion and risk-neutral or 'indirectly' liable for evasion and risk-averse. More specifically, the second and third scenarios could be that of a firm which, after being caught, faces bankruptcy. Here the agent does not directly receive a penalty from the tax authorities (as it is commonly done in the literature), but he may lose all (or part) of the incentive he would obtain after production is realized given the fact that the principal can use this income to pay her fine. These hypothetical scenarios are presented to emphasize the consequences of introducing uncertainty in the analysis.

Available studies on game theoretic models of principal-agent approach have been mainly focused on the determinants of wage and effort decisions (e.g. trust, reciprocity and fairness) in the bargaining process of agency dilemma (see, for example, Guth et al., 1998; Charness, 2004; Fehr and Schmidt, 2007). Therefore, this is the first study that addresses tax evasion as a causal attribution of different outcomes in an exchange situation. Casual attribution refers to the idea that people need to attribute responsibility for outcomes (Charness, 2004). An abundance of experiments on individuals' tax evasion shows the influence of specific elements (e.g. tax rates, audit probability and fines) on the decision to evade taxes or not[3]. Given the nature of the problem this paper wants to analyze (i.e. the distortion of manager's effort in a context of tax evasion) I assume that there is

[2] Assuming linear remuneration contracts, the manager's compensation is a function of a fixed wage component defined (*ex ante)* before production takes place, and a flexible transfer (i.e. a 'bonus') to be made (*ex post)* after production is observed (by the owner of the firm), using a certain parameter which measures the intensity of the incentive to the manager to produce the output. Linear contracts are commonly used in the 'real world' (e.g. in agriculture) and have the peculiarity of being self-enforcing since they are designed for the parties to have economic incentives to honor them under all contingencies.

[3] See, for example, Bradley (1987), Alm et al. (1993) and Alm and McKee (2000).

evasion and I place the responsibility of the outcomes to the fact that managers may be risk-averse or not (by modifying the payoff functions of the agents). In order to facilitate the analysis and on the basis of expected utility theory, I try to induce risk aversion by paying expected utility with certainty. This procedure allows excluding the influence of other factors in determining individuals' payoffs (e.g. an external audit) and focusing on the changes of manager's effort provision in different contexts. While I am not directly trying to capture information about firms' behavior towards tax evasion; the current paper contributes to this area of research by analyzing strategic aspects of social interaction in an experimental environment. As stated by Chen and Chu (2005), in fact, corporate income tax evasion is much more complicated than an individual portfolio selection problem because it involves the cooperation of more than one person. Therefore, if on the one hand, I believe that this game will reflect the prediction that kindness (i.e. effort level) is proportional to the size of the gift (i.e. the wage); on the other hand, I am expecting that, when the risk of evasion exacerbates the unequal repartition of payoffs between the economic agents, self-interested workers will provide the minimum possible effort in order to maximize their own utility and will not be willing to cooperate for the wealth of the firm by sacrificing part of their income. I analyze these aspects by defining Subgame Perfect Nash Equilibrium (SPNE) in the next section[4].

2.2 Experimental design

Participants were students recruited by posting notices at the Universities of Florence and Siena (Italy) in December 2008 and January 2009. A total of 48 subjects participated in the experiment: 24 were named 'owner' and the other 24 'manager'. Average earnings, including a 5 euros show-up fee, were 10 euros for about 60 minutes of time.[5] Instructions are available in Appendix A.

[4] A Nash equilibrium can be defined "subgame perfect" if and only if it is a Nash equilibrium in every subgames of the game. For a detailed description of SPNE, see Gibbons (1992).

[5] In particular, subjects earned in the average 11.50 euros, 10 euros, and 7.50 euros in the first, second and third treatment respectively, depending on their performance.

The experiment was run using a computer-aided game designed for this specific purpose and considering a between – subject design. There were, in general, 8 owners and 8 managers in a session with 10 periods[6]. Owners and managers all met in a room. They never met before. After a brief introduction to the experiment, roles were randomly assigned to participants. At the beginning of each session were formed eight pairs of owners and managers. When a pair was matched, partners remained the same and they were anonymous until the end of the session. Owners and managers were matched only once in order to ensure that reputation-formation[7] problems were not a concern.

The experiment was performed as follows. At the first stage owners chose an incentive coefficient (between 0 and 100 tokens[8], inclusive) which was assigned to the paired managers. Once received the incentive coefficient, each manager was asked to choose an effort level (between 0.1 and 1.0, inclusive), that appeared on the screen of the principal. All participants were allowed to calculate the payoffs obtained for each incentive coefficient/effort choice. Then, if, in the third stage, owners confirmed the offered incentive coefficient (chosen at the first stage) payoffs were calculated. On the other hand, if they changed the incentive coefficient, a new stage took place. In this case managers were called to accept (agreement) or reject (strike) the final incentive coefficient and consequently to pay the level of effort chosen at stage two[9]. The combination of incentive coefficient and effort level in each period determined monetary payoff for each pair of subjects that were cumulated at the end of the game. However, if in the final stage the manager refused the incentive coefficient offered by the paired owner, neither received any income (adding no benefits to the total payoff).

[6] This has been done in order to ensure subjects understood the game by playing it repeatedly and to consider issues of reciprocation.
[7] As suggested by Charness (2004), by avoiding re-pairings between participants in different treatments, it is excluded the possibility that a subject expect his/her choice to be a factor in a re-pairing.
[8] The "token" was the experimental currency unit (ECU). In the first treatment, experimental "tokens" were converted to euros at the rate of 60 to 1 euro (see Appendix A). The exchange rate for the second and third treatments were 50 tokens (= 1 euro) and 10 tokens (= 1 euro), respectively. Given the payoff structure the exchange rates were adjusted in order to guarantee a fair reward to students among treatments.
[9] A comparison across treatments is, therefore, allowed considering the pairs incentive coefficient/effort at stages one and two.

To summarize, the game includes three subgames. In the first one the manager chooses a level of effort (given the incentive coefficient offered by the principal). If the owner accepts (cooperate), payoffs are calculated. If she rejects (defect), a new subgame (i.e. an ultimatum game) takes place. The third one is the game itself.

Before proceeding with the experiment, the payoff functions as well as the relationship between efforts and their costs were shown to participants. They were allowed to run some practice periods without payment to ensure that they understood the payoff and the game mechanism. The outcomes were calculated according to different functions for each treatment considered. Each owner received an initial endowment of 120 tokens in each period. In all cases, the wage offered to the manager (by choosing the incentive coefficient) was subtracted by the initial endowment of the principal. When the experiment was concluded participants were paid privately. In order to make sure subjects were not influenced by ethical considerations (i.e. moral constraints), at the beginning of the game it was decided not to inform them that they were involved in an experiment on tax evasion. The same treatment was maintained throughout the entire session, although each treatment differed about the payoff-generating mechanism.

