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OTHER-REGARDING PRINCIPAL AND MORAL HAZARD: THE SINGLE AGENT CASE

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Abstract:

Using the classic moral hazard problem with limited liability we characterize the optimal incentive contracts when first an other-regarding principal interacts with a self-regarding agent. The optimal contract differs considerably when the principal is 'inequity averse' vis-a-vis the self-regarding case. Also the agent is generally (weakly) better-off under an 'inequity averse' principal compared to a 'status seeking' principal. Then we extend our analysis and characterize the optimal contracts when both other-regarding principal and other-regarding agent interact.

Keywords: *Other regarding preferences, self regarding preferences, inequity-averse, status- seeking, optimal contract.*

JEL: D86, D63, M52.

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1. Introduction:

Standard economic theory, from its very inception, assumes that all economic participants are self-interested. This standard assumption, although is meaningful in many circumstances might not be true always. People are not always motivated by self-gain maximization; instead we often do care about others and react in fair, altruistic ways. Unfair distributions of wealth or consumption, relatively unequal payment structures do make us worried. From Guth, Schmittberger & Schwarze (1982) and their famous experiment on 'ultimatum game' to recent social experiments by Camerer (2003), various experimental evidences have proved the existence of other-regarding preferences in behavioural decision making[1]. In fact relaxing the self-regarding hypothesis is crucial for contract theory since the aim is to design appropriate incentives, and therefore people's attitude towards other's wellbeing as well as his own wellbeing is crucial for incentive design. However, so far not much work has been done to see how classical contract-theoretic predictions change in the presence of other-regarding preferences. We in this paper try to analyze how participants interact in presence of interdependent (other-regarding) preferences and how the conclusions obtained deviate from the standard case of self-interested participants. Specifically we focus on the case where there is hidden action and an other-regarding principal interacts with first a self regarding agent and then an other-regarding agent. The agent is income constrained implying that a limited liability constraint operates. We characterize the optimal contracts under various parametric cases and compare it with the standard self-regarding scenario. We see, first in the case of self-regarding agent, that the optimal contract differs considerably when the principal is inequity averse. Also the agent is

[1] For a comprehensive survey of these experimental studies see Fehr and Schmidt (2003).

generally (weakly) better-off under an ‘inequity averse’ principal compared to a ‘status seeking’ principal. Then we consider the case where an other-regarding principal interacts with an other-regarding agent. We characterize the optimal contracts and compare our results with Itoh (2004). In Itoh (2004) the principal was self regarding and there existed a unique optimal contract. Whereas, in our paper the principal is other regarding and we show that the same unique optimal contract exists for a ‘status seeking’ principal and this doesn’t necessarily hold for an inequity-averse principal. We also show that a status seeking principal is worse-off the more other regarding the agent is. An inequity-averse principal is also worse-off given that an additional condition holds. When the principal is behind and therefore always inequity-averse, she would always prefer a status seeking agent. This entire analysis is carried out in a single principal-agent framework; multiple agent case is kept for future research.

Examples of other-regarding principal can be an employer who is benevolent and cares about the welfare and income distribution of the employee vis-a-vis his own. Other examples can be the concept of ‘welfare capitalism’ where in some capitalist economies (mainly in Europe) there was (and still is) a practice of businesses providing welfare services to their employees. There are also examples of employee’s welfare cooperatives in Europe that took care of employee welfare in different dimensions[2].

[2] Recent examples of companies that have practiced welfare capitalism include Kodak, Sears, and IBM which provides retirement benefits, health care, and employee profit-sharing, permanent employment, extensive security and fringe benefits among others (See Gordon (1994) for more). One interesting example from history can be Robert Owen, a utopian socialist of the early 19th century, who introduced one of the first private systems of philanthropic welfare for his workers at the cotton mills of New Lanark. He embarked on a scheme in New Harmony, Indiana to create a model cooperative, called the New Moral World.

Quite a few recent papers have dealt with the matter of incorporating other regarding (or social) preferences into contract theory[3]. One of the earlier papers that talked about other regarding preferences and moral hazard is the paper by Itoh (2004). The paper focused mainly on the interaction between a self-regarding principal and an other-regarding agent and showed that the principal is in general worse-off the more other-regarding the agent is. Although Itoh (2004) briefly mention other-regarding principal, he doesn't analyze the other-regarding principal self-interested agent case in detail, and this paper attempts to fill that gap and show that interesting non-trivial outcomes occur in such a structure. Englmaier and Wambach (2010)[4] address optimal incentive contracts with inequity-averse agents and show that the optimal structure of the contracts does get altered. But they don't focus on other-regarding principal. Dur and Glazer (2008) use a principal-agent model to study profit-maximizing contracts when a worker envies his employer. They show that envy tightens the worker's participation constraint and calls for higher pay and/or a softer effort requirement. This paper is also an example where the agent is other-regarding whereas the principal is self-regarding whereas we focus exclusively on the case where the principal is other regarding[5].

The rest of the paper is organized as follows: In section 2 we examine the benchmark self-interested principal-agent case. In section 3 we analyze the interaction between other-regarding principal and self-regarding agent. In section 4 we analyze the case where both

[3] For a survey on this topic see Englmaier (2005).

[4] They focus on continuum of outcomes whereas we focus on discrete outcomes.

[5] Other papers like Englmaier and Leider (2008) incorporate reciprocal preferences into a moral hazard framework and derive properties of the optimal contract and implications for organizational structure. Also Hart and Moore (1998) incorporate social preferences into a contracting problem but that was done in an incomplete contracting framework.

the principal and the agent are other-regarding. Section 5 provides concluding remarks and throws some light on future works.

