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Delegation with a Reciprocal Agent

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Abstract: We consider a model in which a principal may delegate the choice of a project to a better informed agent. The preferences of the agent and the principal about which project should be undertaken can be discordant. Moreover, the agent benefits from being granted more discretion in the project choice and may be motivated by reciprocity. We find that the impact of the agent's reciprocity on the discretion he receives crucially depends on the conflict of interest with the principal. If preferences are very discordant, the principal is more likely to retain authority about the choice of the project when the agent is more reciprocal. Hence, reciprocity exacerbates a severe conflict of interest. In contrast, if preferences are more congruent, discretion is broader when the agent is more reciprocal. Hence, reciprocity mitigates a mild conflict of interest. In addition, we find that the possibility of being able to offer monetary payments to the agent can make the principal worse off when the agent reciprocates. We also empirically test the predictions of our model using the German Socio-Economic Panel finding some support for our theoretical results.

JEL Codes: D03, D82, D83, D86.

Keywords: Authority, Delegation, Reciprocity.

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1 Introduction

Subordinates often have a better understanding of what tasks should be performed or are in a better position to evaluate what projects should be pursued than the organizational leaders. For this reason, especially in large firms, delegation of decision-making authority and extensive job autonomy are rife. In some of these firms, employees are even allowed to spend a fraction of their working time on their own projects. A remarkable example is Google's time-off program, commonly referred to as 20 percent, which allows employees to allocate one-fifth of their time to side-projects that they can choose or even create. Over the years, this policy has led to the development of successful products, such as Gmail and Google news.[1] Similar initiatives exist at 3M (15 per cent time), LinkedIn (InCubator), and Apple (Blue Sky).[2]

The economics literature has emphasized how the benefits of delegating authority are diminished when the interests of the parties are dissonant and the superiors have limited instruments to align the employees' preferences (e.g., see Holmström, 1977 and Aghion and Tirole, 1997). However, in many real-world situations, employees receive a substantial degree of discretion and they do not seem to act at the detriment of their employers, although their interests are not fully aligned. As a case in point, the leading pharmaceutical company GlaxoSmithKline lets its scientists choose which projects to pursue and provides wide discretion to the different research teams on how to spend their budget. Among other things, scientists can embark on trials of promising compounds without asking for the headquarter's permission. The adoption of this approach has been successful and conducive to more innovation.[3]

How can one reconcile this discrepancy between theory and reality? In this paper we argue that one important determinant of the amount of authority delegated by an employer may be the employee's sensitivity to reciprocity. An individual is said to be *reciprocal* if she responds to actions she perceives to be kind in a kind manner, and to actions she perceives to be hostile in a hostile manner (see Rabin, 1993, Dufwenberg and Kirchsteiger, 2004, and Falk and Fischbacher, 2006). In the last decades, experimental evidence has shown that individuals are often motivated by reciprocity (for a review, see Fehr and Schmidt, 2006).

Delegating authority can stimulate the response of a reciprocal agent thanks to its impact on job satisfaction. Psychologists have long argued for a causal link between worker discretion and happiness in the workplace as well as welfare. In particular, the seminal article by Karasek Jr (1979) posits that employees' authority over job-related decisions positively affects their health and their morale (the job-strain model), whereas the influential work by Hackman and Oldham (1976) suggests that on-the-job autonomy is one of those work characteristics which increase job satisfaction (the job characteristics model) and this hypothesis has been supported by later studies (e.g., see Fried and Ferris, 1987 and Humphrey et al., 2007). Furthermore, an increasingly large body of empirical research in other disciplines, from sociology (see Gallie and Zhou, 2013,

[1] See *The Google Way: Give Engineers Room*, The New York Times on October 21, 2007.

[2] For 3M see the company's web-site. *The 15 per cent time* has been used since 1948 and it numbers the Post-It among its inventions. In the program adopted by LinkedIn, engineers have up to 3 months to develop products out of their own ideas. See *LinkedIn Gone Wild: 20 Percent Time to Tinker Spreads Beyond Google* on Wired June 12, 2012. And finally for Apple see *Apple Gives In to Employee Perks* on the Wall Street Journal November 12, 2012.

[3] See *Bureaucracy Buster? Glaxo Lets Scientists Choose Its New Drugs*, The Wall Street Journal on March 27, 2006.

who use data from the 5th European Working Condition Survey) to economics (see Freeman and Kleiner, 2000 and Bartling et al., 2013), supports the existence of a positive relationship between employee involvement and job satisfaction.[4] As a result, by granting more discretion, the employer can increase the employee's job satisfaction and thereby being perceived as kind.

In the model, a principal (she) may delegate the choice of a project to a better informed agent (he). The agent is better informed as he knows which project may succeed. The agent and the principal have conflicting interests about which project should be undertaken. In particular, the agent is biased towards larger projects.[5] Both the principal and the agent are interested in the project being successful even though they may attach a different weight to it.

Initially, we assume that the principal can only restrict the set of projects from which the agent can choose. We say that the agent is granted more *discretion* when the set of allowed projects is larger. When the agent is not motivated by reciprocity, the principal might find it profitable to exclude those projects which yield the agent the largest private benefits. Although the optimal decision will not always be available, constraining the agent's decision set ensures that he will not systematically opt for the largest project.

When the agent is motivated by reciprocity, the principal's choice of restricting the set of decisions can be interpreted in different ways. The agent may perceive the principal's behavior as *hostile* to him. As the agent is not allowed to obtain his largest private benefits, he may intentionally hurt the principal by choosing a suboptimal project. Alternatively, the agent may perceive the principal's decision to delegate a certain set of projects as *kind*. In that case, the principal could be better off by delegating a larger set. In both instances, the decision set found in the delegation problem when the agent has standard preferences is no longer optimal.

We find that the effect of reciprocity on the discretion granted to the agent crucially depends on the underlying conflict of interest between the parties. When the agent's and the principal's preferences about the best course of action are very dissonant, the principal can only grant the agent little discretion, which makes the principal appear unfriendly to the agent. The principal is better off restricting even more the agent's delegation set to escape his retaliation when the agent is more sensitive to reciprocity. Hence, reciprocity exacerbates a severe conflict of interest. In contrast, when the principal's and the agent's preferences are more congruent, discretion can be broad, and this makes the principal appear kind to the agent. When the agent is more prone to reciprocate, the principal can increase his delegation set, trusting that the agent will choose a project which can be successful, even if it is not his favorite one. Thus, reciprocity alleviates a mild conflict of interest.

In the second part of the paper, we let the principal offer monetary payments to the agent as additional instruments to affect his project choice. In particular, we consider both a fixed wage and a performance bonus. Since the agent can receive a transfer from the principal, he expects to receive at least some positive amount of money or has to be compensated with more discretion than before to perceive the principal as fair. Therefore, the effect of a change in

[4] Employee involvement is a broader concept which refers to the employees' opportunity to actively participate in decisions that impact on their work. It distinguishes between three different levels of an employee's authority, i.e. task discretion, organizational participation, and strategic participation.

[5] In this way we can capture the conflict of interest existing within firms when it comes to project decisions. While employers are interested in maximizing the firm's profit or market value, employees may favor larger projects, with which larger private benefits are typically associated as in the case of empire-building preferences.

the delegation set on the agent's perception of the principal's kindness is dampened when the principal can make monetary transfers. As a result, the principal may be worse off when she has this additional instrument at her disposal. As for the type of monetary instrument, this depends on both the agent's sensitivity to reciprocity and the conflict of interest. When the agent has very little reciprocity concerns, the principal is more likely to use a performance bonus rather than a fixed wage to motivate the agent. In contrast, a fixed wage is more likely to be used when the conflict of interest is not very severe and/or the agent is more sensitive to reciprocity concerns.

We also empirically test some of the predictions of our model through the German Socio-Economic Panel (GSOEP), which contains data on individuals' reciprocity inclinations, discretion and conflict of interest in the workplace. We show that our theoretical prediction that the agents' sensitivity to reciprocity affects the level of delegation they enjoy in the workplace finds some empirical support.

The remainder of the article is as follows. The related literature is discussed in the next section. In Section 3, the setup of the benchmark model is presented and the analysis of the optimal delegation contract without reciprocity is performed. Section 4 is devoted to the analysis of the role of reciprocity in shaping the optimal delegation set granted by the principal. In Section 5 the case in which the principal can also offer monetary payments to the agent in order to align his preferences is examined; in Section 6 the empirical analysis is carried out and concluding remarks are provided in Section 7.

2 Related Literature

The economics literature has long studied contexts in which a principal delegates the right of taking a decision to a better informed agent. Holmström (1977) was the first to formalize the problem in terms of constrained delegation as the principal may wish to limit the agent's discretion. This occurs because the principal and the agent disagree on what project should be undertaken and the principal cannot use monetary incentives to align the agent's preferences. Building on Holmström's pioneering contribution, many authors have characterized the optimal delegation sets. Melumad and Shibano (1991) characterize the solution to the delegation problem when preferences are quadratic and the state of the world is uniformly distributed. Martimort and Semenov (2006) determine a sufficient condition on the distribution of the state of the world for interval delegation to be optimal. Alonso and Matouschek (2008) provide a comprehensive characterization of the optimal delegation set allowing for general distributions and more general utility functions. We follow this tradition by developing a delegation model in which the principal must decide how much discretion to give to an agent who may be sensitive to reciprocity. We also consider a setting in which the set of the states of the world is continuous and the agent is biased towards larger projects.

Our paper is most closely related to Englmaier et al. (2010), who also develop a model in which the agent has a predilection for larger projects. They study how the provision of monetary incentives and discretion to an agent varies with the horizon of the relationship. The agent observes a signal about the state of the world which can be either right or wrong. Both the agent and the principal do not know whether the former has observed the right signal and

the agent also derives personal benefits from taking larger actions. The authors find that the level of discretion is positively associated with stronger monetary incentives and the length of the relationship. We do not explore the role of repeated interaction and career concerns but we focus on the impact of reciprocity concerns on the delegation set granted to the agent. Moreover, we borrow from them the definition of discretion.

In our paper, the agent is motivated by reciprocity. Indeed, in the last decades, experimental evidence has shown that individuals have reciprocity concerns (for a review, see Fehr and Schmidt, 2006). The gift-exchange game introduced by Fehr et al. (1993) shows that workers are willing to reward actions that are perceived as kind.[6] In addition, experimental evidence on the ultimatum game indicates that a substantial fraction of agents is willing to punish behavior that is perceived as hostile (see for example Güth et al., 1982, Gale et al., 1995, and Roth and Erev, 1995). Similarly, Falk and Kosfeld (2006) argue that individuals may perceive control as a signal of distrust and experimentally find that agents exert less effort when principals restrict their choice set.