A basic framework[10] was used as a benchmark for a comparison with other two treatments in which evasion was considered.

In particular, when there was no tax evasion and both parties were risk-neutral, the monetary payoffs were calculated according to:

$$\pi_o = (120 - w) * e, \tag{1}$$

$$\pi_m = w - C(e), \tag{2}$$

[10] This framework is inspired from a study provided by Charness (2004). However, the fact that here the wage is dependent on the effort and the incentive rate (instead of being a single transfer to the manager) leads to different equilibrium predictions to that of Charness, where $w^* = 20$ and $e^* = 0.1$ (i.e. in equilibrium there minimum wage and effort are chosen).

where O represents the *owner*, M the *manager*, e denotes the manager's effort, w is the wage calculated according to the linear scheme $w = a + be$ [11], in which a is the fixed wage component equal to 20 tokens and b is the flexible wage component (defined between a minimum of 0 and a maximum of 100 tokens, inclusive),[12] and *C(e)* is the cost of effort, a function increasing in *e*. The latter is expressed by the relation:[13]

Effort	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Cost	0	1	2	4	6	8	10	12	15	18

The agent's maximization problem is thus:

$$\underset{e}{Max}\left(w - C(e)\right) \quad (3)$$

[14],

$$\text{s.t. } w = a + be. \quad (4)$$

From the first order condition $\left(\partial\pi_m / \partial e\right)$, it follows that:

$$e^* = C'(e) = b. \quad (5)$$

[11] In order to simplify the analytical treatment of the payoff functions and in contrast with what is usually done in the economic literature of principal-agent models it was decided to omit the manager's productivity, such that the incentive coefficient is given by an integer (i.e. *b*) rather than a percentage (to be multiplied for the manager's productivity). In addition, taxes were excluded from the owner's payoff, since they were not relevant for the aspects this study wants to analyze.

[12] The values of the fixed and flexible wage component were defined according to Charness (2004). In particular, he considers a wage chosen by an employer (or alternatively by an external process) that varies between 20 and 120 (inclusive) guilders (i.e. ECU). According to this, here I assume that with a minimal effort level the manager earns at least a wage of 20 ECU (if *b* = 0 and *e* = 0.1), and, when *b* reaches its maximum level (*b* = 100 tokens), with the maximum effort level (*e* = 1), the manager earns a wage of 120 ECU.

[13] This functional form was used by Fehr et al. (1998) and Charness (2004). It guarantees that effort costs are increasing in *e* and that profits are non-negative. In addition, it ensures that higher levels of effort generate greater joint income.

[14] The base-line setting assumes a continuous and differentiable cost function, which the experimental design does not have. However, this is for expositional reasons only. In particular, it can be argue that e*(b)>0 for b>10 and that e*(b) is monotonously increasing in *b* in the discrete case.

Equation (5) shows that the marginal benefits (b) are equal to the marginal costs of effort (C'(e)). This also means that e*(b) is an increasing step function. In particular, by using backward induction it is possible to show that any $b > 30$ induces full effort. Taking into account the payoff functions of the owner and considering the consequent reaction functions of the managers it can be affirmed that one possible subgame-perfect Nash equilibrium (SPNE) is actually $b^* = 30$ and $e^* = 1$. A formal proof of this is provided as follows. In the first subgame, any values included in the interval $20 \leq b < 30$ will never incentive the manager to choose the maximum level of effort (i.e. $e = 1$), since this gives him a lower payoff than that in which he chooses an effort of 0.8. Besides, for $b < 20$, the effort level that maximizes the manager's payoff is always below 0.8. Therefore, in order to induce managers to choose higher level of efforts (which in turn boosts principal's payoffs), principals will offer values of *b* such that $b \geq 30$. Depending on the strategy space (i.e. how finely *b* can be chosen) full effort can be the only subgame-perfect outcome. On the other hand, in the ultimatum game, at $e = 1$ and $b \geq 30$, manager's payoffs increase and principal's payoffs decrease. To give an example, at $b = 30$ effort of 1 leads to (Owner, Manager) monetary payoffs (70, 32), whilst at $b = 50$ effort of 1 gives the outcome (50, 52). Therefore, principals will try to decrease incentive coefficients at stage three of the experiment. This reduces agent's payoffs. However, they know that by rejecting any new proposal, they are choosing nothing rather than something. For this reason, it is more convenient to accept any offer that gives them any amount whatsoever. If principals understand this they will give managers the smallest amount possible (among those that are able to boost manager's effort) which is actually $b = 30$. According to the payoff functions, in fact, owner's return is large (low) the larger (lower) the level of efforts and the lower (higher) the incentive coefficients are. For example, at $b = 10$, effort of 0.1 gives (Owner, Manager) material payoffs (9.9, 21), and effort of 0.5 yields (47.75, 19); while at $b = 50$, effort of 0.1 gives (Owner, Manager) material payoffs (9.5, 25), and effort of 0.5 yields (37.5, 39).

When evasion was considered into the analysis and the manager was 'indirectly' punished for evasion and risk-neutral the payoffs were calculated according to:[15]

$$\pi_o = (120 - w) * e + p(be) - p(20 + M), \tag{6}$$

$$\pi_m = w - C(e) - p(be), \tag{7}$$

where w, e and $C(e)$ are defined as in the first treatment, p is the audit probability (assumed to be equal to 0,3), $p(be)$ is the flexible wage component, which is added to the principal's payoff and detracted from the manager's payoff with probability p, and the last term in the left-hand side of the owner's payoff represents the penalty faced when evasion is detected (that is given by the amount evaded, 20, plus a fine which is assumed to be M = 3*20).[16] Also in this case, backward induction reveals that one SPNE is b* = 43 and e* = 1. In other words, the subgame equilibrium predicts that in order to maximize their utility managers will provide full efforts.

Finally, when the manager was 'indirectly' liable for evasion and risk-averse the monetary payoffs were given by:

$$\pi_o = (120 - w) * e + p(be) - p(20 + M), \tag{8}$$

$$\pi_m = (1 - p)(\sqrt{w}) + p(\sqrt{a}) - C(e), \tag{9}$$

[15] Expressions (6) and (7) are obtained respectively from: $\pi_o = (1 - p)(120 - w) * e + p[(120 - w) * e + be - (20 + M)]$, and $\pi_m = (1 - p)(w - C(e)) + p(a - C(e))$.

[16] The values of the probability of being detected from the tax authorities and the fine were chosen according to previous studies on individual's tax evasion (see, for example, Bernasconi and Mittone, 2003).

where *w*, *e*, *p*, *M* and *C(e)* are defined as described in the previous treatments, and the condition (9) represents an additive function of the agent's utility of income[17] minus the disutility of his effort.