2. The self-interested benchmark:

We briefly analyze how players react in a standard principal-agent framework where both parties are assumed to be *self-interested* in nature. We assume both the principal and agent to be risk-neutral. The principal hires an agent for engaging in a project, where the agent can choose either high or low effort denoted by e_1 and e_0 respectively where $e_1 > e_0$[6]. Effort is unobservable and hence non-verifiable. Cost to the agent for implementing effort e_1 is d and 0 for e_0. The project can either succeed or fail. The project returns b in case of success and 0 in case of failure which are verifiable[7]. In case the agent puts e_i the project succeeds with probability p_i, $i = 0,1$ and it is assumed that $1 > p_1 > p_0 > 0$. Denote $\Delta p = p_1 - p_0$. We assume that the value of b is sufficiently high such that the principal optimally implements high effort over low effort. We maintain this assumption throughout the paper.

Assumption 1: *b is sufficiently high such that it is optimal for the principal to elicit high effort from the agent i.e. $\Delta pb > p_1 d / \Delta p$ holds.*

The timing of the game is as follows: the principal offers a wage contract $\{w_1, w_0\}$ where the agent is paid w_1 in case of success and w_0 if the project fails given $w_j \geq 0$, $j = 0,1$, which implies that a limited liability (LL) constraint operates and therefore the

[6] Our intuition goes through even with continuum of effort choices.
[7] Without loss of generality we focus on a 0-1 outcome.

agent cannot be paid a negative amount[8]. The agent then can either accept or reject the contract. If rejected, the game ends and the agent receives his outside option u which is assumed to be 0[9]. The project outcome is then realized and wages are paid accordingly. The payoff functions of the self-interested principal and the agent are $U_P = b_j - w_j$ and $U_A = w_j - d_j$ respectively where b_j and d_j are the project returns and effort costs in the j[th] state respectively, j = success, failure. Similar to Itoh (2004) we assume that the principal wants to implement e_1 over e_0. Therefore the principal will maximize $p_1 b - [p_1 w_1 + (1-p_1)w_0]$ subject to the participation constraint $p_1 \Delta w + w_0 \geq d$, the incentive compatibility constraint $\Delta w \Delta p \geq d$ and the limited liability constraints $w_j \geq 0$; $j = 0,1$, where $\Delta w = w_1 - w_0$. One optimal first-best contract when effort is observable is $(d/p_1, 0)$[10]. One can easily check that this first best doesn't satisfy the incentive compatibility constraint and therefore no first best is implementable when effort is non-verifiable. The optimum wage contract, under non-verifiability, is stated below:

Claim1: *The optimal unique wage contract is given by* $(w_1^* = d/\Delta p, w_0^* = 0)$. *No 'first-best' wage contract can be implemented.*

The participation constraint will not bind at the optimum and the agent gets a rent equal to $p_0 d/\Delta p$. With this preamble we go over to our analysis of other-regarding principal and self regarding agent.

[8] This implies that the set of feasible contracts are given by $C = \{(w_1, w_0) \mid (w_1, w_0) \text{ satisfies LL}\}$.

[9] The implication is that at the optimum the participation constraint will not bind. One can extend the analysis to $u > 0$ without changing the qualitative aspect of the paper much.

[10] In fact there is a continuum of first best contracts.

3. Other regarding principal and self regarding agent:

From various experimental evidences, starting from the ultimatum game, it has been shown that the principal is not always motivated by self-interest (see Forsythe et al., 1994). The principal might act other-regarding either because she is fair-minded, or she anticipates that otherwise, the unequal distribution of payoff might hurt the agent and thus he might retaliate and hurt the principal. Or, put simply, a principal can be benevolent and therefore might care about the wellbeing of the agent vis-à-vis his own payoff. As already mentioned in the introduction, the concepts of 'welfare capitalism' and the 'employee's welfare cooperatives' in Europe stand testimony to the existence of other-regardingness in employer's preferences. In this section, we will focus on the problem of a single other-regarding principal interacting with a self-interested agent. We will try and characterize the optimal contracts in this framework. The major departure of this model from the benchmark one is that the utility function of the principal is not only a function of her own material payoff but also of the agent's material payoff[11]. We work with a modified version of a piecewise linear utility function due to Fehr and Schmidt (1999) and Neilson and Stowe (2003). The function captures a broader class of other-regarding preferences viz. 'inequity-aversion' and 'status-seeking' as will be explained shortly. All the other basic assumptions are kept same as the benchmark case. Following Fehr and Schmidt (1999) and Neilson and Stowe (2003) we can write the utility function of the principal as

[11] For more on other regarding preferences and different approaches see Itoh (2004).

$$U_P = \begin{cases} b_j - w_j - \pi\rho f(b_j - 2w_j); & when\ b_j - w_j \geq w_j \quad (Principal\ ahead) \\ b_j - w_j - \pi f(2w_j - b_j); & when\ b_j - w_j \leq w_j \quad (Principal\ behind) \end{cases}^{12} \tag{1}$$

The first part of the principal's utility function corresponds to the case where principal's net payoff (when the project succeeds) exceeds that of the agent's i.e. $b - w_1 > w_1$ which implies $w_1 < b/2$. The second part corresponds to the case where principal is behind i.e. $b - w_1 < w_1$ implying $w_1 > b/2$. In case of failure, since $b = 0$ and $w_0 = 0$ (limited liability binds as we will see), the question of principal or agent being ahead doesn't arise. The parameter $\pi > 0$, a constant, captures the extent to which the principal cares about the agent's material payoff. If $\pi = 0$ we get back the standard self-regarding case. ρ, another constant, captures situations where the principal is either 'inequity averse' or 'status seeking'. If $\rho < 0$, the principal prefers to increase the difference in payoffs when he is ahead, i.e. the principal is 'status seeking'[13]. If $\rho > 0$, the principal's utility is decreasing in the difference in payoffs between the principal and the agent and therefore the principal is said to be 'inequity averse', even if he is ahead. When the principal is behind then he is always 'inequity averse'. Along with this we make the standard assumptions that $f(0) = 0$ and $f'(z) > 0$ for $z > 0$. The objective of the principal is to maximize her own expected utility, subject to the agent participating in the project and putting in high effort. Now, as before, even here the implicit assumption we make is that the principal wants to implement high effort over low[14].