Our concept of reciprocity is borrowed from Rabin (1993), Dufwenberg and Kirchsteiger (2004), Falk and Fischbacher (2006), and von Siemens (2013). A reciprocal agent responds to actions he perceives to be kind in a kind manner, and to actions he perceives to be hostile in a hostile manner. In these models, preferences do not only depend on material payoffs but also on beliefs about why an agent has chosen a certain action. These models require the use of the sophisticated tools of psychological game theory (see Geanakoplos et al., 1989). Having several states of the world about which only the agent is perfectly informed makes it hard to apply the more elaborate models of reciprocity. For this reason, we content ourselves with a simplified treatment of reciprocity which is still able to convey useful insights about its role in a delegation problem. We base the definition of kindness on the observation that a larger delegation set benefits the agent. The more discretion the principal grants to the agent, the higher the agent's perceived principal's kindness. In our modeling approach we follow Englmaier and Leider (2012) who find a very tractable way of embedding reciprocity in a principal-agent model. Englmaier and Leider (2012) develop a moral-hazard model in which an agent has reciprocal preferences towards the principal and reciprocal motivations are a source of incentives. They find that a higher fixed wage and explicit performance-based pay are substitutes and that the optimal contract entails an optimal mix of both incentive forms. If the agent is very sensitive towards reciprocity or output is a poor signal of effort, the use of performance-based compensation is less effective in inducing the agent to exert effort. Then the principal will pay a higher fixed wage to motivate the agent.[7] In a related vein, Dur (2009) considers a manager-employee relationship in which managers may be innately altruistic towards their employees and employees are conditionally altruistic towards their managers. While Englmaier and Leider (2012) assume

[6] In this experiment, workers increase their level of effort if they receive a higher wage. Despite the presence of selfish workers, the relation between average effort and wages is sufficiently steep as to make a high-wage policy profitable.

[7] The idea explored by Englmaier and Leider (2012) is based on the works of Akerlof (1982) and Akerlof and Yellen (1990). Akerlof (1982) assumes that if a firm pays wages above the market clearing price, i.e. the firm gives its employees a gift, employees reciprocate by increasing their effort provision. In a similar way, Akerlof and Yellen (1990) argue that employees reduce their effort whenever they are paid less than a fair wage. These articles are implicitly focused on a moral hazard situation even if asymmetric information and incentives do not play an important role.

that the principal induces reciprocity by leaving a monetary rent to the agent, Dur (2009) assumes that reciprocity can also be induced by the manager's attention. Dur (2009) shows that an altruistic manager always gives attention to the employee and may pay a lower wage than an egoistic manager. Dur et al. (2010) also study optimal incentive contracts paid to employees who are sensitive to reciprocity, which is stimulated by the principal's attention. Using survey data representative for the German population, Dur et al. (2010) find that employees who are more sensitive to reciprocity are significantly more likely to receive promotion incentives.

3 The Model

We develop a delegation model where a principal may find it profitable to grant some discretion over the choice of a project to an agent. The benefits of delegation stem from the agent's superior information regarding the best course of action. The potential costs of delegation are associated with the conflict of interest between the principal and the agent. In particular, we assume that the agent's and the principal's favorite project may differ. Therefore, the principal faces a trade-off between the *gain of information* and the *loss of control*. We study how the principal can address this conflict of interest by limiting the agent's discretion. In what follows, we first describe and solve the model when the agent has standard preferences, and we subsequently study how the agent's reciprocity concerns affect the optimal solution.

3.1 The Basic Set-up

Information. We consider a principal who may delegate the right to choose a project to a better informed agent. Specifically, the agent privately observes the state of the world, whereas the principal only knows its distribution. The state of the world is denoted by $\omega \in \Omega = [0, n]$ and is distributed according to a continuous uniform distribution function.

Payoffs and Conflict of Interest. The principal may refrain from delegating the choice of the project, assigning the agent a standard task $\tilde{d}$. This standard task generates a small payoff s for the principal and 0 for the agent with certainty.[8] If the principal delegates the choice of the project, the principal's and the agent's payoff depend on both the agent's decision and the state of the world. The decision d yields a success with probability $p \in (0, 1)$ if $d = \omega$, and 0 otherwise.

A successful project generates a payoff S for the principal and αS for the agent. The parameter $\alpha \geq 0$ captures how congruent the preferences of the agent and the principal are. An agent may derive some benefits, captured by αS, from having managed a successful project, e.g. a success may boost the agent's career or just make him proud.[9] In addition, we assume that the

[8] The payoff the principal attains when she assigns a standard task to the agent may also include the intrinsic value that she attaches to holding the decision right. The existence of a taste for control has recently found support in experimental research (Fehr et al., 2013, and Bartling et al., 2014).

[9] Alternatively, the parameter α may capture the agent's altruism: when choosing the project which coincides with the state of the world, the agent is taking an action that benefits the principal. Notice that, unlike reciprocity, altruism is a form of unconditional kindness, i.e. it does not depend on the action taken by the other party (e.g., see Cox, 2004). Following this interpretation, in our model the agent would exhibit both altruism and reciprocity

agent obtains private benefits from the project, $b(d) = \underline{b} + g(d)$, irrespective of its outcome. We assume that $\underline{b} > 0$ to indicate that the agent always obtains a fixed benefit from being delegated the choice of the project, e.g. he likes to be trusted by the principal. Moreover, we assume that $g'(\cdot) > 0$, $g''(\cdot) > 0$ with $g(0) = 0$ and $g'(0) = 0$. This means that the agent is increasingly biased towards larger decisions.[10] This is the case when the marginal private benefits that an agent derives from a project are increasing in its size. Consider, for instance, a scientist who may prefer to pursue an ambitious cure to a disease which could win him international fame and colleagues' recognition than make marginal improvements upon a standard treatment. The latter option may well be preferred by the firm, which is just interested in maximizing profits. The conflict of interest between the principal and the agent on which decisions should be taken is more severe when α is smaller and g more convex.

Both the principal and the agent are risk-neutral and have zero outside option. To summarize, the principal's expected utility is:

$$u_P = \begin{cases} s & \text{if } d = \tilde{d} \\ pS & \text{if } d = \omega \\ 0 & \text{if } d \neq \{\omega, \tilde{d}\} \end{cases} \tag{1}$$

and the agent's expected utility is:

$$u_A = \begin{cases} 0 & \text{if } d = \tilde{d} \\ \alpha pS + b(\omega) & \text{if } d = \omega \\ b(d) & \text{if } d \neq \{\omega, \tilde{d}\} \end{cases} \tag{2}$$

Contracts. We assume that the principal is able to restrict the set of decisions from which the agent can choose. In particular, the principal chooses a compact decision set $D \subseteq \Omega$ and we say that the agent is granted more *discretion* when this set encompasses more projects. In Section 5, we let the principal offer monetary payments in addition to the delegation set in order to align the agent's preferences.

Timing of the game. *In stage 1*, the principal chooses between the set of decisions D and the standard task $\tilde{d}$. In the latter case, the agent performs the task and the game ends. Otherwise, the game proceeds as follows. *In stage 2*, the agent observes the state ω. *In stage 3*, the agent chooses $d \in D$. *In stage 4*, payoffs are realized.

Assumption 1. *Throughout the paper we maintain the following:*

$$pS + \alpha pS \geq b(n) - b(0) = g(n).$$

The above condition implies that it is always socially optimal to choose the project that coincides with the state of the world, that we henceforth call *the right project*.

concerns.

[10] We have made some restrictions on the function $g(\cdot)$ and the distribution of the states of the world. In general, our results hold when both the following weak inequalities are satisfied (at least one with strict inequality): $g''(\cdot) \geq 0$ and $f'(\omega) \leq 0$ for all $\omega \in \Omega$, where $f(\cdot)$ denotes the probability density function of the states of the world. Notice that there is a close relationship with Assumption 1 in Englmaier et al. (2010).

3.2 Benchmark: Optimal Delegation without Reciprocity

The principal's problem is to choose how much discretion to grant to the agent, if any.[11] If the principal delegates, she chooses the decision set D to maximize the following expected utility:

$$E_\omega u_P(d^*(\omega, D), \omega) = pSPr[d^*(\omega, D) = \omega] \tag{3}$$

subject to the agent's incentive compatibility constraint:

$$d^*(\omega, D) \equiv \arg\max_{d \in D} E[u_A|\omega, D] \tag{4}$$

Let h be the maximum element of D, i.e. the largest decision the agent is allowed to take. The following lemma characterizes the optimal agent's choice:

Lemma 1. *If $\omega \in D$ the agent chooses either $d = \omega$ or $d = h$. If $\omega \notin D$ the agent chooses h.*

If the state of the world belongs to the set of allowable decisions, the agent's choice is in fact dichotomic. The agent will pick either the right project, i.e. $d = \omega$, obtaining an expected payoff of $\alpha pS + b(\omega)$, or the wrong project which gives him the maximum private benefit, i.e. $b(h)$. Whenever the state of the world does not belong to D, the best the agent can do is to choose h.

As for the principal's delegation choice, the following lemma shows that this takes the form of a decision set which, without loss of generality, includes all the projects smaller than h and induces the agent to choose the right project whenever this is available:

Lemma 2. *The principal's delegation choice takes the form: i) $D_{h^*} \equiv [0, ..., h^*]$; ii) h^* is set in such a way that $d^*(\omega, D_{h^*}) = \omega \quad \forall \omega \in D_{h^*}$.*

This allows us to focus on the choice of the optimal h. The principal's problem can be restated as follows:

$$\max_{h \in \Omega} \frac{h}{n} pS \tag{5}$$

subject to the agent's incentive compatibility constraint:

$$\alpha\, p\, S + b(\omega) \geq b(h) \quad \forall \omega \in D_h - h. \tag{6}$$

This condition means that the agent must be weakly better off if he chooses the right project when this is available rather than the one which gives him the maximum private benefits, whose associated payoff we henceforth call the *agent's temptation*. The tightest incentive compatibility constraint occurs when $\omega = 0$ and can be written as:

$$\alpha\, p\, S + b(0) \geq b(h) \Leftrightarrow \alpha\, p\, S \geq g(h). \tag{7}$$

When the tightest incentive compatibility constraint is satisfied, the agent always chooses the right project when available. Proposition 1 illustrates that the optimal h is determined from the tightest incentive compatibility constraint. Before stating this result, it is useful to define γ as the inverse of the function g, with $\gamma' > 0$, $\gamma'' < 0$.

[11] Notice that the problem can also be stated in terms of a direct mechanism design problem where the agent is asked to report the state of the world and the principal commits to a decision rule which maps the report to the selection of a project. The equivalence is due to the inability of the principal to observe the true state of the world.

Proposition 1. *The optimal maximum element of D satisfies the following:*

$$h^* = \min\{\gamma(\alpha pS), n\}. \tag{8}$$

This proposition establishes that the optimal level of discretion h^* is positively correlated with the non-monetary benefits accruing to the agent from managing a successful project and negatively correlated with the steepness of the function $g(\cdot)$ which represents his private benefits for larger projects and captures the conflict of interest with the principal. If the conflict of interest between the parties is not very severe, the agent may be granted full discretion.

In stage 1 the principal compares her utility when she delegates $[0, h^*]$ and s, i.e. the payoff of the standard task $\tilde{d}$. The principal will delegate authority over the choice of the project to the agent if and only if:

$$\frac{h^*}{n} pS \geq s \Leftrightarrow h^* \geq \frac{ns}{pS}. \tag{9}$$

4 Delegation with a Reciprocal Agent

In this section we augment the model developed so far by assuming that the agent may be motivated by reciprocity and we study the interaction between reciprocity and discretion. As discussed in the introduction, a reciprocal individual responds to actions he perceives to be kind in a kind manner, and to actions he perceives to be hostile in a hostile manner (see Rabin, 1993, Dufwenberg and Kirchsteiger, 2004, Falk and Fischbacher, 2006, and von Siemens, 2013).