In this context, given any value of *b,* managers will have large payoffs for values of $e \leq 0.3$ and negative payoffs for any $e > 0.5$. On the other hand, principals will receive positive gains from any $b \geq 0$ and $e \geq 0.3$. Since there is not a dominant strategy to be considered as a Nash equilibrium in all the subgames, it is difficult to make any prevision about a possible SPNE. However, if psychological aspects are relevant (i.e. reciprocity[18] and fairness), I presume to find deviations from pure money maximization results in which managers always select the minimum effort level. In particular, I am expecting that for any $b \geq 0$ (and especially for large values of b), managers will provide an effort of 0.3.

Table 1 summarizes the experimental design.

Table 1: Summary of the experimental design

Treatment	**Description**	**N. of participants**
Treat1	No-evasion	16
Treat2	Evasion, manager 'indirectly' liable and risk-neutral	16
Treat3	Evasion, manager 'indirectly' liable and risk-averse	16

3. Results and discussion

Results (see Table 2) indicate that efforts provided by managers are higher in the first two treatments than in the third one (on average they are almost three times the values of efforts in

[17] The square root guarantees that the agent's utility function is increasing in income and concave (that is the agent is risk-averse).
[18] The concept of reciprocity refers to the degree to which a voluntary choice by a self-interested party induces another party to sacrifice money to help her/him.

Treat3). The increase of effort over time is higher in Treat1 (25 per cent) than in the second treatment (11.1 per cent), while the decrease of effort in Treat3 is almost 41.2 per cent. This is not surprising since in the third treatment the marginal revenue of effort is considerably lower than that in the two other treatments[19].

According to the pre-existing principal-agent games (Charness, 2004; and Fehr et al., 1998), in general all treatments suggest a positive relationship between efforts and wages obtained by choosing incentive coefficients (see Figure 1)[20]. In particular, in Treat1 and Treat2, efforts are distributed such that subjects seem not to act with the pure purpose of maximizing their own financial interest (by selecting always e = 1 for any b ≥ 30) showing, in general, a contingent willingness to cooperate for the common wealth. Although data suggest that higher incentive coefficients lead to higher efforts, they seem also to reveal a departure from the equilibrium.

According to predictions, I was expecting to find that, given an effort of 1, the incentive coefficient brackets (offered at stage three of the experiment) with the highest number of observation were (30-39) in Treat1 and (40-49) in Treat2. However, results show that these incentive coefficient brackets received respectively the 0 and 2.5 per cent of observations, while the incentive coefficient brackets with the highest number of observations were (40-49) in Treat1 and (50-59) in Treat2. Detailed results are presented in Appendix B.

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[19] This can be shown by taking into account the solutions to the manager's maximization problem. The first order condition in Treat2 gives $C'(e) = (1-p)b$, while in Treat3 it leads to $C'(e) = \frac{(1-p)b}{2\sqrt{a+be}}$.

[20] I refer to incentive coefficients offered at stage three of the experiment since they determine the final wages and payoffs. However, Table 2 suggests that similar considerations can be done for efforts and wages determined by incentive coefficients selected by owners at stage one of each treatment.

Table 2: Incentive coefficient offered by owners vs agents' effort by period

	No evasion		Manager 'indirectly' liable and risk-neutral		Manager 'indirectly' liable and risk-averse	
Period	**Effort**	**Inc. Coeff**	**Effort**	**Inc. Coeff**	**Effort**	**Inc. Coeff**
1	0.56	37.50	0.63	30.75	0.34	22.75
2	0.64	39.50	0.60	52.38	0.29	58.50
3	0.60	44.25	0.60	47.88	0.33	52.88
4	0.66	53.88	0.69	53.88	0.23	47.88
5	0.60	50.38	0.69	65.13	0.26	36.13
6	0.63	56.63	0.66	57.25	0.30	35.13
7	0.75	65.25	0.58	53.88	0.23	44.88
8	0.69	60.13	0.53	54.88	0.25	56.38
9	0.64	67.25	0.85	69.88	0.21	50.00
10	0.70	65.75	0.70	60.38	0.20	54.13
Average	**0.65**	**54.05**	**0.65**	**54.63**	**0.26**	**45.86**

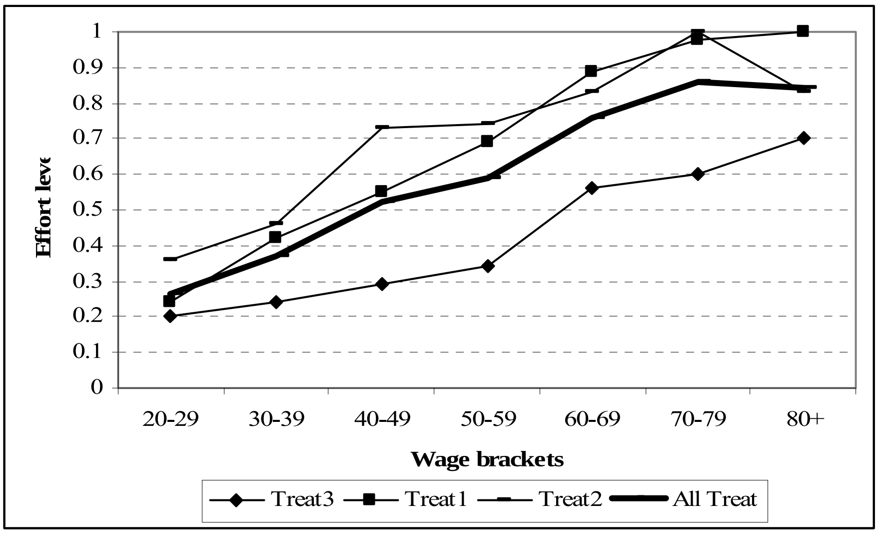
Note: the table considers average values of effort and incentive coefficient (offered at stage one of the experiment) by period in all treatments.

These findings can be explained not only by distributional models (see Bolton, 1991; Fehr and Shmidt, 1999), but also by reciprocal considerations and fairness (see Rabin, 1993).

On the one hand, as suggested by distributional models, the positive relationship between efforts and wages can be a consequence of manager's volition of avoiding greater disparities generated either by minimum or higher effort provision. On the other hand, according to the notion of reciprocal altruism, it seems that payoffs are determined taking into consideration individual kindness. In particular, it can be argued that principal's kindness affects manager's willingness to sacrifice money for the wealth of the firm, and *vice versa*. The distribution of chosen effort and offered incentive coefficient (see Appendix B) may help to clarify the above considerations. In this context, what is relevant is that principals tend to choose fair incentive coefficients even when efforts are lower than the level that maximizes their own utility. To give an example, although with and effort of 1 principals would get higher payoffs when $b < 40$ (in Treat2), at $e = 0.6$ the incentive coefficient bracket with the highest frequency is (40-49). By taking into account manager's decisions, they provide levels of $e \leq 0.5$ only when forced by low initial incentive coefficient offered by the owners. Besides, negative reciprocity (in which one player strategically tends to lower the first-mover's payoff) happens only one time in Treat1 (with the pair incentive coefficient/effort, 50/0.1) and two times in Treat2 even if in this case the low level of effort is determined by an initial offered incentive coefficient lower than the optimal value b* = 43.