[12] Itoh (2004) also works with the same function. Here we take the agents payoff to be his wage. One can alternatively specify agent's payoff net of his effort cost, i.e. $w - d$ and it is straightforward to extend our analysis in this direction.
[13] This terminology is due to Neilson and Stowe (2003).
[14] Which implies that the following condition holds: $p_1 b - p_1 w_1 - p_1 \pi\rho f(b - 2w_1) \geq p_0 b - p_0 \pi\rho f(b)$, i.e. the principal's payoff from implementing high effort exceeds that from implementing low effort.

Since the agent is self-interested the principal needs to satisfy the standard incentive compatibility constraint $\Delta p w_1 \geq d$ and the participation constraint $p_1 w_1 \geq d$ of the agent in order to make the agent put in high effort and also accept the contract. Therefore at the optimum the principal has to offer $w_1 \geq d / \Delta p$ in case of success. It is easy to check that the participation constraint will be satisfied and not bind[15]. Now given this, two possible cases might arise and are described below:

(i) Case 1: $b/2 > d/\Delta p$

Straightforward observation suggests that the principal will not offer $w_1'' > b/2$ as it would mean that the principal will be behind the agent and thus the inequity-averse nature of the principal would lower her benefit further down. Hence, it is not optimal to have $w_1'' > b/2$. Therefore, this is the case where w_1 will optimally lie somewhere between $d/\Delta p$ and $b/2$ and the principal will always be ahead at the optimum. Therefore, given binding limited liability implying $w_0'' = 0$, the problem of the principal in this case can be formulated as:

$$Maximize\ U_P = p_1[b - w_1 - \pi\rho f(b - 2w_1)]$$

Subject to

(a) $p_1 w_1 \geq d$ (Participation constraint)

(b) $\Delta p w_1 \geq d$ (Incentive compatibility constraint)

We now state our first proposition:

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[15] This is a consequence of the assumption that the outside option of agent is 0.

Proposition 1:

(a). $(w_1'' = d / \Delta p, w_0'' = 0)$ *is the unique optimal contract if the principal is status-seeking in nature* $(\rho < 0)$.

(b). $(w_1'' = b / 2, w_0'' = 0)$ *will be the unique optimal contract if the principal is inequity-averse* ($\rho > 0$) *and if* $2\pi\rho f'(b - 2w_1) > 1$ *holds.*

(c). *If* $\rho > 0$ & $2\pi\rho f'(b - 2w_1'') = 1$ *for some* $w_1'' \in [d / \Delta p, b / 2]$ *then* $(w_1'', 0)$ *is an optimal contract. However if* $f(.)$ *is linear and* $2\pi\rho f'(b - 2w_1) = 1 \; \forall \; w_1 \in [d / \Delta p, b / 2]$ *then any contract* $\{w_1'' \in [d / \Delta p, b / 2], w_0'' = 0\}$ *will be optimal.*

Proof:

(a). The expected benefit to the principal when high effort is implemented is

$$U_P = p_1[b - w_1 - \pi\rho f(b - 2w_1)]$$

Hence, $\partial U_P / \partial w_1 = -p_1 + 2p_1\pi\rho f'(b - 2w_1) = p_1[2\pi\rho f'(b - 2w_1) - 1] < 0$ if $\rho < 0$. Thus, $w_1'' = d / \Delta p$ and it is unique. Therefore $(w_1'' = d / \Delta p, \; w_0'' = 0)$ is the *unique optimal contract* if the principal is *status-seeking*. The agent gets a positive net expected payoff equal to $p_0 d / \Delta p$ and the principal gets $p_1[b - d / \Delta p - \pi\rho f(b - 2d / \Delta p)]$ which is certainly positive for $\rho < 0$.

(b). Since $\partial U_P / \partial w_1 = p_1[2\pi\rho f'(b - 2w_1) - 1]$, if $2\pi\rho f'(b - 2w_1) > 1$ then $\partial U_P / \partial w_1 > 0$ for $\rho > 0$. Therefore $w_1{*} = b / 2$ and it is unique implying that $(w_1'' = b / 2, w_0'' = 0)$ would be the optimal contract iff $2\pi\rho f'(b - 2w_1) > 1$. Note that in this case the loss from inequality is zero and the principal's payoff is $p_1 b / 2$ whereas the agent gets $p_1 b / 2 - d > 0$, since $b / 2 > d / \Delta p$.