The agent's utility given the state of the world ω and a decision set D_h now consists of his material payoff and his reciprocity payoff:

$$U_A(d^*(\omega, D_h)|\omega) = \underbrace{u_A(d^*(\omega, D_h)|\omega)}_{\text{Agent's Material Payoff}} + \underbrace{\eta\, k_{PA}(D_h) u_P(d^*(\omega, D_h)|\omega)}_{\text{Reciprocity Payoff}} \tag{10}$$

In the above expression, the term $\eta \in [0, 1]$ represents the agent's sensitivity to reciprocity. The agent is more concerned about the kindness/hostileness of the principal's action when this parameter is higher. $k_{PA}(D_h)$ is the agent's perceived principal's kindness. This is positive when the principal's action is perceived as kind and is negative when it is perceived as hostile. Its sign and value depend on how much discretion the principal grants to the agent. We devote the next subsection to the characterization of $k_{PA}(D_h)$. Finally, as it is standard in the literature on reciprocity, the agent takes into account how his action affects the principal's material payoff u_P.

4.1 The Agent's Perceived Principal's Kindness

In our setup the only action the principal takes is to decide how much discretion to grant to the agent. A reciprocal agent will perceive the principal as friendly or hostile depending on this action and will respond accordingly. Since granting more discretion has a positive impact on the agent's material payoff, we postulate a positive relationship between discretion and the agent's perceived principal's kindness. In the following lemma, we formally prove the observation that more discretion increases the agent's material payoff.

Lemma 3. *If $D' \subset \hat{D} \subseteq \Omega$, it holds that*

$$E_\omega u_A(\omega, \hat{D}) \geq E_\omega u_A(\omega, D') \tag{11}$$

If $D' \subset \hat{D} \subseteq \Omega$ and $h' < \hat{h}$, where h' and $\hat{h}$ are the maximum elements of D' and $\hat{D}$, respectively, then the above inequality holds strictly.

In fact, we can consider the agent's perceived principal's kindness as a function of the maximum element of the delegation set h. This is because it is without loss of generality for the principal to grant a delegation set of the form $D_h = [0, ..., h]$ as the following lemma shows:

Lemma 4. *When $\eta \geq 0$ it is without loss of generality for the principal to set a delegation set of the form: $D_{h^R} \equiv [0, ..., h^R]$.*

We make some general assumptions on the functional form of k_{PA}. In particular, we assume that $k_{PA}(h)$ is continuous, belongs to the interval $[-1, 1]$, with $k'_{PA} > 0$ for all $h \in (0, n)$. The perceived principal's kindness takes positive values when the discretion granted by the principal is greater than some *reference point* that we abstain from modeling explicitly. The reference point is a level of discretion that the agent considers to be fair. As such, it can be affected by a number of variables, like the amount of discretion an agent receives relative to his peers' or the range of possibilities of the principal. In contrast to most of the existing literature, we refrain from adopting a specific view of what the agent considers as a fair payoff, but we just suppose that the agent regards the principal as kinder the more discretion she grants him.[12] We will later make some specific assumptions on the functional form of k_{PA} and we will provide an example of a reference point.

4.2 Effect of Reciprocity on Delegation

If $\eta = 0$ we are back to the setting illustrated in the previous section. If $\eta > 0$ the solution $D_{h^*} = [0, .., h^*]$ ceases to be optimal. If the principal continues to implement the solution without reciprocity, expecting the agent to always select the right project when available, either of the following situations may occur. For one, if the agent perceives the principal's choice of delegating D_{h^*} as *kind*, i.e. $k_{PA}(h^*) > 0$, the agent might weakly prefer $d = \omega$ to $d = h'$ when ω is very small for some $h' > h^*$. In that case, the principal would not be enjoying all the benefits of delegation. Conversely, if the agent perceives the principal's choice of delegating D_{h^*} as *hostile*, i.e. $k_{PA}(h^*) < 0$, the agent would be willing to retaliate and for ω small enough he might choose $d = h^*$. Therefore, we need to consider the sign of $k_{PA}(h^*)$ to determine whether or not the agent judges the action of the principal as kind or hostile. Consider, for instance, what happens when $\omega = 0$. Incentive compatibility requires

$$\alpha pS + \eta\, k_{PA}(h^*) pS \geq g(h^*)$$

[12] Notice also that in our model the agent does not take into account the underlying intention of the principal to evaluate her kindness. In other papers in the literature on reciprocity, intentions play a fundamental role (e.g. Rabin, 1993; Dufwenberg and Kirchsteiger, 2004). Despite being less sophisticated, our modeling approach still conveys some of the key features of reciprocity, namely that an individual's perception of how he has been treated by the others affects his well-being and consequently his actions. In this respect, there are close similarities with the approach followed by Englmaier and Leider (2012).

If $k_{PA}(h^*) < 0$ this inequality may not hold anymore and the agent may prefer to choose $d = h^*$. When the sign of the principal's kindness is positive, the above incentive compatibility condition holds but it is slack. Then, the principal could be better off setting a higher limit to the agent's discretion.

Through its effect on the agent's material payoff, the principal's choice of h also affects the agent's reciprocity payoff. Like in the previous section, a marginal increase in h positively affects the agent's temptation, and this is captured by $g'(h)$, which makes it more difficult to satisfy incentive compatibility. On the other hand, granting more discretion has a positive impact on the reciprocity payoff as the principal is perceived by the agent as kinder or less hostile. The marginal impact of h on the reciprocity payoff is captured by $\eta k'_{PA}(h)pS$, which is increasing in η, and makes it easier for the incentive compatibility constraint to hold.

Plausibly, the agent evaluates more the direct effect of selecting a larger project on his material payoff than the indirect effect due to his perception of the principal's kindness, which is associated with the possibility of selecting it. For this reason, in what follows we maintain the following assumption:

Assumption 2. *For all $h \in (0, n)$, it holds that:*

$$g'(h) > \eta k'_{PA}(h)pS$$

A marginal increase in the delegation set has a greater impact on the agent's temptation than on the reciprocity payoff. When this assumption holds, the delegation set is chosen in such a way that the agent selects the right project whenever this is available, as shown in the following lemma.[13]

Lemma 5. *h^R is set in such a way that $d^R(\omega, D_{h^R}) = \omega \quad \forall \omega \in D_{h^R}$.*

In the next subsection, we examine the optimal amount of discretion received by the agent and we study how this is affected by a change in his sensitivity to reciprocity.

4.3 Optimal Delegation with Reciprocity

When the principal delegates, she solves the following problem:

$$\max_{h \in \Omega} \frac{h}{n} pS \tag{12}$$

subject to the agent's incentive compatibility constraint:

$$\alpha\, p\, S + b(\omega) + \eta k_{PA}(h)pS \geq b(h) \quad \forall \omega \in [0, h) \tag{13}$$

The tightest incentive compatibility is then:

$$\alpha pS + \eta k_{PA}(h)pS \geq g(h) \tag{14}$$

[13] This makes the problem of characterizing the delegation set univariate. If this assumption did not hold, the principal might prefer to increase the delegation set even if the agent might select a wrong project when the state of the world were small enough. However, the principal's problem would become difficult to solve, since the agent's incentive compatibility constraint would not be convex and, therefore, the Karush-Kuhn-Tucker conditions would not guarantee the sufficiency of the optimal solution. Moreover, it would mean that an increase in h has a lower impact on the agent's material payoff than on his reciprocity payoff. However the latter is increasing exactly because of the rise in the material payoff.

Proposition 2 illustrates the optimal delegation set granted by the principal when the agent is motivated by reciprocity.

Proposition 2. *When the agent is motivated by reciprocity and the principal delegates, she sets $h^R = n$ if*

$$n \leq \gamma((\alpha + \eta)pS) \tag{15}$$

Otherwise, the principal sets h^R equal to the maximum value of $h \in [0, n)$ which implicitly solves the following equation:

$$\alpha pS + \eta k_{PA}(h)pS = g(h) \tag{16}$$

if it exists. If such h^R does not exist, the principal never delegates.

As the principal's utility is strictly increasing in h, she will grant the agent full discretion when at $h^R = n$, (14) is satisfied. Namely, when

$$n \leq \gamma((\alpha + \eta)pS)$$

If at $h^R = n$, (14) is not satisfied, then the principal sets h^R equal to the maximum value of $h \in [0, n)$ which implicitly solves the following equation:

$$\alpha pS + \eta k_{PA}(h)pS = g(h) \tag{17}$$

if it exists. If such h^R does not exist, the principal never delegates and gives the agent the standard project.

The agent's sensitivity to reciprocity may crucially affect the optimal delegation set. To have a better understanding of the effect of changes in η on h^R we now carry out a comparative statics analysis. To this end, it is useful to define h^F as the value of h such that k_{PA} evaluated at h^F is equal to 0. This means that the agent perceives h^F as the *fair* level of discretion. A level of discretion greater than h^F is perceived by the agent as a gift, because the principal is delegating more than what the agent considers as fair or equitable. In contrast, the agent perceives the principal's behavior as unfriendly if she delegates less than h^F. For the Intermediate Value Theorem there exists an $h^F \in (0, n)$ such that $k_{PA}(h^F) = 0$. The following proposition shows how the agent's sensitivity to reciprocity affects the optimal level of discretion and thereby the principal's utility.

Proposition 3. *If $h^* \geq h^F$, the principal is always weakly better off if the agent's sensitivity to reciprocity increases, i.e. $\frac{\partial h^R}{\partial \eta} \geq 0$. If $h^* < h^F$, the principal is always weakly worse off if the agent's sensitivity to reciprocity increases, i.e. $\frac{\partial h^R}{\partial \eta} \leq 0$.*

Therefore, how the sensitivity to reciprocity affects the optimal level of discretion critically depends on the conflict of interest between the principal and the agent.

When the underlying conflict of interest is relatively small, i.e. $h^* \geq h^F$, the principal can grant at least h^* to a reciprocal agent.[14] Since the agent would perceive the principal as kind, he would be willing to reward her. This means that the agent would choose the smallest but right project over some projects larger than h^*. As a result, the principal finds it profitable to

[14] This is a situation in which the agent would get broad discretion even if $\eta = 0$, e.g. the agent's and the principal's interests are substantially aligned.

increase the delegation set. The higher η, the more discretion the principal will grant up to the point where she will give full discretion.

When the underlying conflict of interest is severe, i.e. $h^* < h^F$, the principal cannot continue to grant the same level of discretion as when $\eta = 0$. In this case, the agent would perceive her as unfriendly and would be willing to retaliate. The principal can never take advantage of an increase in η to give more discretion. If she grants an $h > h^F > h^*$ for any $\eta \in (0, 1]$ the agent will not always choose the right project when it is available. This is because granting larger projects has a stronger impact on the agent's material than reciprocity payoff. For η sufficiently greater than 1, the dominance between the two effects would be reversed and the principal could benefit from granting more discretion. However, this would imply that the agent values more the reciprocity than the material payoff. As a result, for $\eta \in (0, 1)$ a marginal increase in the agent's sensitivity to reciprocity leads the principal to restrict the amount of discretion.

To summarize, reciprocity has opposing effects on the optimal level of delegation. It alleviates a mild conflict of interest up to the point where this disappears, thereby enabling the principal to grant full discretion. However, it exacerbates a severe conflict of interest, thereby rising the likelihood that the principal retains authority and assigns the agent the standard task.

Our model predicts that when an agent has reciprocity concerns, the delegation decision will tend to be starker, namely will be closer to either full or no discretion.

4.4 An Illustrative Example

To clarify the relationship between the agent's reciprocity concerns and discretion, let us develop an illustrative example in which we consider a specific functional form for $k_{PA}(h)$.