In addition, if intention were irrelevant I was expecting an incentive coefficient to generate the same level of effort, regardless the causal attribution (i.e. the change of payoffs depending on the presence of tax evasion into the analysis or not). Results show, in fact, that the percentage of individuals that chose an effort of 1 for any $b \geq 50$ is respectively 10 per cent in Treat1 and 12.5 per cent in Treat2. This follows easily from the fact that in both treatments risk-neutrality assigns the same utility to a specific incentive coefficient (in contrast to what happens in Treat3). Thus, calculated wages are the same even though payoff functions differ across treatments.

<u>Figure 1: Wage brackets vs average efforts</u>



<u>Note:</u> wages are calculated using incentive coefficients offered at stage three of the experiment.

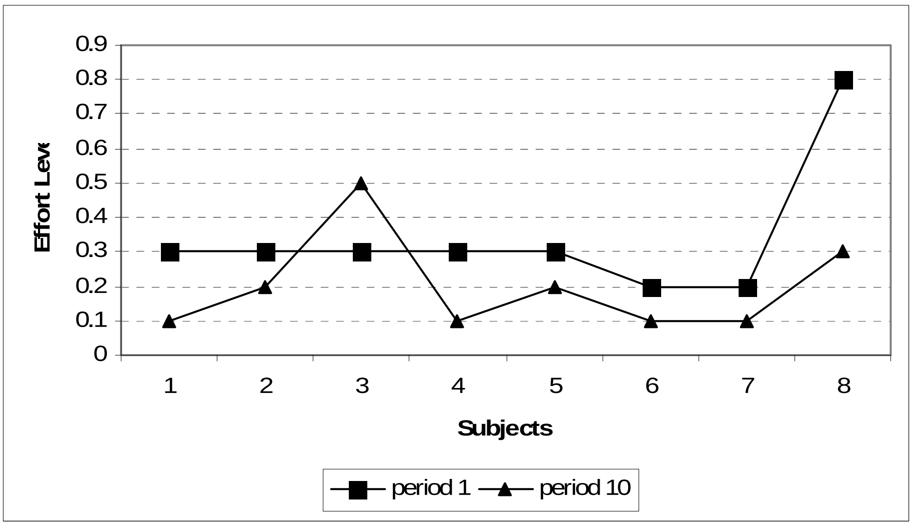
As stated in the previous section, if psychological aspects were important I predicted that in Treat3 individuals directed effort choices towards e = 0.3. However, results contradict this prediction. Specifically, the percentage of managers that chose e = 0.3 equals those who chose $e \leq 0.3$. This behavior is exacerbated through the end of the session. Efforts in period 10, in fact, are considerably lower than that in period 1 (see Figure 2). Therefore, findings suggest that when there is an unequal sharing of risks between individuals, there is a tendency to act in an opportunistic way. Examples of this can also be seen in effort's choices when incentive coefficients increase (see Appendix B): the percentage of subjects that chose $e \leq 0.3$ when $b \geq 80$ was 16.25, with respect to the 6.25 per cent of those who chose $e = 0.3$. Given all this, it is not surprising that reciprocal considerations matter more for the first two treatments than for Treat3. In particular, individuals seem to move from a fair distribution of outcomes (by choosing an effort $e = 0.3$) to a pure money-maximization situation in which managers always select the minimum effort level, and principals receive negative payoffs. As predicted by the Chen-Chu model, here agents are not acting in the interest of the firm by giving therefore support to the prediction of loss of internal control.

The experimental payoff structure confirms these conclusions. Results show that outcomes reach an equitable distribution in the first two treatments (see Table 3). This may be a consequence of the parties' risk-neutrality, providing that when individuals are risk-neutral they behave in a similar manner in alternative situations regardless of other considerations (i.e. the presence of evasion or not). By contrast, in Treat3 managers' payoffs are always higher than those of principals.

A further implication of the distribution of payoffs is that in Treat1 and Treat2 individuals are not looking for efficiency by increasing the total payoff of the group and the minimum payoff for any player (see Charness and Rabin, 2002), but choices seem to reduce inequality among subjects. To give an example, when the wage is in the range $35 \leq b \leq 43$ (in Treat2), the manager receives less than the owner of the firm. By choosing non maximum effort managers reduce the total payoffs as well as the minimum payoff but increase equality between subjects. For instance, at $b = 41$ effort of 1 leads to (Owner, Manager) monetary payoffs (47.3, 30.7), while an effort of 0.6 gives (28.62, 29.02). In this range, effort lower than the maximum level are provided 7.5 per cent (6/80) of the time. The same considerations can be done for an incentive coefficient higher than 43. In this case, manager payoffs start to increase and principal payoffs decrease. If efficiency and money maximization considerations were relevant, I was expecting that an incentive coefficient of 50 led to an effort of 1 (since this increases the total payoff). However, by choosing non maximum effort, managers tend to decrease both the total and the minimum payoffs, but they increase equality between parties. For b = 50, e = 0.9 gives (Owner, Manager) outcomes (39, 36.5), while an effort of 1 leads to (41, 37) monetary payoffs. In this range, almost the 44 per cent (35/80) of individuals chose efforts e < 1. Similar arguments arise when considering other incentive coefficient ranges in both treatments.

The results above are also strengthening by the fact that the managers reject always the contract (strike) when principals decrease strategically the amount of incentive coefficients at stage three of the experiment (which in turn increases their final payoffs by reducing managers' payoffs). This is in accordance with Fehr and Schimdt (1999) who develop the notion of self-centered inequality aversion and state that individuals generally dislike inequalities, but they care more about them when they are in a relative disadvantageous situation (i.e. they have a lower payoff if compared to others).

Figure 2: Average effort level in first and last period (Treat3)



An additional relevant aspect emerging from results (see Table 2 and Appendix C) is that the average incentive coefficients chosen by principals vary much across periods. In particular, they show a significant trend upward over time. As the average incentive coefficient chosen at stage one of the experiment tends to be always[21] above the empirically optimal incentive coefficient (as defined in previous section) almost in all treatments it can be argued that principals had a good knowledge of how agents would have reacted and understood that higher effort level would have been expected with higher incentive coefficient choices.