(c). For $\rho > 0$, $\partial B_P / \partial w_1 = 0$ if $2\pi\rho f'(b - 2w_1) = 1$. If $f(.)$ is linear and $2\pi\rho f'(b - 2w_1) = 1$ holds for all w_1 then any $w_1'' \in [d/\Delta p,\ b/2]$ will be optimal. But if $f(.)$ is non-linear then $2\pi\rho f'(b - 2w_1) = 1$ holds for any specific value of w_1 and that $w_1 \in [d/\Delta p,\ b/2]$ will be optimal. **QED**

The intuition of the first part is simple. Since the principal is status seeking, he enjoys being ahead and therefore he will optimally offer a wage (in case of success) that is as low as possible and just satisfies the incentive compatibility constraint. Therefore the principal will optimally offer $w_1'' = d/\Delta p$ and also gets the agent to put in high effort and accept the contract. The agent gets a positive net expected payoff equal to $p_0 d/\Delta p$ since the participation constraint doesn't bind at the optimum. In the second case two opposite effects are at play. First the direct effect of paying more to the agent reduces the utility of the principal. But the principal also suffers a utility loss from inequity. Therefore increasing w_1 towards $b/2$ reduces inequity and therefore leads to an increase in the principal's utility. If the marginal utility gain due to reduced inequity is sufficiently high i.e. $2\pi\rho f'(b - 2w_1) > 1$ then second effect will dominate and therefore the principal will optimally offer $w_1'' = b/2$ if the project succeeds. But if the first effect dominates then it is optimal for the principal to offer a low enough wage to minimize the loss due to increased wage payment and therefore, $w_1'' = d/\Delta p$ will be optimal. Finally, if the first effect is exactly outweighed by the second effect then the principal's expected utility remains unchanged with respect to changes in w_1 and any $w_1'' \in [d/\Delta p, b/2]$ will be optimal if $f(.)$ is linear. However if $f(.)$ is non-linear then $2\pi\rho f'(b - 2w_1'') = 1$ can hold only for a specific value of w_1 and therefore that w_1 will be the optimal wage in case of success. Therefore it is evident that the optimal contract is sensitive to whether the principal is inequity-averse or status-seeking. Except for the situation where $2\pi\rho f'(b-2w_1)=1$, the optimal contracts are 'bang-bang' in nature and are unique. But amidst all these, what happens to the agent's payoff? The next proposition states the result:

Proposition 2:

The agent is (weakly) better-off under an inequity-averse principal than a status seeking principal.

Proof:

$p_1 w_1'' - d > p_1 d/\Delta p - d = p_0 d/\Delta p > 0 \quad \forall w_1'' \in (d/\Delta p,\ b/2]$ since $b/2 > d/\Delta p$. Equality holds for $w_1'' = d/\Delta p$. Therefore, the result. **QED**

Case 2: $b/2 < d/\Delta p$

This is the case where the principal is certainly behind the agent when the project succeeds. Again, for the tractability of solution, we assume that b is sufficiently high such that it is optimal for the principal to offer a contract and elicit high effort from the agent. The principal is always inequity-averse when he is behind. Similar to the previous case, at the optimum, the limited liability will bind and therefore given that the principal wants to elicit high effort the principal's problem becomes

$$Maximize\, U_P = p_1[b - w_1 - \pi f(2w_1 - b)]$$

Subject to (a) $p_1 w_1 \geq d$ Participation constraint

(b) $\Delta p w_1 \geq d$ Incentive compatibility constraint

Since the principal wants to elicit high effort from the agent he cannot offer a success wage which is less than $d/\Delta P$ and since he is inequity averse it is optimum for the principal to offer just $w_1'' = d/\Delta P$ and ensure that the agent accepts the contract[16]. Therefore, $(w_1'' = d/\Delta P, w_0'' = 0)$ will be the unique optimal contract. One final case we consider is when $b/2 = d/\Delta P$. It seems obvious that the optimal wage offer then would be $(w_1'' = b/2 = d/\Delta P, w_0'' = 0)$.

3.1. Alternative Specification:

We have so far assumed that the principal compares his income $b_j - w_j$ to the agent's w_j. But since the principal knows that the agent incurs a private cost of implementing high effort, he might compare his net payoff $b_j - w_j$ to the 'net' earning $w_j - d$ of the agent in case of high effort. In case of low effort the agent doesn't incur any cost of effort. Thus under this alternate specification the new "other-regarding" utility function of the principal can be written as:

$$U_P = \begin{Bmatrix} b_j - w_j - \pi\rho f\,(b_j - 2w_j + d_i) \quad when\ b_j - w_j \geq w_j - d_i\ (principal\ \ ahead) \\ b_j - w_j - \pi f\ (2w_j - b_j - d_i)\ \ when\ b_j - w_j \leq w_j - d_i\ (principal\ \ behind) \end{Bmatrix}$$

where $d_i = d$ for $e = e_1$ and $d_i = 0$ for $e = e_0$. Similar to the earlier case the principal is ahead (when the project succeeds) if $b - w_1 > w_1 - d$ holds implying $w_1 < (b+d)/2$. The second part corresponds to the case where principal is behind i.e. $b - w_1 < w_1 - d$ implying $w_1 > (b+d)/2$. We re-emphasize our assumption that the value of b is such that at the optimum the agent only elicits high effort, therefore we need not worry about the situation

[16] This can also be seen from the fact that $\partial B_P/\partial w_1 = [-p_1 - 2\pi P_1 f'(2w_1 - b)] < 0\ when\ \ w_1 \geq b/2$ and therefore optimal success wage will be $w_1'' = d/\Delta P$.

where the agent might put in low effort. All other assumptions of the previous section are kept intact.