Akin to other papers in the literature on reciprocity (see Rabin, 1993, Dufwenberg and Kirchsteiger, 2004, and Falk and Fischbacher, 2006), we assume that the agent perceives the principal's kindness as the difference between the agent's *effective payoff* and the *equitable payoff*, which serves as a reference point. For effective payoff we mean the maximum private benefits that the agent can achieve given the actual delegation set. For equitable payoff we mean the average between the minimum and the maximum private benefits that the principal may provide to the agent consistently with the actions she could take in the first stage of the game. Formally, we define the agent's perceived principal's kindness when D_h is delegated as follows:

$$k_{PA}(h) = \frac{b(h) - \frac{b(n)}{2}}{\frac{b(n)}{2}} = \frac{\frac{\underline{b}}{2} + g(h) - \frac{g(n)}{2}}{\frac{\underline{b}}{2} + \frac{g(n)}{2}}. \tag{18}$$

In the above expression, $b(h)$ represents the effective payoff whereas $\frac{b(n)+0}{2}$ represents the equitable payoff, since $b(n)$ is the maximum private benefit that the principal may provide to the agent (full discretion) and 0 is the minimum (no discretion). Notice that we consider the difference between effective and equitable payoffs relative to the equitable payoff. As a result of this normalization, k_{PA} takes values in the interval $(-1, 1]$ when $D \subseteq \Omega$. When $h = n$, $k_{PA}(n) = 1$. When $h = 0$,

$$k_{PA}(0) = \frac{\frac{\underline{b}}{2} - \frac{g(n)}{2}}{\frac{\underline{b}}{2} + \frac{g(n)}{2}}$$

which can be either positive or negative depending on $\underline{b}$, the convexity of the function $g(\cdot)$ and the total number of possible projects n. The above expression tends to -1 when $\underline{b}$ goes to 0.

As for the derivative of $k_{PA}(h)$ with respect to h, this is always positive for $h \in (0, n)$ and is equal:

$$\frac{\partial k_{PA}(h)}{\partial h} = \frac{2g'(h)}{\underline{b} + g(n)}.$$

This is greater than 0 as $g'(h) > 0$.

In this example, the impact of h on the reciprocity payoff is given by $\eta \frac{2g'(h)}{\underline{b}+g(n)} pS$, while that on the agent's temptation is $g'(h)$. For Assumption 2 to hold it must be that

$$\underline{b} + g(n) > 2\eta pS.$$

Panel (a) of Figure 1 shows that when the underlying conflict of interest is severe, i.e. $h^* < h^F$, an increase in η leads to a reduction in the agent's discretion up to the point in which the principal would set $h^R = 0$. We take the following values: $g(h) = h^2, \alpha = 0.7, p = 0.8, S = 6, b = 1$, and $n = 3$. In Panel (b) of Figure 1 we graphically represent the relationship between η and h^R when the underlying conflict of interest is not very severe, i.e. $h^* > h^F$. As compared to Panel (a), the only difference that we have made in the values of the parameters is that α is now equal to 0.9. This means that the agent's and the principal's interest in the success of the project are substantially aligned. As η rises, the principal can grant more and more discretion up to the point in which $h^R = n$.[15]

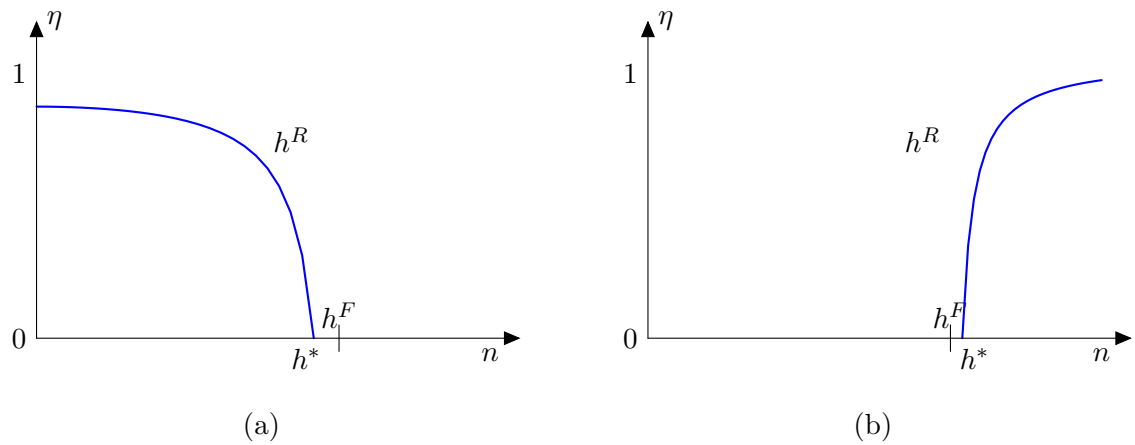


Figure 1: The effect of η on the optimal amount of discretion.

4.5 Two Traits of Reciprocity

So far we have assumed that we only have one parameter that captures the agent's reciprocity concerns. However, our model can be easily adapted when an agent responds differently to a kind (positive reciprocity) and to a hostile (negative reciprocity) behavior. To do so, consider two parameters η_1 and η_2 that represent the agent's sensitivity to positive and negative reciprocity, respectively. Equation (10) can be rewritten in the following way:

$$\begin{aligned} U_A(d^*(\omega, D_h)|\omega) = u_A(d^*(\omega, D_h)|\omega) + \\ + \eta_1 \max\{k_{PA}(D_h), 0\} u_P(d^*(\omega, D_h)|\omega) + \\ + \eta_2 \min\{k_{PA}(D_h), 0\} u_P(d^*(\omega, D_h)|\omega) \end{aligned} \tag{19}$$

[15] Notice that Assumption 2 is satisfied with these values of the parameters.

Positive (negative) reciprocity kicks in only when the principal's action is perceived as kind (hostile). Considering separately positive and negative reciprocity does not contradict our theoretical analysis. Specifically, if the underlying conflict of interest is severe only negative reciprocity plays a role and it impacts negatively on the amount of discretion. In contrast, only positive reciprocity plays a role and its impact on the amount of discretion is positive when the conflict of interest is mild.

5 Delegation and Transfers

In this section we relax the assumption that the principal is unable to offer monetary payments to the agent. In Subsection 5.1, we consider a setting in which the principal can only offer a fixed wage to the agent. This assumption can be justified if, for instance, the agent is infinitely risk-averse with respect to income shocks and, as a result, he is unresponsive to bonuses tied to the success of the project.[16] In Subsection 5.2, we assume that the agent is no longer unresponsive to income shocks and the principal can commit to a bonus conditional on the success of the project.

Throughout, we assume that the agent is protected by limited liability so that the principal cannot extract his surplus setting a negative wage. Moreover, we assume that the principal cannot commit to transfers contingent on the selected project. Although this assumption is strong considering that the principal is able to describe projects, it considerably simplifies the analysis and enables us to better focus on the interplay between wages and performance bonuses as alternative tools to induce the agent to choose the right project. Furthermore, it can be shown that tying payments to the selected project does not alter qualitatively the results of the analysis. To this end, before concluding this section, we briefly provide some intuition on the main consequences brought about by the possibility of writing complete contracts.

5.1 Wage Policy

Suppose that the agent can receive a fixed wage t. The principal's expected utility is now equal to:

$$\frac{h}{n}pS - t \tag{20}$$

when she delegates the project decision to the agent.

When the agent is not motivated by reciprocity, the principal optimally sets $t^* = 0$. This is because the principal dislikes paying a positive wage and t does not have any effect on the agent's incentive constraint.

When the agent is motivated by reciprocity, we assume that a higher wage impacts positively on the agent's perceived principal's kindness, i.e. $\frac{\partial k_{PA}(h,t)}{\partial t} > 0$. This is reasonable because the wage has a positive effect on the agent's material payoff and, being unconditional, can be interpreted as a gift. We continue to assume that $k_{PA}(h,t) \in [-1,1]$.

The principal has an additional instrument to affect the agent's decision on top of the delegation set. Through its effect on the agent's reciprocity payoff, a higher wage helps satisfy the agent's incentive compatibility constraint. However, the principal would rather grant more

[16] This type of preferences is often used in this literature (see, for example, Aghion and Tirole, 1997).

discretion than raise the agent's wage: a higher h would increase the principal's expected payoff, whereas a higher t would increase the fraction of the expected payoff the principal shares with the agent, as can be seen from (20). However, when the principal copes with the incentive problem, she may need to pay a positive wage. This can be seen from the tightest incentive compatibility constraint, which can be written as:

$$\alpha pS + t + \eta k_{PA}(h,t)(pS - t) \geq g(h) + t + \eta k_{PA}(h,t)(-t)$$

Namely:

$$\alpha pS + \eta k_{PA}(h,t)pS \geq g(h) \tag{21}$$

As illustrated before, the choice of h affects the agent's incentives in two counteracting ways. First, it increases the agent's perception of the principal's kindness. Second, it raises the agent's temptation to choose the highest project even when this is not the right one. In contrast, a higher t has only a positive effect on the agent's incentives, since it improves how the agent perceives the principal's kindness without affecting the agent's temptation.

To determine whether the principal is being kind/unkind, the agent takes into account that the highest wage he can receive is positively related to the level of discretion. This is because the principal's expected payoff is increasing in the level of discretion granted to the agent, and so is the highest wage she can rationally be willing to pay. In particular, such highest individually-rational wage is increasing in h and reaches its maximum when $h = n$. In that case, it is equal to $pS - s$, because s is the payoff the principal obtains if she does not delegate.[17] Therefore, when the principal gives the agent full discretion, the agent can at most obtain the maximum private benefits $b(n)$ and the maximum wage $pS - s$. In general, for a given level of discretion h, the maximum individually-rational wage the principal can pay is $\frac{h}{n}pS - s$.

When the principal can pay a wage to the agent, the agent's perception of what represents the fair level of discretion, h^F, changes. This can now be represented by a function of t, that is $h^F(t)$. Intuitively, since the agent can receive a transfer from the principal, he expects to receive *at least* some positive amount of money or has to be compensated with more discretion than before to perceive the principal as fair. This implies that $h^F(t = 0) > h^F$. Put differently, in itself the effect of h on the agent's perception of the principal's kindness is dampened when the principal has this additional instrument at her disposal. As a result, when the agent reciprocates, the principal may be worse off when she is able to pay a fixed wage.

Denote by h^T and t^T the optimal amount of discretion and the optimal wage, respectively. Consider that for the principal to benefit from being able to pay a fixed wage, two conditions must be simultaneously satisfied. First, the possibility of paying a wage must increase the level of discretion, i.e. $h^T > h^R$. Second, provided that the first condition is met, the benefits stemming from granting more discretion must more than offset the wage bill. Namely, it must be that:

$$\frac{h^T - h^R}{pS} \geq t^T \tag{22}$$

The following proposition provides a sufficient condition for the principal to be (weakly) worse off when she can pay the agent a wage.

[17] Obviously, the principal contemplates delegating only if she can get at least s.

Proposition 4. *The principal is weakly worse off when she can pay the agent a fixed wage if:*

$$\frac{\partial k_{PA}(h^R)}{\partial h} - \frac{\partial k_{PA}(h^T, t^T)}{\partial h} \geq \frac{pS}{n} \frac{\partial k_{PA}(h^T, t^T)}{\partial t}. \tag{23}$$

For this condition to be satisfied, it must be that the difference in the impact of an increase in the equilibrium level of delegation on the agent's perceived principal's kindness when the principal cannot pay a wage and when she can (the left-hand side of equation 23) is greater than the impact of an increase in t on $k_{PA}(h, t)$.