Table 5: Average payoffs by period

	No evasion		**Manager 'indirectly' liable and risk-neutral**		**Manager 'indirectly' liable and risk-averse**	
Period	**Principal**	**Manager**	**Principal**	**Manager**	**Principal**	**Manager**
1	35.93	35.60	30.75	27.00	2.79	2.92
2	34.99	33.14	23.75	29.24	2.95	3.40
3	39.99	39.59	15.56	22.06	5.42	3.01
4	42.62	40.53	19.30	21.20	-1.08	3.95
5	39.96	40.50	31.33	29.25	1.54	3.47
6	40.41	39.41	29.90	30.33	4.65	2.55
7	45.21	47.10	19.22	31.78	-0.72	3.90
8	38.38	37.84	18.60	25.86	1.22	3.79
9	41.16	40.73	16.39	15.48	-2.55	4.04
10	41.46	45.11	23.34	20.51	-6.62	3.82
Average	**40.01**	**39.95**	**22.81**	**25.27**	**0.76**	**3.49**

Note: the table reports the average managers' and principals' payoffs by period.

A possible concern in principal-agent experiments is represented by repeat-game effects. In particular, one explanation of costly effort provision and higher level of incentive coefficient can be that agents and principals respectively are attempting to develop a reputation. Although the design of the experiment is meant to rule out individual reputations, it could still be possible that subjects would try to develop one. This can be checked by testing for changes in subjects' choices over time

[21] The only exception is given by period 1 in Treat2, where the average incentive coefficient is lower than 43 (see Table 2 above).

(Charness, 2004). In particular, if reputation were important the level of effort and the difference between incentive coefficients offered at stage one and three of the experiment should be expected to decrease near the end of the session. Regression results are presented in Appendix D. They show that average effort decreases (by 0.013) with time in Treat3 at a statistically significant rate (at the 1 per cent level) and follows an increasing pattern in the other two treatments although it is not statistically significant for Treat2. However, the difference between incentive coefficients offered in the first and third stage of the experiment tends to increase over time in all treatments. The increase is statistically significant in Treat1 and Treat2, and to a lower extent in Treat3 (at the 10 per cent level).

According to these considerations, it seems that in Treat3 managers attempt to develop a reputation. Therefore, the presence of a substantial time trend (see Appendix C) and the comparison across regressions seem to confirm reputation effects in Treat3. These findings strengthen the conclusion that, when there is tax evasion and managers are risk-averse they are more likely to behave in an opportunistic way in order to maximize their utility. This in turn leads to negative owner's payoffs. Therefore it is possible to conclude that tax evasion decisions may have an impact on firm's production. Furthermore, according to Chen and Chu (2005) this implies that a firm which intends to engage in tax evasion needs to balance the trade-off between two relevant aspects. On the one hand, tax evasion can boost expected after-tax income. On the other hand, the firm bears both the risk of being detected from the tax authorities and the costs due to the loss of internal control. Thus, if owners act in a rational way (based on expectations on manager's behavior), they will be discouraged to evade taxes. In fact, as shown from the payoff distribution in the experiment, in many cases the costs of evasion may appear considerably higher than gains.

The argument above supports also the idea that in the presence of tax evasion, if penalties are imposed on the manager rather than on the shareholders (principals) they are more efficient in deterring tax evasion. As suggested by Crocker and Slemrod (2005), the intuition here is that when there is asymmetric information a sanction imposed on shareholders affects a Chief Financial Officer (CFO) only indirectly through the *second best* compensation contract. Consequently, a sanction that is directly applicable on the CFO appears to be more efficient in reducing tax evasion because it exacerbates the conflict (i.e. the different interests) between the principal and the manager when they participate in the illegal action.

4. Conclusions

This study considers information about individuals' strategic behavior in the context of corporate tax evasion. In particular, in order to investigate the relevance of tax evasion on the loss of internal control (i.e. the distorting effect of tax evasion on the provision of manager's effort) a laboratory experiment was conducted at the Universities of Florence and Siena (Italy).

The experiment includes three different treatments: one in which there is no evasion, and other two treatments in which there is evasion and the manager is considered either 'indirectly' liable for evasion and risk-neutral or 'indirectly' liable for evasion and risk-averse. According to previous findings in the literature (see, for example, Fehr et al., 1998; Charness, 2004), results show in general a positive relationship between effort chosen by agents and wage offered by principals. However, in the third treatment the introduction of risk aversion leads individuals to frequently act with the purpose of pure money-maximization by selecting the minimum effort. This provides evidence that when agents bear part of the risk for evasion they are less willing to cooperate for the wealth of the firm. According to this, reciprocity and fairness seem to matter more in the first two treatments. When subjects, in fact, are considered risk-neutral they try to push choices towards a fair distribution of payoffs. Results also illustrate that reputation effects seem to play a role in the third treatment giving support to the idea that, under uncertainty (generated by evasion) risk-averse individuals tend to show opportunist behavior. In addition, the fact that in the third treatment findings seem to confirm the expected predictions of loss of internal control and that in general participants with the role of 'principals' well understood the game mechanism (by frequently choosing high incentive coefficients) seem to provide evidence that the experiment was properly designed. However, since the number of observation is limited, results must be interpreted with caution. Further improvements can be made by increasing the sample size and performing additional experiments.

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Appendix A

Instructions

Welcome to this experiment!

Introduction to the experiment

This is an experiment in the economics of decision-making. The University of Siena and the University of Genoa (Italy) have provided funds to conduct this research. The instructions you are about to read are self-explanatory. A person has been chosen as the monitor, who will check that the instructions are followed as they appear here. However, he will not answer any questions during this experiment. If you have any doubts, you should read back through these instructions and go through the practice periods. At the end of this session, I will answer publicly eventual questions.

Now that the experiment has begun, I ask that you do not talk at all during this experiment. If you follow these instructions closely and make appropriate decisions, you can earn an amount of money that will be given to you in cash at the end of the experiment. In addition, each person will be given 5 Euros as a show-up fee for this experiment.

Instructions

Each of the participants will be randomly assigned to one of two groups A, B. Players A will be 'owners', players B will be 'managers.' Each player A will be anonymously randomly paired with only one player B.

You will not be told who the person you are paired with is, either during or after the experiment. The only information you will have is the decisions taken by the person to which you are paired with. Neither the monitors nor the other participants will be able to associate your choices to your name.

At the start of the experiment, each owner A will be given 120 tokens as endowment. Each manager B will not receive any endowment.