Is it still optimum for the principal to offer zero wage in case of failure? To understand that note the subtle difference of this case with the earlier one. If the principal offers zero wage in case of failure the agent's net payoff now is $-d$ whereas the principal's payoff is zero. Therefore the principal is always ahead when the project fails assuming that he pays zero in case of failure. Now a status seeking principal will enjoy this inequity and therefore he will optimally pay $w_0 = 0$. But a sufficiently inequity averse principal might not like this and therefore might optimally offer a positive wage in case of failure to minimize inequity and consequently offer a even higher w_1 so that the incentive compatibility is satisfied. Therefore whether or not limited liability binds will be conditional and the following lemma states a sufficient condition for limited liability to bind at the optimum:

Lemma 1: *The principal will optimally offer* $w_0'' = 0$ *if* $2\pi\rho f'(d - 2w_0) < 1 \;\; \forall w_0 > 0$

Proof: To fix ideas suppose the principal is ahead if the project succeeds. Now, given w_1 the principal will choose that w_0 that will maximize his expected payoff $U_P = p_1[b - w_1 - \pi\rho f(b - 2w_1 + d)] + (1 - p_1)(-w_0 - \pi\rho f(d - 2w_0))$. Put differently if $\partial U_P / \partial w_0 = (1 - p_1)[2\pi\rho f'(d - 2w_0) - 1] < 0 \;\;\; \forall w_0 > 0$ then $w_0'' = 0$. The principal can therefore optimally reduce w_1 such that the incentive compatibility constraint is satisfied. Again if the principal is behind if the project succeeds then the principal is inequity averse in case of success. Therefore the expected payoff function of the principal will be $U_P = p_1[b - w_1 - \pi f(2w_1 - b - d)] + (1 - p_1)(-w_0 - \pi\rho f(d - 2w_0))$. It is always the case that $\partial U_P / \partial w_1 = p_1[-1 - 2\pi f'(2w_1 - b - d) - 1] < 0$. Therefore reducing w_1 always benefits the principal and therefore if $2\pi\rho f'(d-2w_0)<1 \ \forall w_0>0$ holds then it is again optimum for the principal to set $w_0''=0$ and reduce w_1 such that the incentive compatibility binds. **QED**

Note that the above condition is automatically satisfied if the principal is status seeking, i.e. if $\rho<0$. For the tractability of solutions, for the time being we will assume that the above condition holds and therefore at the optimum limited liability binds.

Assumption 2: $2\pi\rho f'(d-2w_0)<1, \ \forall w_0>0$ *holds.*

Given assumption 2 we have $w_0''=0$. Now we characterize the optimal contracts given that assumption 2 holds. Internalizing this the objective of the principal is to maximize her expected utility subject to the participation constraint $p_1 w_1 \geq d$ and the incentive compatibility constraint $\Delta p w_1 \geq d$. Similar to the previous situation we will consider the following two situations: if $(b+d)/2 > d/\Delta p$ then similar to the previous case the principal will not offer $w_1''>(b+d)/2$ as it would mean that the principal will be behind the agent and thus the inequity-averse nature of the principal would lower her benefit further down. Hence, it is not optimal to have $w_1''>(b+d)/2$. Therefore, this is the case where w_1 will optimally lie somewhere between $d/\Delta p$ and $(b+d)/2$ and the principal will always be ahead at the optimum. Therefore, given assumption 2 implying $w_0''=0$, the problem for the principal is to maximize $U_P = p_1[b-w_1-\pi\rho f(b-2w_1+d)]+(1-p_1)(-\pi\rho f(d))$ subject to the participation constraint and the incentive compatibility constraint. Since by assumption 2 we know that $2\pi\rho f'(.)<1$ holds then the unique optimal solution will be $(w_1''=d/\Delta p, w_0''=0)$. On the other hand if $(b+d)/2 < d/\Delta p$, the wage offer w_1'' can't be anything less than $d/\Delta p$ to satisfy the incentive compatibility constraint. Since, principal is always behind in this case, again the unique optimal wage offer will be $(w_1'' = d/\Delta p,\ w_0'' = 0)$. Therefore we get

Proposition 3:

If the effort cost is considered, given assumption 2, $(w_1'' = d/\Delta p, w_0'' = 0)$ *is the unique optimal contract irrespective of whether the principal is status-seeking or inequity averse.*

But if assumption 2 doesn't hold the principal will optimally offer a positive w_0 such that the inequity from being ahead is minimized. Therefore if the optimal failure wage is set at $w_0'' = d/2$ then the resultant utility loss from inequity when the project fails goes to zero. Again we can consider the two previous sub-cases. If $(b+d)/2 > d/\Delta p$, given $w_0'' = d/2$ and given that $2\pi\rho f'(.)>1$ holds the optimal success wage is set at $w_1'' = (b+d)/2$ and one can check that the incentive compatibility is satisfied if $b/2 > d/\Delta p$. Again if $(b+d)/2 < d/\Delta p$ then the only contract that satisfy the incentive compatibility constraint is $(w_1'' = d/\Delta p,\ w_0'' = 0)$. Therefore

Claim 2:

If $2\pi\rho f'(.)>1$ *and* $(b+d)/2 > d/\Delta p$ *holds, then* $(w_1'' = (b+d)/2, w_0'' = d/2)$ *will be the unique optimal contract. The limited liability will not bind in this case. Otherwise* $(w_1'' = d/\Delta p, w_0'' = 0)$ *is optimal and the limited liability will bind at the optimum.*

4. Both Other Regarding Principal and Agent:

We now examine the situation where both the principal and the agent are other regarding and both the principal and the agent cares about each other's material payoffs. The principal's other regarding utility function is given by (1) as in section 3. The primitives of the agent's possible effort choices and the associated costs and other assumptions remain the same as in the benchmark model (i.e. section 2). In addition to this, following Itoh (2004), we assume that the agent also has the following utility structure:

$$U_A = \begin{Bmatrix} w_j - d_i - \alpha\gamma v(2w_j - b_j); & when\, w_j \geq w_j - b_j & (Agent\, ahead) \\ w_j - d_i - \alpha v(b_j - 2w_j); & when\, w_j < w_j - b_j & (Agent\, behind) \end{Bmatrix} \quad (2)$$

where $\alpha > 0$ captures the extent to which the agent cares about the principal's material payoff. When $\alpha = 0$, we get back the standard self-regarding case. The constant γ captures situations where the agent is 'inequity averse' or 'status seeking'. If $\gamma < 0$, the agent is 'status seeking'[17] whereas when $\gamma > 0$ the agent is 'inequity averse'. Also when the agent is behind then he is always 'inequity averse'. We retain the standard assumptions that $v(0) = 0$ and $v'(z) > 0$ for $z > 0$. Therefore in essence the modeling of other-regardingness of the agent is similar to that of the principal (following Nelson and Stowe (2003)).