In this section we have highlighted that when the agent is expected to reciprocate, the principal is more likely to pay a positive wage when she wants to grant some discretion over the choice of the project. Otherwise, the agent might perceive to be treated unfairly and might be willing to retaliate by choosing a project which does not benefit the principal. This argument squares well with the human-resource management literature on high-performance work systems (HPWS). This literature argues that employees are expected to contribute more ideas than under traditional Taylorist-like workplaces. Salaries should be high so as to motivate employees to gather and use information relevant to solve the problems that may arise. In our model, an employer *must* pay a higher wage to a reciprocal employee who enjoys more discretion to avoid that he use his autonomy in a way that hurts the employer.[18]

5.1.1 The Illustrative Example Again

Let us bring up again our illustrative example to better show how the possibility of paying a wage to the agent dampens the positive effect of h on the agent's perceived principal's kindness. We need to amend our definitions of effective and equitable payoffs. The former will also include the wage paid by the principal. The latter will consider the average between the maximum and the minimum private benefits and wages that the principal is able to pay. The maximum individually rational payoff that the principal can give to the agent is $b(n) + (pS - s)$, whereas the minimum is 0.

The equitable payoff is larger than when the principal cannot pay a wage to the agent and therefore the condition under which h can be used as an instrument is harder to satisfy. To see this, consider that the tightest incentive compatibility constraint can be written as follows:

$$\alpha pS + \eta \frac{[\underline{b} + g(h) + t] - [\frac{\underline{b}}{2} + \frac{g(n)}{2} + \frac{pS-s}{2}]}{\frac{\underline{b}}{2} + \frac{g(n)}{2} + \frac{pS-s}{2}} pS \geq g(h)$$

A marginal increase in h has a positive impact on the agent's incentives thanks to its effect on the perceived principal's kindness:

$$\eta \frac{g'(h)}{\frac{\underline{b}}{2} + \frac{g(n)}{2} + \frac{pS-s}{2}} pS,$$

but it also has a positive impact on the agent's temptation, i.e. the right-hand side increases by $g'(h)$. The positive effect on the incentive dominates the negative one if:

$$\eta pS \geq \frac{\underline{b}}{2} + \frac{g(n)}{2} + \frac{pS}{2} - \frac{s}{2},$$

[18] Another explanation for the positive relationship between wage and delegation is provided by Bartling et al. (2012). In an experiment, these authors assume that workers are more productive if they have discretion and show that paying higher wages and giving more discretion are complements, since higher wages may induce employees to exert more effort in the presence of reputation concerns.

which can be rewritten as

$$pS\left[\eta - \frac{1}{2}\right] \geq \frac{b}{2} + \frac{g(n)}{2} - \frac{s}{2}.$$

Notice that when $\eta \leq \frac{1}{2}$, this inequality is never satisfied which implies that the effect of h on the reciprocity payoff outweighs that on the agent's temptation only if η is particularly high.

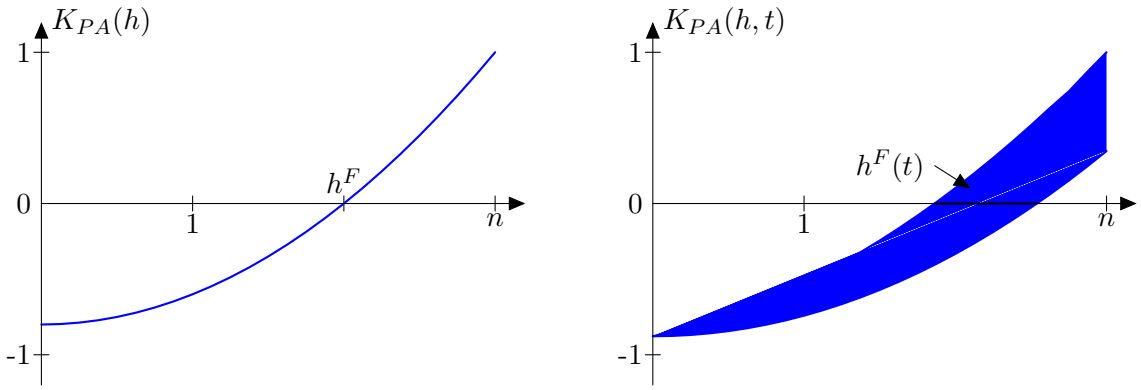
Conversely, when transfers cannot be exchanged the condition is

$$\eta pS \geq \frac{b}{2} + \frac{g(n)}{2},$$

which is easier to satisfy. In particular, η need not be greater than $\frac{1}{2}$ for the above inequality to hold.

In contrast, t always has a positive effect on the agent's incentives as it raises the perceived principal's kindness and therefore t^R may be strictly positive. Its incentive role is likely to be stronger when η is small and the conflict of interest between the parties is somewhat severe so that a higher wage is more effective than more discretion in inducing the agent to comply.

In Figure 2, we compare the agent's perceived principal kindness when the principal cannot and can offer a wage. The fair level of discretion is a function of t in the second graph of Figure 2 and it is immediate to see that $h^F(t=0) > h^F$.



k_{PA} when the principal cannot offer a wage

k_{PA} when the principal can offer a wage

Figure 2

5.2 Wage and Performance Bonuses

We augment the analysis developed in the previous subsection by allowing the principal to also offer a performance bonus. Specifically we assume that the principal pays the agent a fixed wage t and a bonus β if the project undertaken is successful. The principal does not pay a bonus if the project does not succeed or if the standard action is implemented.

When the agent is not motivated by reciprocity $t^* = 0$ because a fixed wage does not have any incentive effect, as before. In contrast, the principal may make use of the performance bonus β to align the agent's preferences. To see this, consider that a positive bonus has a direct negative effect on the principal's utility, which can be rewritten as follows:

$$\frac{h}{n}p(S-\beta) - t \tag{24}$$

However, the bonus impacts positively on the agent's willingness to choose the right project, as can be seen from the tightest incentive compatibility constraint:

$$\alpha pS + p\beta \geq g(h) \tag{25}$$

Therefore, if $\alpha pS \geq g(n)$, then $h^* = n$ and the principal need not pay the agent a bonus, that is $\beta^* = 0$. Conversely, if $\alpha pS < g(n)$, there is a need to align the agent's incentives and β^* may be positive.

When the agent is motivated by reciprocity, both the fixed wage and the performance bonus can play a role in aligning the agent's preferences. The tightest incentive compatibility constraint is as follows:

$$\alpha pS + p\beta + \eta k_{PA}(h, t, \beta)p(S - \beta) \geq g(h) \tag{26}$$

Since a higher β has a positive effect on the agent's material payoff, we assume that the agent's perceived principal's kindness is increasing in β, that is $\frac{\partial k_{PA}(h,t,\beta)}{\partial \beta} > 0$. However, a higher β reduces the payoff the agent can give to the principal when he positively reciprocates. Specifically, the principal will not get pS, but just $p(S - \beta)$. This effect mitigates the overall positive impact of an increase in β on the left-hand side of (26), which we report below:

$$p + \eta \frac{\partial k_{PA}(h, t, \beta)}{\partial \beta} p(S - \beta) - \eta p k_{PA}(h, t, \beta) \geq 0 \tag{27}$$

Instead, the effect of an increase in t on equation (26) is similar to the one described in the previous subsection:

$$\eta \frac{\partial k_{PA}(h, t, \beta)}{\partial t} p(S - \beta) \geq 0 \tag{28}$$

The principal can motivate the agent to choose the right project through t and β. The following lemma illustrates the condition for which the principal uses the fixed wage instead of the bonus to align the agent's preferences.

Lemma 6. *The principal prefers to use t instead of β when:*

$$\left(\frac{h^B}{n} p \frac{\partial k_{PA}}{\partial t} - \frac{\partial k_{PA}}{\partial \beta} \right) \eta S > 1 - \eta k_{PA}, \tag{29}$$

where $h^B \in (0, n]$ is the optimal level of discretion when both t and β are available.

This condition can be satisfied only if the marginal effect of t on the agent's perceived principal's kindness outweighs that of β. From this inequality it is possible to see the interplay between the monetary incentives and the agent's sensitivity to reciprocity: When the agent has very little reciprocity concerns, i.e., η small, the principal is more likely to use a performance bonus rather than a fixed wage to motivate the agent.[19]

We conclude this section by pointing out what happens when the contract is complete in that the principal can also specify a transfer contingent on the selected project.[20] When the agent does not reciprocate, the principal can reduce the size of the bonus paid when the project is successful and it yields the agent some private benefits greater than $\underline{b}$. Therefore, the principal

[19] This result bears some resemblance to that highlighted by Englmaier and Leider (2012).

[20] A more detailed analysis which closely follows the proof strategy of the working-paper version of Englmaier et al. (2010), who face a somewhat similar problem, is available upon request.

no longer needs to give up a rent to the agent whenever $\omega \in (0, h^*]$ as she can decrease the bonus commensurately with the private benefits accruing to the agent: $\beta(\omega) = \max\{\frac{g(h^*)-g(\omega)}{p} - \alpha S, 0\}$ for all $\omega \in [0, h^*]$. In contrast when the agent reciprocates, it may be profitable for the principal to give up some rent to the agent as this may be interpreted as a friendly deed to which the agent may be willing to respond friendly, namely by choosing the right project even though the mere consideration of the material payoff would suggest otherwise.

6 Empirical Analysis

In this section we empirically examine the main theoretical prediction of our model, namely the relationship between an employee's sensitivity to reciprocity and the amount of discretion he or she enjoys in the workplace.

We make use of the German Socio-Economic Panel data (GSOEP), which is a representative panel study of the resident population in Germany. The data include a wide range of information on individual and household characteristics, like employment, education, earnings, and personal attitudes.

Data on delegation. The 2001 wave of the survey asks the following question: *Do you decide how to complete the tasks involved in your work?* Respondents were asked to indicate on a 3-point scale how well the statement applies to them. An answer of 1 on the scale means "applies fully", of 2 means "applies partly", of 3 means "does not apply". This question refers to a central aspect of delegation, which is the worker's influence over decisions that affect his or her work and lies between two different levels of employee involvement, that is, task discretion and organizational participation (see Gallie and Zhou, 2013).

Data on reciprocity. We merge the 2001 wave of the dataset with the 2005 one that contains questions about reciprocity. The questions on reciprocity are based on the measure developed by Perugini et al. (2003). Respondents were asked to indicate on a 7-point scale how well each of the following six statements applies to them:

1. If someone does me a favor, I am prepared to return it;
2. If I suffer a serious wrong, I will take revenge as soon as possible, no matter what the cost;
3. If somebody puts me in a difficult position, I will do the same to him/her;
4. I go out of my way to help somebody who has been kind to me before;
5. If somebody offends me, I will offend him/her back;
6. I am ready to undergo personal costs to help somebody who helped me before.

An answer of 1 means "does not apply at all", while an answer of 7 means "applies to me perfectly". Questions (1), (4) and (6) ask about positive reciprocity, while questions (2), (3) and (5) ask about negative reciprocity. Following Dohmen et al. (2009), we construct a measure of positive and negative reciprocity by taking the average responses over the three positive and

negative statements, respectively.