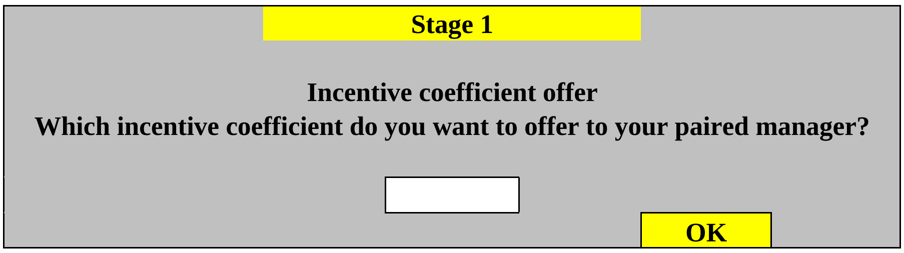
The experimental procedure is divided in four stages. At the first stage each owner A offers manager B remunerations. The remuneration scheme is given by a fixed component (20 tokens) and a flexible component obtained from the product of an incentive coefficient **c** (between 0 and 100 tokens, inclusive) and a level of effort **e** (between 0.1 and 1, inclusive), offered by the manager, such that:

$$\text{Compensation} = 20 + (c)*(e)$$

The first decision taken by the owner is, therefore, the value of the incentive coefficient **c** to offer to the paired manager. In the second stage, each manager B will determine how much she/he wants to work (quantity or amount of effort). In the third stage, owner A decides if to confirm or to modify the offered incentive coefficient at the effort chosen by the paired manager B. In the fourth and last stage, manager B decides if to accept or to reject the final incentive coefficient offered by the paired owner A. If manager B accepts, owner A and manager B obtain the income calculated according to the formula described below. If manager B rejects, owner A and manager B do not receive any income.

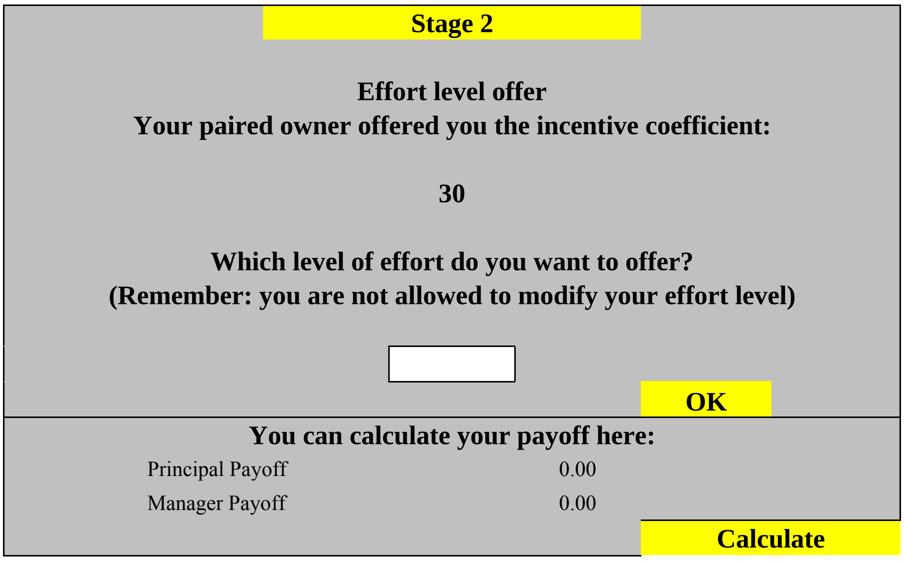
Stage 1

Each owner A will be shown the following screen (the screens below are only examples):



In this stage, each owner A offers the paired manager B an incentive coefficient by writing the amount in the box and then pressing the button **OK**.

Stage 2
Each manager B will be shown the following screen:

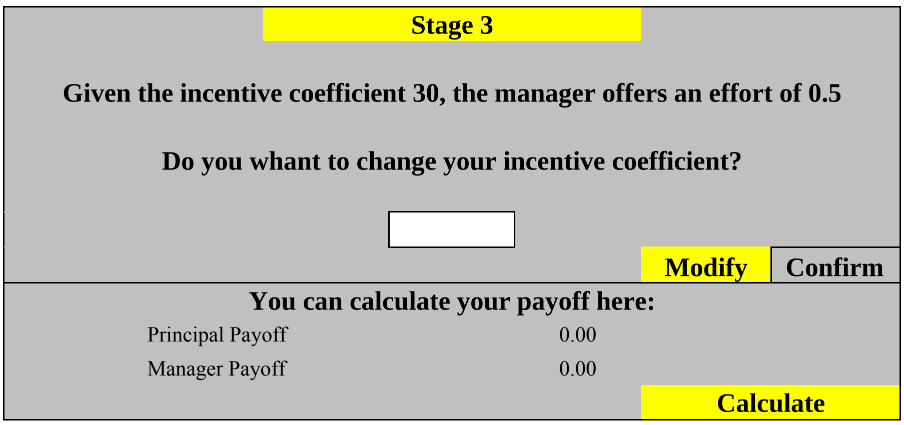


The incentive coefficient will be that offered by the paired owner A. The manager B, then, will choose the level of effort **e** (between 0.1 and 1, inclusive) that cannot be later modified and that is associated to a certain cost, **C(e)** (given in tokens), according to the following table:

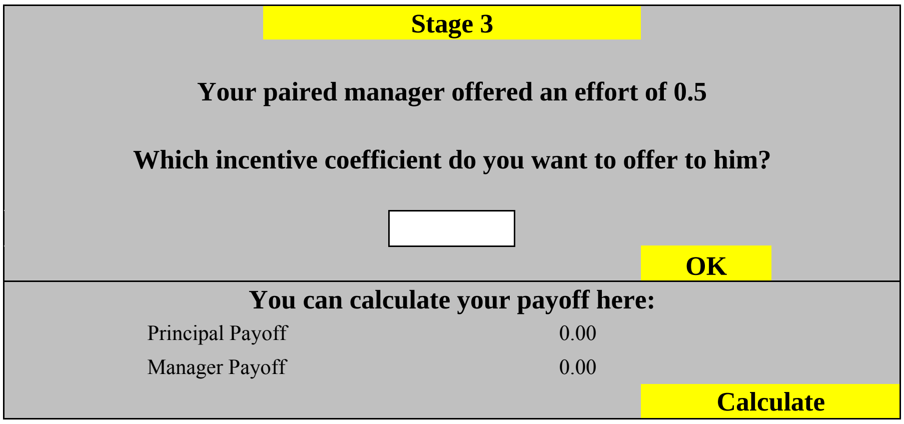
Effort level, **e**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**
Cost of effort, **C(e)**	**0**	**1**	**2**	**4**	**6**	**8**	**10**	**12**	**15**	**18**

In the lower box, the manager can press the button 'Calculate' in order to calculate the income obtained by the parties for each pair incentive coefficient/effort. After taken her/his decision, the manager B will press **OK**.