Once again to simplify our analysis we start with the assumption that $w_0'' = 0$. Later we will show that at the optimum the limited liability will indeed bind. Now given the current specification the agent doesn't suffer from inequity when the project fails, following Itoh (2004), the incentive compatibility constraint of the agent can be written as follows:

$$w_1 - \alpha\gamma v(2w_1 - b) \geq d / \Delta p \quad \text{if } w_1 > b/2 \quad \text{(ICa)}$$

[17] This terminology is due to Neilson and Stowe (2003).

$$w_1 - \alpha v(b - 2w_1) \geq d / \Delta p \qquad \text{if } w_1 \leq b/2 \tag{ICb}$$

where (ICa) and (ICb) are the incentive compatibility of the agent when he is ahead and behind respectively.

Lemma 2 (Itoh (2004)): A necessary condition for a contract to satisfy (ICb) is $b/2 \geq d / \Delta p$.

The proof of the above lemma is given in Itoh (2004). The logic is simple, the left hand side of (ICb) is increasing in w_1. Therefore at least one contract satisfying (ICb) will exist if the (ICb) is satisfied at $w_1 = b/2$. Putting $w_1 = b/2$ in (ICb) we get the required condition. Now, one can define $\tilde{w}_1$ such that

$$\tilde{w}_1 - \alpha v(b - 2w_1) = d / \Delta p \tag{3}$$

It is straightforward to show that $\tilde{w}_1 \leq b/2$ if $b/2 \geq d / \Delta p$ holds. We focus on the following two sub-cases.

Case 1: $b/2 \geq d / \Delta p$

This is the case where the principal is (weakly) ahead of the agent since $w_1 \leq b/2$. We can therefore state the next result which is in essence similar to what has been stated in Itoh (2004) and this holds when the principal is status seeking i.e. $\rho < 0$.

Proposition 4: If $b/2 \geq d / \Delta p$ holds then $(\tilde{w}_1, 0)$ in the unique optimal contract for a status seeking principal if both $1 > 2\pi\rho f'(z)$ and $1 > 2\alpha\gamma v'(z)$ holds $\forall z > 0$.

Proof: We complete the proof in several steps.

Step 1: First we will show that $(\tilde{w}_1, 0)$ is a candidate optimal contract. Since $(\tilde{w}_1, 0)$ is found by satisfying (ICb) with equality it will suffice to show that $(\tilde{w}_1, 0)$ satisfies the participation constraint. Since by definition $\tilde{w}_1 - \alpha v(b - 2\tilde{w}_1) = d / \Delta p \geq d / p_1$ it is proved that $(\tilde{w}_1, 0)$ satisfies the participation constraint. Therefore $(\tilde{w}_1, 0)$ is a candidate optimal contract.

Step 2: Now to show the uniqueness of $(\tilde{w}_1, 0)$ we go by the method of contradiction. Suppose $(\tilde{w}_1, 0)$ is not the optimal contract and there exists another optimal contract (w_1, w_0) such that $w_0 > 0$. We will show that if $1 > 2\pi\rho f'(z) \;\; \forall z > 0$, it must be that $w_1 < b/2$ since $w_0 > 0$. To do that first we show that if the principal is status seeking then an optimal contract (w_1, w_0) with $w_1 > b/2$ and $w_0 > 0$ is not a possibility. But if a contract like that existed then the principal would have been behind under both success and failure states under (w_1, w_0) and therefore the following must hold:

$$p_1[b - w_1 - \pi f(2w_1 - b)] + (1 - p_1)[- w_0 - \pi f(2w_0)] > p_1[b - \tilde{w}_1 - \pi\rho f(b - 2\tilde{w}_1)]$$

$$\Rightarrow p_1[\tilde{w}_1 - w_1 + \pi\rho f(b - 2\tilde{w}_1) - \pi f(2w_1 - b)] > (1 - p_1)[w_0 + \pi f(2w_0)] > 0 \quad \text{since} \quad w_0 > 0$$

which in turn implies that $\tilde{w}_1 - w_1 > \pi f(2w_1 - b) - \pi\rho f(b - 2\tilde{w}_1)$. It is obvious that $\pi f(2w_1 - b) - \pi\rho f(b - 2\tilde{w}_1) > 0$ for $\rho < 0$ and therefore $\tilde{w}_1 - w_1 > 0$. Since $\tilde{w}_1 < b/2$, $w_1 > b/2$ is never a possibility. So a contract (w_1, w_0) such that $w_1 > b/2$ and $w_0 > 0$ is ruled out[18].

The other possibility is a contract (w_1, w_0) such that $w_1 \leq b/2$ and $w_0 > 0$. We will show that it must be the case that $\tilde{w}_1 > w_1$. Now given $w_1 \leq b/2$, the principal is (weakly) ahead when the project succeeds and behind when the project fails and therefore the principal's expected payoff under (w_1, w_0) is given as

[18] Also note that if $\tilde{w}_1 > w_1$ then both $(2w_1 - b)$ and $(b - 2\tilde{w}_1)$ can't be positive and since the function $f(z)$ is defined for $z > 0$ the analysis becomes mathematically inconsistent.