Control variables. The 2001 wave of the survey asks a question that allows us to control for the conflict of interest between an employee and his superior, which plays a critical role in the model: *Do you often have conflicts with your boss?* Respondents were asked to indicate on a 3-point scale how well the statement applies to them. An answer of 1 on the scale means "applies fully", of 2 means "applies partly", of 3 means "does not apply". We create a dummy variable that takes value 0 if the worker's response was "does not apply", and 1 if the response was either "applies partly" or "applies fully". In the regressions presented below, we also control for sectors, level of eduction, the size of the organization, gender, whether the job is full-time or part-time, permanent or temporary.[21] See Table 1 for more details on the independent variables of our analysis.

Positive Reciprocity	Average responses over the three positive statements on reciprocity.
Negative Reciprocity	Average responses over the three negative statements on reciprocity.
Conflict	Dummy variable: 1=conflict.
Male	Dummy variable: 1=male.
Education	Dummy variable: 1= higher education.
Fulltime	Dummy variable: 1=full-time jobs, 0 part-time jobs.
Permanent	Dummy variable: 1= permanent jobs, 0 temporary jobs.
Size	Firm size is controlled by 5 dummy variables. Firms with less than 5 employees serve as a baseline.
Sector	Sectors correspond to the classification of economic activities of the European Community (NACE code). It is controlled by 12 dummies. Agriculture, forest and mining sectors serve as a baseline.

Table 1: Description of independent variables

Predictions. Consistently with our theoretical model we test the following two predictions:

(a) Employees who are more positive reciprocal should receive more discretion.

(b) Employees who are more negative reciprocal should receive less discretion

Another prediction of our paper is that an employee who is sensitive to positive (respectively, negative) reciprocity should receive a higher (weakly lower) wage as well as more (less) delegation. There is already some empirical evidence supporting the relationship between reciprocity and wages using the GSOEP (e.g. see Dohmen et al., 2009).[22]

[21] Schütte and Wichardt (2012) theoretically and empirically (using the GSOEP) show that employees who have temporary jobs are more unlikely to receive discretion.

[22] Dohmen et al. (2009) find that workers who exhibit positive reciprocity tend to earn higher wages whereas negative reciprocity has no effect on labor income.

Empirical Analysis.

In total, 7,623 individuals responded to the questions on delegation, reciprocity, and those regarding the controls. We consider all individuals who were fully employed or worked part time, but we exclude apprentices, self-employed and those who did not provide an answer.

We generate two variables for discretion. The first variable, that we call *delegation*, is binary: it takes value 0 if the worker's response was either "does not apply" or "applies partly", and 1 if the response was "applies fully". The second variable, that we call *discretion* takes value 0 if the worker answered "does not apply" to the question on delegation, 1 if he or she answered "applies partly" and 2 if he or she answered "applies fully". Table 2 shows the distribution of answers.[23]

	Full Sample			Restricted Sample		
Discretion	Freq.	Percent	Cumulative	Freq.	Percent	Cumulative
Applies fully	2.808	36.84	36.84	1.677	44.13	44.13
Applies partly	3.538	46.41	83.25	1.758	46.26	90.39
Does not apply	1.277	16.75	100.00	365	9.61	100.00
Total	7.623	100.00		3.800	100.00	

Table 2: Distribution of Answers

Results. We mostly focus our analysis on the binary variable indicating whether an employee receives a lot of discretion or not. In Table 3 we report the coefficients of the Logit (column 1) and the Probit (column 2) regressions. The results are in line with our theoretical predictions: the coefficients of positive and negative reciprocity have the predicted signs but only the former is statistically significant. In columns 3 and 4 we report the coefficients of the Logit and Probit regressions, respectively, for a sub-sample of the population which only includes workers who earn at least 2,000 euros gross per month. In this sub-sample positive reciprocity continues to be highly statically significant (now even at the 1% level) and negative reciprocity becomes statistically significant at the 5% level with the expected sign. Thus, positive reciprocity always plays a role in determining the amount of delegation granted to the employees. In contrast, negative reciprocity plays a role for those workers employed in occupations with a higher salary. One plausible explanation is that reciprocity fully plays a role in determining the scope of delegation for those workers employed in occupations which are more productive and, as a consequence, earn a higher salary.[24] Notice also that this sub-sample continues to be quite sizable, including a total number of observations of 3,800 (the distribution of answers is reported in Table 2).

[23]The table also reports the distribution of answers for the restricted sample of the population, to be defined momentarily.

[24]This argument is somewhat related to a point also made by Bartling et al. (2013). Namely, that in high-performance work systems discretion, productivity, and salary are all positive correlated.

	(1)	(2)	(3)	(4)
Delegation	Logit	Probit	Logit	Probit
Positive reciprocity	0.0649**	0.0391**	0.1305***	0.0812***
	(0.011)	(0.011)	(0.001)	(0.001)
Negative reciprocity	-0.0269	-0.0162	0.0474**	−0.0297**
	(0.183)	(0.193)	(0.030)	(0.029)
Conflict	−0.2751***	−0.1648***	−0.3284***	−0.2016***
	(0.000)	(0.000)	(0.000)	(0.000)
Male	0.0509	0.0286	-0.0089	-0.0064
	(0.431)	(0.472)	(0.895)	(0.878)
Education	0.6016***	0.3730***	0.4346***	0.2694***
	(0.000)	(0.000)	(0.000)	(0.000)
Fulltime	0.2283***	0.1416***	0.017	0.0118
	(0.006)	(0.005)	(0.888)	(0.875)
Permanent	0.4945***	0.3009***	-0.0477	-0.0298
	(0.000)	(0.000)	(0.817)	(0.817)
Observations	7,623	7,623	3,815	3,815
Size	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes

Table 3: Logit and Probit Regressions. The table reports the coefficients of the Logit and Probit regressions considering the entire sample (columns 1 and 2) and the restricted sample (columns 3 and 4). P-values are reported in parentheses. Standard errors are clustered at NACE 2-digit level. *** Denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

To provide an interpretation of the magnitude of the effects in Table 4, we report the odds ratio of the Logit model and the marginal effects estimates of the Probit model.

For the Logit model (columns 1 and 3), we find that for a one unit increase in the scale of positive reciprocity the odds of delegation versus no delegation/some delegation are 1.07 (or 1.14 if we consider the restricted sample) times greater, given all the other variables constant. For a one unit increase in negative reciprocity the odds of delegation versus no delegation/a bit of delegation are 0.95 (considering only the restricted sample) times lower, holding all the other variables constant.

For the Probit model (columns 2 and 4), a 1 point increase in the scale of positive reciprocity increases the probability of the worker's receiving a lot of delegation by 1.47% (or 3.20% for the restricted sample), holding all other variables at their means. A 1-point increase in the scale of negative reciprocity decreases the worker's probability of having high delegation by 1.17%, holding all other variables at their means.

Tables 3 and 4 also show that the variables conflict and education have a statistically significant impact on the dependent variable. A higher conflict of interest reduces the probability that the worker receives a large amount of delegation, as predicted by the literature on organizational economics as well as our paper.[25] A more educated worker is more likely to receive

[25] We have also replicated the empirical analysis with a different variable for conflict, wherein we distinguish between workers who have a high, some, and no conflict of interests with their superior. The results are not

broad delegation in the workplace. The effects of gender, fulltime, and permanent are not statistically significant when we consider the restricted sample. However, the variables fulltime and permanent become highly significant when we consider the entire sample of the population.

	(1)	(2)	(3)	(4)
Delegation	Odds ratio	dy/dx	Odds ratio	dy/dx
Positive reciprocity	1.0670**	0.0147**	1.1395***	0.0320***
	(0.011)	(0.011)	(0.001)	(0.001)
Negative reciprocity	0.97345	-0.00609	0.9537**	−0.0117**
	(0.183)	(0.192)	(0.030)	0.029
Conflict	0.7595***	−0.0619***	0.7201***	−0.0795***
	(0.000)	(0.000)	(0.000)	(0.000)
Male	1.0522	0.0108	0.9912	-0.00253
	(0.431)	(0.471)	(0.895)	(0.878)
Education	1.8250***	0.1402***	1.54439***	0.10626***
	(0.000)	(0.000)	(0.000)	(0.000)
Fulltime	1.2565***	0.0532***	1.01714	0.00464
	(0.006)	(0.005)	(0.888)	(0.875)
Permanent	1.6397***	0.1131***	0.95340	-0.0118
	(0.000)	(0.000)	(0.817)	(0.817)
Observations	7,623	7,623	3,815	3,815
Size	Yes	Yes	Yes	Yes
Sector	Yes	Yes	Yes	Yes

Table 4: Odds Ratio (Logit) and Marginal Effects (Probit). The table reports the Odds Ratio of Logit regressions for the entire sample (column 1) and for the restricted sample (column 3). It also reports the Marginal Effects of Probit Regressions for the full sample (column 2) and for the restricted one (column 4). P-values are reported in parentheses. Standard errors are clustered at NACE 2-digit level. *** Denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

As a robustness check, we regress the variable discretion on our measures of reciprocity. In Table 5 we directly report the coefficients of the Generalized Ordered Logit Model (column 1) with the associated odds ratios (Column 2) only for the restricted sample.[26] In all regressions, the signs of the coefficients of positive and negative reciprocity are in line with our theoretical predictions (i.e. the sign is positive for positive reciprocity and negative for negative reciprocity) and are highly statistically significant (at the 1% level for positive reciprocity and at the 5% level for negative reciprocity).

In Column 2 we report the proportional odds ratios of the Generalized Logit model for a one unit increase in the scale or positive (negative) reciprocity on discretion given that the other variables in the model are held constant.[27] For a one unit increase in the scale or positive

qualitatively affected by this different specification of the conflict of interest and, therefore, are not reported here. They are available on request.

[26]We cannot use the Ordered Logit Model because some of the independent variables (e.g. male) violate the Parallel-lines assumption (i.e. the requirement that the coefficients be the same for all categories). Therefore, we turn to the Generalized Ordered Logit Model (see Williams, 2006).

[27]Notice that the parallel-lines assumption is validated for these two variables.

reciprocity, the odds of a high level of discretion versus the combined levels of low and no discretion are 1.12 times greater, given the other variables are held constant in the model. In contrast, for a one unit increase in the scale of negative reciprocity, the odds of a high level of discretion versus the combined levels of low and no discretion are 0.96 times lower, given the other variables are held constant in the model.[28]

Generalized Ordered Logit		
Discretion	Coefficient	Odds ratio
Positive reciprocity	0.114***	1.1207***
	(0.001)	(0.001)
Negative reciprocity	−0.0432**	0.9577**
	(0.040)	0.040

Table 5: Discretion and Reciprocity. In the regression, we control for conflict, male, education, fulltime, permanent, size and sector. P-values are reported in parentheses. Standard errors are clustered at NACE 2-digit level. *** Denotes significance at the 1 percent level, ** at the 5 percent level, and * at the 10 percent level.

7 Conclusions

In this article, we have studied a delegation model in which a better informed agent is motivated by reciprocity. The preferences of the agent and the principal about which projects should be undertaken can be discordant. When the conflict of interest is mild, a more reciprocal agent will optimally receive more discretion. In contrast, when the conflict of interest is more severe, a more reciprocal agent will optimally receive less discretion and the principal may even prefer to retain authority about the choice of the project.