Stage 3
Each owner A will be shown the following screen:



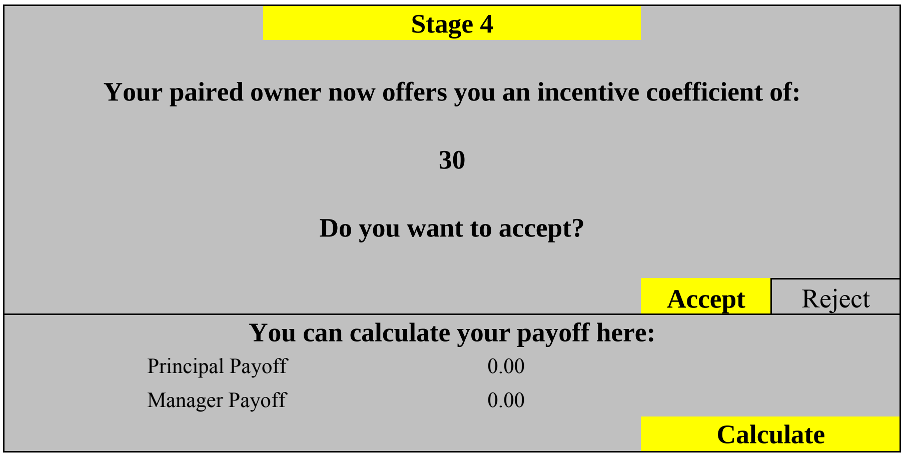
The shown effort will be that offered at Stage 2 by the paired manager B. In the lower box, each owner A can press the button ‘Calculate’ in order to calculate the income obtained for each pair incentive coefficient/effort.
If the manager A confirms the offered incentive coefficient, she/he presses the button “Confirm”.
If the manager A does not confirm the offered incentive coefficient, she/he presses the button “Modify”. In this case, the following screen will appear:



The owner A will propose a new incentive coefficient to the paired manager B, by writing it in the box and by pressing **OK**.

Stage 4

If at Stage 3 the manager A has confirmed the offered incentive coefficient, Stage 4 will not take place.
Otherwise, the manager B will be shown the following screen:



The manager B, thus, has two possible choices:
1. To accept the final incentive coefficient offered by the paired owner A and to pay the chosen level of effort, **e**. In this case, the incomes of subjects A and B will be calculated according to the following formula:[22]

Owner A’s income	=	[120 – 20 – (c)*(e)]*(e)
Manager B’s income	=	[20 + (c)*(e)] – C(e)

[22] The payoffs for Treat2 and Treat3 were calculated according to the equations (3) and (4), and (10) and (11) respectively, where **c** is replaced by *b* and the values of *p* and *M* are that described in section 5.2 of Chapter 5.

The effort related costs to managers for each level of chosen effort, which is comprised between 0.1 and 1, will be calculated according the following table:

Effort level, **e**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**	**1.0**
Cost of effort, **C(e)**	**0**	**1**	**2**	**4**	**6**	**8**	**10**	**12**	**15**	**18**

2. To reject the final offered incentive coefficient and to pay the level of effort chosen in Stage 2, without receiving any income.
Also in this screen, in the lower box each manager can calculate the income obtained by the parties for each pair incentive coefficient/effort.
After each manager B has taken his/her decision, all the participants (A and B) will be shown a screen in which the received incomes (positive or negative) are shown.
This four stage procedure will be repeated 10 times and in each repetition each of you will be paired with the same person.
Your total income for the participation in this experiment will be the sum of the earnings (positive or negative) in each of the ten periods. At the end of the experiment, tokens will be converted into euros at the rate of:[23]

60 tokens = 1 euro

Before we start the experiment, you will run through some practice periods. This will be performed as described in the instructions, except for two changes. You will not receive a prize for your actions, and you will have another opportunity for questions to the experimenter at the end of practice. You will also have some time to examine the tables and the formula.

Thank you for participating in the experiment!

[23] The exchange rate for Treat2 and Treat3 were 50 tokens (= 1 euro) and 10 tokens (= 1 euro), respectively.

Appendix B

Distribution of incentive coefficient and effort

Table B.1: Incentive coefficient/Effort pairs by Incentive Coefficient Brackets-No evasion (% Obs.)*

Inc. Coeff. bracket	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	Tot %
0-19	1.25	0	0	2.5	0	0	0	0	0	0	**3.75**
20-29	1.25	2.5	3.75	0	0	1.25	0	1.25	0	0	**10**
30-39	0	0	1.25	2.5	2.5	0	1.25	1.25	1.25	0	**10**
40-49	0	2.5	2.5	2.5	3.75	5	2.5	5	8.75	7.5	**40**
50-59	0	0	0	0	3.75	5	2.5	2.5	5	6.25	**25**
60-69	1.25	0	0	0	0	1.25	0	0	1.25	0	**3.75**
70-79	0	0	1.25	0	0	1.25	0	0	1.25	1.25	**5**
80-89	0	0	0	1.25	0	1.25	0	0	0	0	**2.5**
90-	0	0	0	0	0	0	0	0	0	0	**0**
Total %	**3.75**	**5**	**8.75**	**8.75**	**10**	**15**	**6.25**	**10**	**17.5**	**15**	**100**

Table B.2: Incentive coefficient/Effort pairs by Incentive Coefficient Bracket-Manager indirectly liable (% Obs.)

Inc. Coeff. bracket	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	Tot
0-19	0	1.25	2.5	11.25	0	0	0	0	2.5	1.25	**18.75**
20-29	0	1.25	1.25	2.5	3.75	2.5	0	0	0	2.5	**13.75**
30-39	0	0	1.25	1.25	1.25	5	0	5	0	2.5	**16.25**
40-49	0	0	0	0	0	6.25	5	7.5	3.75	2.5	**25**
50-59	1.25	0	0	0	0	1.25	2.5	2.5	0	7.5	**15**
60-69	0	0	0	0	0	0	2.5	0	0	0	**2.5**
70-79	0	0	0	0	0	0	1.25	2.5	1.25	0	**5**
80-89	0	0	0	0	0	0	0	0	0	0	**0**
90-	2.5	0	1.25	0	0	0	0	0	0	0	**3.75**
Total %	**3.75**	**2.5**	**6.25**	**15**	**5**	**15**	**11.25**	**17.5**	**7.5**	**16.25**	**100**

Table B.3: Incentive coefficient/Effort pairs by Incentive Coefficient Bracket-Manager indirectly liable and risk-averse (% Obs.)