$p_1[b - w_1 - \pi\rho f(b-2w_1)] + (1-p_1)[-w_0 - \pi f(2w_0)]$. Again by assumption (w_1, w_0) is optimal and this implies that the following holds:

$$p_1[b - w_1 - \pi\rho f(b-2w_1)] + (1-p_1)[-w_0 - \pi f(2w_0)] > p_1[b - \tilde{w}_1 - \pi\rho f(b-2\tilde{w}_1)]$$

which in turn implies that

$$p_1[\tilde{w}_1 - w_1 + \pi\rho f(b-2\tilde{w}_1) - \pi\rho f(b-2w_1)] > (1-p_1)[w_0 + \pi f(2w_0)] > 0 \text{ since } w_0 > 0.$$

Now for $p_1[\tilde{w}_1 - w_1 + \pi\rho f(b-2\tilde{w}_1) - \pi\rho f(b-2w_1)] > 0$ to hold we need $[\tilde{w}_1 + \pi\rho f(b-2\tilde{w}_1)] > [w_1 + \pi\rho f(b-2w_1)]$ to hold. Put differently if $[w_1 + \pi\rho f(b-2w_1)]$ is an increasing function of w_1 i.e. if $1 > 2\pi\rho f'(.)$ holds then certainly the previous inequality holds which implies that $\tilde{w}_1 > w_1$ and therefore $w_1 < b/2$ holds. So if another optimal contract (w_1, w_0) such that $w_0 > 0$ exists then it must be that $w_1 < \tilde{w}_1$. Note that the condition $1 > 2\pi\rho f'(z)$ is always true for a status seeking principal. The final step shows that if $1 > 2\alpha\gamma v'(z)$ then no contract (w_1, w_0) such that $w_0 > 0$ can be optimal.

Step 3: Now, given $w_1 < b/2$ and we will follow Itoh (2004) to complete the proof. Since (w_1, w_0) satisfies the incentive compatibility constraint we get

$$\Delta_w - \alpha v(b-2w_1) + \alpha\gamma v(2w_0) \geq d/\Delta p \tag{4}$$

Combining (4) and (3) we get

$$\Delta_w + \alpha\gamma v(2w_0) \geq \tilde{w}_1 + \alpha v(b-2w_1) - \alpha v(b-2\tilde{w}_1) \geq \Delta_w + w_0/p_1 + \alpha v(b-2w_1) - \alpha v(b-2\tilde{w}_1) \tag{5}$$

Similar to Itoh (2004), after re-arranging terms we get

$$-w_0/p_1 + \alpha\gamma v(2w_0) \geq \alpha v(b-2w_1) - \alpha v(b-2\tilde{w}_1) \tag{6}$$

Since $\tilde{w}_1 > w_1$, the right hand side of (6) is positive. Thus, if the left hand side is non-positive, (w_1, w_0) does not satisfy the incentive compatibility constraint, which is a contradiction. $1 > 2\alpha\gamma v'(z)$ ensures that the left hand side is non-positive and therefore (w_1, w_0) such that $w_0 > 0$ cannot be an optimal contract. Therefore $(\tilde{w}_1, 0)$ is the unique optimal contract. **QED**

A pathological case arises when the principal is in-equity averse, (that is $\rho > 0$) and it is not certain that $\pi f(2w_1 - b) - \pi\rho f(b - 2\tilde{w}_1) > 0$. But if the principal is moderately in-equity averse in the sense that ρ is not very high such that $\pi f(2w_1 - b) - \pi\rho f(b - 2\tilde{w}_1) > 0$ holds then our previous result will follow[19].

For the rest of our analysis we assume that both $1 > 2\pi\rho f'(z)$ and $1 > 2\alpha\gamma v'(z)$ holds $\forall z > 0$ and we maintain this as an assumption.

Assumption 3: *Both* $1 > 2\pi\rho f'(z)$ *and* $1 > 2\alpha\gamma v'(z)$ *holds* $\forall z > 0$.

What happens to the principal's expected utility when the agent becomes more other-regarding? The next result sheds some light on this:

Proposition 5*: A status seeking principal is worse-off the more other regarding the agent is. An inequity averse principal is also worse-off if* $2\pi\rho f'(z) < 1$ *holds.*

Proof: Note that the principal's optimal expected utility in this case will be $U_P^* = p_1[b - \tilde{w}_1 - \pi\rho f(b - 2\tilde{w}_1)]$. Therefore $\frac{\partial U_P^*}{\partial \alpha} = -p_1 \frac{\partial \tilde{w}_1}{\partial \alpha} + 2\pi\rho f'(b - 2\tilde{w}_1)\frac{\partial \tilde{w}_1}{\partial \alpha}$

[19] But if $\pi f(2w_1 - b) - \pi\rho f(b - 2\tilde{w}_1) < 0$ then there might be a case where there might exist a contract (w_1, w_0) such that $\tilde{w}_1 < w_1$ with $w_1 > b/2$ and $w_0 > 0$ holds. This arises due to the fact that if the principal is strongly in-equity averse then the loss from inequity is more under $(\tilde{w}_1, 0)$. Therefore it is technically possible for another contract (w_1, w_0) such that $w_1 > b/2$ and $w_0 > 0$ to make the principal relatively better-off vis-à-vis $(\tilde{w}_1, 0)$. But if the principal is not sufficiently inequity averse when ahead then this pathological case can be ruled out.