In our empirical analysis of the GSOEP we have found some support for these predictions, at least for the German population. Moreover, differences in reciprocity inclinations may also explain why different levels of discretion are observed between different countries, even after controlling for sector and type of occupations (see Gallie and Zhou, 2013). This intriguing pattern calls for additional and more detailed empirical studies which could measure how sensitivity to reciprocity varies among countries and relate it to several indicators of delegation of decision-making authority and employee involvement. In particular, it would also help to relate sensitivity to reciprocity to some measures of *strategic participation*, namely employees' involvement in high-level decisions such as investment and product development.

The model also shows that the principal may actually be hurt by the possibility of making monetary transfers to the agent. The principal may pay the agent to induce him to choose the right project. However the agent may perceive the principal as unfair if he deems that she is paying him too little. As a result, when the agent is sensitive to reciprocity, the possibility of

[28] Likewise, for a one unit increase in the scale or positive reciprocity, the odds of the combined high and low levels of discretion versus no discretion are 1.12 times greater, given the other variables are held constant in the model. In contrast, for a one unit increase in the scale of negative reciprocity, the odds of the combined high and low levels of discretion versus no discretion are 0.96 times lower, given the other variables are held constant in the model.

making monetary transfers may backfire: unless the principal transfers at least a certain amount of money, the agent will be resentful and keen to retaliate.

We leave for future research some potential extensions of the current set-up. First, employees may respond differently to the delegation decisions and therefore firms need to adjust the amount of discretion depending on the composition of the workforce.[29] To incorporate this aspect in our model, we could assume that the agent's sensitivity to reciprocity is his private information while the principal only knows the distribution from which this parameter is drawn. Second, typically in workplaces there are more than one employee and therefore it might be worthwhile to analyze the delegation choice granted to a team of workers.

[29]Some media have reported that Google has reduced the leeway it traditionally used to give to its employees. See for instance *Google's "20% time", which brought you Gmail and AdSense, is now as good as dead* on Quartz, August 16, 2013.

A Appendix

A.1 Proof of Lemma 1

Let $\omega \neq h' < h$ and $\omega, h', h \in D$. Suppose that the agent prefers h' to ω. Then, he obtains $b(h')$ which is lower than what he could get by selecting h, i.e. $b(h)$. Suppose that the agent prefers ω to h, i.e. $\alpha pS + b(\omega) \geq b(h)$. In that case, he strictly prefers ω to any h' lower than h and different from ω. If ω does not belong to D, the agent is always better off choosing h.

A.2 Proof of Lemma 2

To prove i) Given $h^* < n$, let $l^* > 0$ such that $b(l^*) + \alpha pS = b(h^*)$, that is l^* is the minimum element of D such that for all $\omega \in D$ the agent picks the right project. Then, for all $\omega < l^*$ the agent picks h^* irrespective of whether ω belongs to D or not. The principal is then indifferent as to whether or not to include projects lower than l^* in the delegation set. If $l^* = 0$ and $b(0) + \alpha pS \geq b(h^*)$, then 0 is included in the decision set.

Let us show that the principal does not want to exclude any project in the interval $[l^*, h^*]$. Suppose for example that the principal grants the agent $[l^*, j] \cup [k, h^*]$ with $l^* < j < k < h^*$. Then, the principal would expect to get $\frac{(h^*-k)+(j-l^*)}{n} pS$ which is strictly lower than $\frac{(h^*-l^*)}{n} pS$, that she would get by granting the agent $[l^*, h^*]$.

To prove ii) we show that h^* is such that $\alpha pS + b(0) = b(h^*)$ if $h^* < n$. Suppose that this is not true and h^* is such that $\alpha pS + b(0) > b(h^*)$. But then the principal will find it profitable to give more discretion to the agent, which leads to a contradiction. Consider then the case where $\alpha pS + b(0) < b(h^*)$. Then, there exist $\epsilon > 0$ and $\epsilon' > 0$ such that $\alpha pS + b(0) = b(h^* - \epsilon)$ and $\alpha pS + b(\epsilon') = b(h^*)$. The principal prefers to grant the agent $[0, h^* - \epsilon]$ to $[0, h^*]$ because in the former interval the agent always picks the right project when available, while in the latter, the agent picks the right project only when $\omega \in [\epsilon', h^*]$. Since the function $g(\cdot)$ is convex, the former interval is greater than the latter, meaning that $\frac{h^*-\epsilon}{n} pS > \frac{h^*-\epsilon'}{n} pS$. The principal grants the agent full discretion if $\alpha pS + b(0) \geq b(n)$.

A.3 Proof of Proposition 1

The principal wants to set the highest h that induces the agent to always choose the right project when this is available. To see this, notice that (5) is strictly increasing in h. Then h^* is the maximum element of the decision set that satisfies the agent's tightest incentive compatibility, i.e. when $\omega = 0$. So it must be that $\alpha pS + \underline{b} \geq \underline{b} + g(h^*)$. The principal grants full discretion to the agent when this condition is satisfied at $h^* = n$. In contrast, if the tightest incentive compatibility constraint binds, $h^* = g^{-1}(\alpha pS) = \gamma(\alpha pS)$.

A.4 Proof of Lemma 3

Suppose that the principal grants the agent $\hat{D}$ instead of D', where $\hat{D} = D' + \{j\}$, and consider the following agent's decision rule. When $\omega \in D'$, $d(\omega, \hat{D}) = d^*(\omega, D')$, while when $\omega \notin D'$, $d(\omega, \hat{D}) = \max\{j, h'\}$, where h' is the largest project in set D'. If $j \leq h'$, then $\hat{h} = h'$ and the agent's expected material payoff is the same under D' and under $\hat{D}$. Since the decision rule for $\hat{D}$ may be suboptimal, the agent can expect to derive a weakly higher material payoff under $\hat{D}$

than D'. If $j > h'$, $j = \hat{h}$, and the agent's expected material payoff is strictly higher under $\hat{D}$. To see this, consider that the agent expects to get exactly the same payoff when $\omega \in D'$ and to get $b(\hat{h}) > b(h')$ when $\omega \notin D'$.

A.5 Proof of Lemma 4

Consider $D_{h^R} \equiv [0, ..., h^R]$, with $h^R < n$ and let $D_{h'} \equiv [l', ..., l^R, ..., h^R]$, with $0 < l' < l^R < h^R$. Let l^R be such that:

$$\alpha pS + b(l^R) + \eta k_{PA}(D_{h'})pS = b(h^R), \tag{A1}$$

that is, l^R is the minimum element of $D_{h'}$ such that for all $\omega \in [l^R, ..., h^R]$ the agent picks the right project. Therefore, the principal's expected utility when she grants $D_{h'}$ is $\frac{h^R - l^R}{n} pS$. If the principal delegates projects lower than l', her expected utility cannot decrease. To see this, consider that $D_{h'} \subset D_{h^R}$ and, as a result, $E_\omega u_A(\omega, \hat{D}_{h'}) \leq E_\omega u_A(\omega, D_{h^R})$. Since we have posited a non-negative relationship between an agent's expected material payoff and his perception of the principal's kindness, $k_{PA}(D_{h^R}) \geq k_{PA}(D_{h'})$. It follows that:

$$\alpha pS + b(l^R) + \eta k_{PA}(D_{h^R})pS \geq b(h^R) \tag{A2}$$

and the principal's expected utility may only increase.

Let us now show that the principal does not want to exclude any project in the interval $[l^R, h^R]$. Suppose for example that the principal grants the agent $\tilde{D} = [l', ..., l^R, ..., j] \cup [k, h^R]$ with $l' \leq l^R < j < k < h^R$. Then, the principal would expect to get at most $\frac{(h^R - k) + (j - l^R)}{n} pS$ which is strictly lower than $\frac{(h^R - l^R)}{n} pS$, that she would get by granting the agent D'.[30] Hence, there is no loss of generality in restricting attention to delegation set of the form $[0, ..., h^R]$.

A.6 Proof of Lemma 5

We need to show that h^R is set in such a way that $\alpha pS + \eta k_{PA}(h^R)pS = g(h^R)$ whenever $h^R < n$.

Suppose that this were not true and h^R were such that $\alpha pS + \eta k_{PA}(h^R)pS = g(h^R) + \phi$ for $\phi > 0$ but small. Then it is immediate to see that the principal would find it profitable to give more discretion to the agent.

Consider then the case where $\alpha pS + \eta k_{PA}(h^R)pS + \phi = g(h^R)$, with ϕ positive but small. At the margin, the principal can either decrease discretion or keep the same level of discretion knowing that the agent will not choose the right project when the state of the world is small enough. We show that she always prefers the first option.

To see this, take $\epsilon' > 0$ such that $g(\epsilon') = \phi$:

$$\alpha pS + \eta k_{PA}(h^R)pS = g(h^R) - g(\epsilon'). \tag{A3}$$

Namely, faced with $D = [0, h^R]$, the agent strictly prefers h^R to the right project whenever $\omega \in [0, \epsilon')$. By granting this level of discretion, the principal expects to receive $\frac{h^R - \epsilon'}{n} pS$.

[30] Consider that $k_{PA}(\tilde{D}) \leq k_{PA}(D')$ because $E_\omega u_A(\omega, \tilde{D}) \leq E_\omega u_A(\omega, D')$. As a consequence,

$$\alpha pS + b(l^R) + \eta k_{PA}(\tilde{D})pS \leq b(h^R).$$

Moreover, there exists $\epsilon > 0$ such that:

$$\alpha pS + \eta k_{PA}(h^R - \epsilon)pS = g(h^R - \epsilon) \tag{A4}$$

Namely, faced with $D = [0, h^R - \epsilon]$, the agent strictly prefers h^R when this is available. By restricting discretion in this way the principal would expect to get $\frac{h^R-\epsilon}{n}pS$.

The principal prefers the latter option if and only if $\frac{h^R-\epsilon}{n}pS - \frac{h^R-\epsilon'}{n}pS$, that is, if and only if $\epsilon' > \epsilon$. Since $g(\cdot)$ is a strictly increasing function, $\epsilon' > \epsilon$ only if $g(\epsilon') > g(\epsilon)$. From equation (A3):

$$g(\epsilon') = g(h^R) - \alpha pS - \eta k_{PA}(h^R)pS \tag{A5}$$

The value of αpS can be taken from equation (A4):

$$\alpha pS = g(h^R - \epsilon) - \eta k_{PA}(h^R - \epsilon)pS \tag{A6}$$

Therefore, we obtain:

$$g(\epsilon') = g(h^R) - g(h^R - \epsilon) + \eta k_{PA}(h^R - \epsilon)pS - \eta k_{PA}(h^R)pS \tag{A7}$$

This is greater than $g(\epsilon)$ if:

$$g(h^R) - g(h^R - \epsilon) > g(\epsilon) + \eta pS[k_{PA}(h^R) - k_{PA}(h^R - \epsilon)] \tag{A8}$$

Dividing each term for ϵ and taking the limit of both sides for $\epsilon \to 0$,

$$g'(h^R) > \eta pS k'_{PA}(h^R) \tag{A9}$$

which is satisfied because of Assumption 2.