Inc. Coeff. bracket	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	Tot %
0-19	12.5	5	3.75	0	0	0	0	0	0	0	**21.25**
20-29	1.25	2.5	11.25	1.25	0	0	0	0	0	0	**16.25**
30-39	2.5	1.25	3.75	0	0	0	0	1.25	0	0	**8.75**
40-49	0	0	2.5	0	0	0	0	0	0	0	**2.5**
50-59	1.25	1.25	8.75	0	0	0	0	0	0	0	**11.25**
60-69	0	0	3.75	0	0	0	0	1.25	0	0	**5**
70-79	0	0	3.75	0	0	0	0	0	0	0	**3.75**
80-89	1.25	1.25	1.25	3.75	1.25	0	0	0	0	0	**8.75**
90-	5	8.75	5	1.25	0	1.25	1.25	0	0	0	**22.5**
Total %	**23.75**	**20**	**43.75**	**6.25**	**1.25**	**1.25**	**1.25**	**2.5**	**0**	**0**	**100**

* *Note:* Incentive coefficients in all tables refer to those offered at stage three of the experiment.

Appendix C

Average effort and incentive coefficient by periods

Figure C.1: Average effort by periods

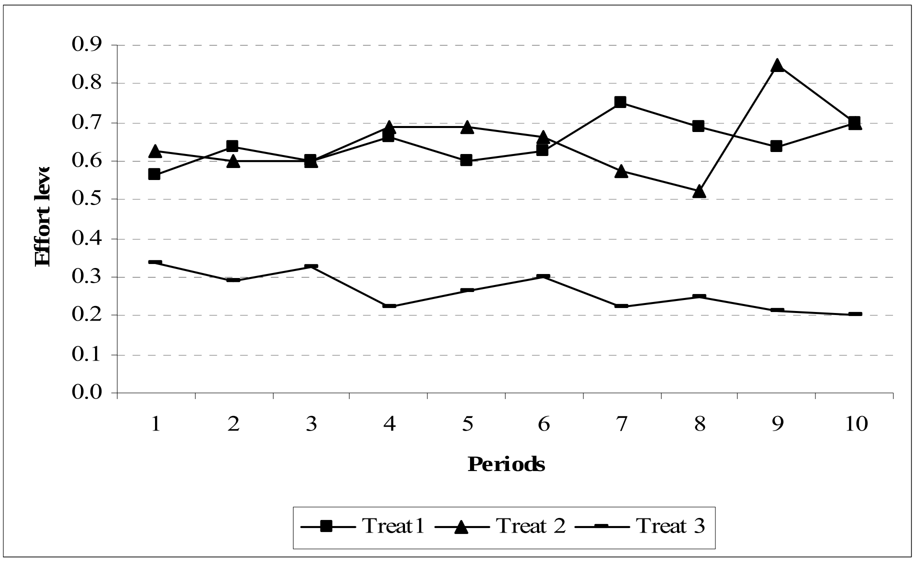
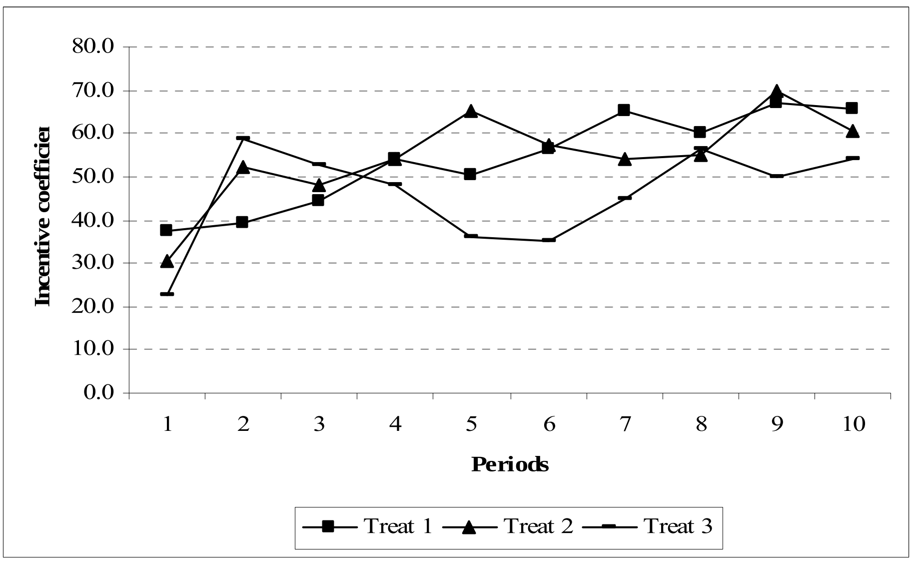


Figure C.2 Average incentive coefficients by periods



Note: average incentive coefficients refer to those offered at stage one of the experiment.

Appendix D

Reputation effect

Table D.1: OLS regression results: average effort by period

Independent variable	Effort (Dependent variable)					
	Treat1		**Treat2**		**Treat3**	
	Coefficient	t-statistics	Coefficient	t-statistics	Coefficient	t-statistics
Period	0.012**	2.51	0.01	1.04	-0.013***	-3.99
Constant	0.58***	19.25	0.59***	9.94	0.33***	16.38
F-statistics	6.29		1.09		15.92	
	(0.036)		(0.326)		(0.004)	
R-squared	0.44		0.12		0.66	
Adj R-squared	0.37		0.01		0.62	

Note: regression results using OLS in Stata. Number of observations: 10. ***significant at 1% level; ** significant at 5% level; *significant at 10% level. The table also reports the *F*-statistics, the R^2 and the Adj R^2 for the goodness of fit of the model. The p-values for the *F*-statistics are reported in parentheses.

Table D.2: Difference between incentive coefficients offered at stage one and three of the experiment

	Treat1	**Treat2**	**Treat3**
Period	**(Coeff1-Coeff2)**	**(Coeff1-Coeff2)**	**(Coeff1-Coeff2)**
1	1.38	-9.38	-10.63
2	1.00	18.00	-1.88
3	-1.88	2.63	-11.13
4	10.38	24.63	-2.75
5	1.63	28.13	-19.25
6	13.13	18.63	1.50
7	14.25	5.38	-2.63
8	16.38	25.13	1.00
9	21.25	35.88	-0.13
10	16.50	31.00	8.50

Table D.3: OLS regression results: 'Coeff1 – Coeff2' by period

Independent variable	'Coeff1 - Coeff2' (Dependent variable)					
	Treat1		**Treat2**		**Treat3**	
	Coefficient	t-statistics	Coefficient	t-statistics	Coefficient	t-statistics
Period	2.37***	5.27	3.23**	2.67	1.61*	2.23
Constant	-3.67	-1.31	0.2	0.03	-12.61**	-2.81
F-statistics	27.79		7.14		4.96	
	(0.000)		(0.028)		(0.056)	
R-squared	0.77		0.47		0.38	
Adj R-squared	0.74		0.40		0.30	

Note: regression results using OLS in Stata. Number of observations: 10. ***significant at 1% level; ** significant at 5% level; *significant at 10% level. The table also reports the *F*-statistics, the R^2 and the Adj R^2 for the goodness of fit of the model. The p-values for the *F*-statistics are reported in parentheses.

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