$= \frac{\partial \tilde{w}_1}{\partial \alpha}[2\pi\rho f'(b - 2\tilde{w}_1) - 1]$. Now from (3) $\tilde{w}_1$ is defined such that $\tilde{w}_1 - \alpha v(b - 2w_1) = d / \Delta p$. Let $f(\alpha) = \tilde{w}_1 - \alpha v(b - 2w_1)$ and therefore $\frac{\partial f(\alpha)}{\partial \alpha} = -v(b - 2\tilde{w}_1) < 0$ for $\tilde{w}_1 < b/2$. To maintain equality (3) $\tilde{w}_1$ has to increase and therefore $\frac{\partial \tilde{w}_1}{\partial \alpha} > 0$. Now if $\rho < 0$, then $\frac{\partial U_P^*}{\partial \alpha} < 0$ unambiguously. Again if $\rho > 0$ then $\frac{\partial U_P^*}{\partial \alpha} < 0$ iff $2\pi\rho f'(z) < 1$ holds. **QED**

To explain the above proposition, note that the agent is always behind and therefore is inequity averse in this situation. So the greater the α, more wage will have to be paid to the agent to make up for the agent's welfare loss due to inequity. Now a status seeking principal will hate this increased wage payment and therefore will be unambiguously worse-off the more other –regarding the agent. On the contrary a, inequity-averse principal might like this increased wage payment since this will lead to reduced inequity and if the positive in-equity effect dominates the negative wage effect then the inequity-averse principal will be better-off dealing with a more other-regarding agent. Put differently the inequity-averse principal will **not** prefer a more other fair-minded agent if the negative wage effect dominates the positive in-equity effect. The condition $2\pi\rho f'(z) < 1$ ensures that the negative wage effect dominates the positive in-equity effect.

Case 2: $b/2 < d/\Delta p$

We now briefly consider the case where $b/2 < d/\Delta p$ holds and therefore (ICb) cannot be satisfied and thus the principal has to choose a contract $(w_1, 0)$ such that $w_1 > b/2$ to satisfy

(ICa). The principal is always behind in this situation and therefore inequity averse. The agent can be either inequity-averse or status seeking. To fix ideas define $w_1 *$ such that the following holds:

$$w_1 * - \alpha\gamma v(2w_1 * - b) = d / \Delta p \tag{4}$$

Define $g(\alpha) = w_1 * - \alpha\gamma v(2w_1 * - b)$ and we get $\frac{\partial g(\alpha)}{\partial \alpha} = -\gamma v(2w_1 * - b)$. Since for $w_1 * > b/2$ if $\gamma > 0$ we get $\frac{\partial g(\alpha)}{\partial \alpha} = -\gamma v(2w_1 * - b) < 0$ and therefore to maintain equality (4) $w_1 *$ should increase given $1 > 2\alpha\gamma v'(z)$ (assumption3). Therefore we get $\frac{\partial w_1 *}{\partial \alpha} > 0$. The principal's expected utility is given by $U_P^* = p_1[b - w_1 * - \pi f(2w_1 * - b)]$ and it is immediate that the principal is worse off given an increase in $w_1 *$ since $\frac{\partial U_P^*}{\partial w_1 *} = p_1[-1 - 2\pi f'(2w_1 * - b)] < 0$. Therefore if the agent is inequity averse then a more other-regarding agent makes the (inequity averse) principal worse-off. But if $\gamma < 0$ we get $\frac{\partial w_1 *}{\partial \alpha} < 0$ and since $\frac{\partial U_P^*}{\partial w_1 *} < 0$ which implies that a more status seeking agent makes the (inequity averse) principal better-off. We can state the above finding succinctly:

Proposition 6: *If $b/2 < d/\Delta p$ holds then the principal is inequity averse and would always prefer a status seeking agent.*

An inequity-averse principal will never benefit from a more inequity-averse (fair-minded) agent. This is due to the fact that the principal is already behind in this case and if the agent is inequity averse the agent hates being ahead. Therefore if the agent becomes more inequity-averse he has to be compensated more by an increased wage. This will hurt the already behind inequity averse principal more. On the contrary the principal will benefit from a more status-seeking agent. Since in this case the principal is behind the agent and the agent being status seeking enjoys being ahead. Now if the agent becomes more status seeking the principal can optimally reduce his payment and still get to elicit high effort from the agent. Put differently now it is possible for the principal to implement high effort from the agent at a lower cost. This in turn makes the principal less-behind and therefore the inequity-averse principal will benefit from a more status seeking agent.

5. Conclusion:

This paper analyzes optimal contracts when an other-regarding principal interacts separately with a self-regarding and other-regarding agent that hitherto has been left untouched in the literature. We showed that when an other-regarding principal interacts with a self-regarding agent the optimal contract differs considerably when the principal is 'inequity averse' compared to the self-regarding case. Put differently when the principal is status seeking we get back the self regarding result whereas when the principal is inequity averse the optimal success wage is considerably higher than the self regarding case. Then we considered the case of an other-regarding principal interacting with an other-regarding agent and we show that the a unique optimal contract similar to Itoh (2004) exists but if the principle is status seeking, otherwise not. We also show that a status seeking principal is worse-off the more other regarding the agent is. An inequity-averse principal can also worse-off under certain parametric configurations. Finally when the principal is behind and therefore always inequity-averse, she would always prefer a status seeking agent. One limitation of our paper is that we in this paper consider a single principal agent interaction whereas one can conceive of a situation where an other-regarding principal is interacting with more than one agents. Therefore a natural extension of this paper is to consider a multi-agent framework but one has to be careful while defining other-regardingness of the principal in the multi-agent framework.

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