A.7 Proof of Proposition 2

The principal chooses $h \geq 0$ to maximize:

$$\frac{h}{n}pS \tag{A10}$$

subject to the tightest incentive compatibility constraint,

$$\alpha pS + \eta k_{PA}(h)pS \geq g(h) \tag{A11}$$

and a feasibility constraint:

$$h \leq n \tag{A12}$$

Consider the Lagrangian:

$$\mathcal{L}(h, \lambda, \mu) = \frac{h}{n}pS + \lambda\left(\alpha pS + \eta k_{PA}(h)pS - g(h)\right) + \mu(n - h) \tag{A13}$$

Karush-Kuhn-Tucker first-order necessary conditions for h yield:

$$\frac{\partial \mathcal{L}(h^R, \lambda^R, \mu^R)}{\partial h} = \frac{pS}{n} + \lambda^R(\eta k'_{PA}(h^R)pS - g'(h^R)) - \mu^R \leq 0 \tag{A14}$$

with equality if $h^R > 0$. λ^R is such that:

$$\frac{\partial \mathcal{L}(h^R, \lambda^R, \mu^R)}{\partial \lambda} = \alpha pS + \eta k_{PA}(h^R)pS - g(h^R) \geq 0 \tag{A15}$$

with equality if $\lambda^R > 0$. μ^R is such that:

$$\frac{\partial \mathcal{L}(h^R, \lambda^R, \mu^R)}{\partial \mu} = n - h^R \geq 0 \tag{A16}$$

with equality if $\mu^R > 0$.

If $\mu^R = 0$ and $\lambda^R > 0$, h^R is the maximum value of h which implicitly solves the following equation:

$$\alpha pS + \eta k_{PA}(h^R)pS = g(h^R) \tag{A17}$$

However, if such h were greater than n, the feasibility constraint would bind and $h^R = n$. This occurs whenever:

$$\alpha pS + \eta k_{PA}(n)pS \leq g(n),$$

that is when

$$n \leq \gamma(\alpha pS + \eta pS).$$

If the inequality holds strictly, $\lambda^R = 0$.

Notice that for the first order conditions to be sufficient, it must be that $g(h)$ is more convex than $\eta k_{PA}(h)pS$. If $k_{PA}(h)$ is twice continuously differentiable, this requires that:

$$g''(h) \geq \eta k''_{PA}(h)pS,$$

for all $h \in (0, n)$.

A.8 Proof of Proposition 3

To study how changes in η affects h^R we distinguish between two main cases, when $h^R = \{0, n\}$ and when $h^R \in (0, n)$.

Suppose that at the current level of η, $h^R = n$. This implies that the tightest incentive compatibility constraint is slack. If η increases, the impact on h^R is null. To see this, consider that $h^R = n$, $k_{PA}(n) = 1$, and therefore a marginal increase in η has a positive impact on the left-hand side and no effect on the right-hand side of the tightest incentive compatibility constraint. This constraint continues to be slack. It follows that at $h^R = n$, a marginal increase in η has no effect on the optimal level of discretion.

Suppose conversely that at the current level of η, $h^R = 0$. As $k_{PA}(0) = -1$ a marginal increase in η has a negative impact on the left-hand side of the tightest incentive compatibility constraint. However, an increase in η cannot further restrict discretion, because h is bounded below at 0. Because of Assumption 2, its effect cannot be positive either. Therefore, its effect has to be null.

For $h^R \in (0, n)$, the tightest incentive compatibility constraint binds and determines h^R. Therefore, to study how a marginal change in η affects h^R we can make use of the Implicit Function Theorem. We can rewrite the tightest incentive compatibility as an implicit function:

$$H(h^R(\eta), \eta) = \alpha pS + \eta k_{PA}(h^R)pS - g(h^R) = 0$$

By totally differentiating this function with respect to η:

$$\frac{\partial H}{\partial h^R}\frac{\partial h^R}{\partial \eta} + \frac{\partial H}{\partial \eta} = 0$$

Since,

$$\frac{\partial H}{\partial \eta} = k_{PA}(h^R)pS,$$

and

$$\frac{\partial H}{\partial h^R} = \eta k'_{PA}(h^R)pS - g'(h^R),$$

the impact of an increase in η on h^R is:

$$\frac{\partial h^R}{\partial \eta} = -\frac{k_{PA}(h^R)pS}{\eta k'_{PA}(h^R)pS - g'(h^R)} \tag{A18}$$

Notice that the denominator is the difference between the marginal impacts of a change in h^R on the agent's reciprocity payoff and on his temptation to choose the largest available project. Because of Assumption 2 is always negative. Therefore, the sign of the derivative only depends on the sign of the numerator. That is, it depends on the sign of $k_{PA}(h^R)$.

When $k_{PA}(h^R) > 0$, that is the principal is perceived as friendly, $\frac{\partial h^R}{\partial \eta} > 0$. When $k_{PA}(h^R) < 0$, that is the principal is perceived as unfriendly, $\frac{\partial h^R}{\partial \eta} < 0$. As a result, if $h^* \geq h^F$, the impact of η on h^R is always non-negative, whereas if $h^* < h^F$, the impact of η on h^R is always non-positive.

A.9 Proof of Proposition 4

We need to consider three cases. First, we compare interior solutions when the principal cannot offer a fixed wage and when she can, i.e. $h^R \in (0, n)$ in the former case and $h^T \in (0, n)$, $t^T > 0$ in the latter case.

When the principal cannot offer t, first-order condition of (A13) which binds at the optimum yields:

$$\frac{pS}{n} + \lambda^R \left(\eta \frac{\partial k_{PA}(h^R)}{\partial h} pS - g'(h^R)\right) = 0$$

which implies that

$$g'(h^R) = \eta \frac{\partial k_{PA}(h^R)}{\partial h} pS + \frac{pS}{\lambda^R n} \tag{A19}$$

where $\frac{pS}{\lambda^R n} > 0$.

When the principal can offer a fixed wage, the Lagrangian is:

$$\mathcal{L}(h, t, \lambda, \mu) = \frac{h}{n}pS - t + \lambda\left(\alpha pS + \eta k_{PA}(h, t)(pS - t) - g(h)\right) + \mu(n - h) \tag{A20}$$

First-order condition with respect to h yields:

$$\lambda^T = \frac{pS}{n\left(g'(h^T) - \eta \frac{\partial k_{PA}(h^T, t^T)}{\partial h} pS\right)} \tag{A21}$$

whereas the first-order condition with respect to t yields:

$$\lambda^T = \frac{1}{\eta \frac{\partial k_{PA}(h^T, t^T)}{\partial t} pS} \tag{A22}$$

Putting together the above two equations:

$$\frac{pS}{n\left(g'(h^T)-\eta\frac{\partial k_{PA}(h^T,t^T)}{\partial h}pS\right)}=\lambda^T=\frac{1}{\eta\frac{\partial k_{PA}(h^T,t^T)}{\partial t}pS}$$

which can be rearranged as:

$$\frac{\eta pS}{n}\left(\frac{\partial k_{PA}(h^T,t^T)}{\partial t}pS+n\frac{\partial k_{PA}(h^T,t^T)}{\partial h}\right)=g'(h^T) \tag{A23}$$

Now considering together (A19) and (A23):

$$g'(h^R)-g'(h^T)=\eta pS\left(\frac{\partial k_{PA}(h^R)}{\partial h}-\frac{\partial k_{PA}(h^T,t^T)}{\partial h}\right)-\frac{\eta pS}{n}\left(\frac{\partial k_{PA}(h^T,t^T)}{\partial t}pS\right)+\frac{pS}{\lambda^R n} \tag{A24}$$

Since $g'(\cdot)$ is an increasing transformation of h, $h^R > h^T$ if:

$$\frac{\partial k_{PA}(h^R)}{\partial h}-\frac{\partial k_{PA}(h^T,t^T)}{\partial h}>\frac{pS}{n}\frac{\partial k_{PA}(h^T,t^T)}{\partial t} \tag{A25}$$

If this condition is satisfied, then the principal will grant less discretion when she can use the fixed wage as an instrument. It follows, that she is necessarily worse off.

Second, consider the case of a corner solution to the principal's maximization problem when she cannot pay the fixed wage, i.e., the principal grants full discretion, $h^R = n$. If so, her utility cannot increase if she can also offer a fixed wage.

Third, consider the case of a corner solution to the principal's maximization problem when she can pay the fixed wage, i.e., $h^T = n$. Then the condition under which the principal grants full discretion when she cannot use this instrument is:

$$\frac{\partial k_{PA}(h^R)}{\partial h}-\frac{\partial k_{PA}(h^T,t^T)}{\partial h}\geq\frac{pS-n\mu^T}{n}\frac{\partial k_{PA}(h^T,t^T)}{\partial t} \tag{A26}$$

which is easier to satisfy than the condition reported in the proposition since $\mu^T > 0$. To see this, consider that when the principal can offer the fixed wage, the first order condition with respect to h is

$$\lambda^T=\frac{pS-n\mu^T}{n\left(g'(h^T)-\eta\frac{\partial k_{PA}(h^T,t^T)}{\partial h}pS\right)} \tag{A27}$$

whereas the first-order condition with respect to t yields:

$$\lambda^T=\frac{1}{\eta\frac{\partial k_{PA}(h^T,t^T)}{\partial t}pS} \tag{A28}$$

Putting together the above two equations:

$$\frac{pS-n\mu^T}{n\left(g'(h^T)-\eta\frac{\partial k_{PA}(h^T,t^T)}{\partial h}pS\right)}=\lambda^T=\frac{1}{\eta\frac{\partial k_{PA}(h^T,t^T)}{\partial t}pS}$$

which can be rearranged as:

$$\frac{\eta pS}{n}\left(\frac{\partial k_{PA}(h^T,t^T)}{\partial t}(pS-n\mu^T)+n\frac{\partial k_{PA}(h^T,t^T)}{\partial h}\right)=g'(h^T) \tag{A29}$$

By comparison with (A19), it is immediate to see that if (A26) is satisfied, then $h^R = h^T = n$ and, as a result, the principal cannot be better off when she can pay the fixed wage.

A.10 Proof of Lemma 6

When the principal can offer both a fixed wage and a bonus, the Lagrangian is:

$$\mathcal{L}(h,t,\beta,\lambda,\mu) = \frac{h}{n}p(S-\beta) - t + \lambda\left(\alpha pS + p\beta + \eta k_{PA}(h,t,\beta)p(S-\beta) - g(h)\right) + \mu(n-h) \quad \text{(A30)}$$

First-order condition with respect to h yields:

$$\lambda^B \leq \frac{p(S-\beta^B) - n\mu^B}{n\left(g'(h^B) - \eta\frac{\partial k_{PA}(h^B,t^B,\beta^B)}{\partial h}p(S-\beta^B)\right)} \quad \text{(A31)}$$

whereas the first-order condition with respect to t yields:

$$\lambda^B \leq \frac{1}{\eta\frac{\partial k_{PA}(h^B,t^B,\beta^B)}{\partial t}p(S-\beta^B)} \quad \text{(A32)}$$

with equality if $t^B > 0$. The first-order condition with respect to β yields:

$$\lambda^B \leq \frac{hp}{n\left(p + \eta\frac{\partial k_{PA}(h^B,t^B,\beta^B)}{\partial \beta}p(S-\beta^B) - \eta k_{PA}(h^B,t^B,\beta^B)p\right)} \quad \text{(A33)}$$

with equality if $\beta^B > 0$.

Suppose that the principal cannot induce the agent to always choose the right project by simply providing him with full discretion, i.e., $\alpha pS + \eta k_{PA}(n,0,0)pS < g(n)$, so that the principal is willing to use transfers at the optimum. The principal will strictly prefer to use t instead of β if:

$$\lambda^B = \frac{1}{\eta\frac{\partial k_{PA}(h^B,t^B,\beta^B)}{\partial t}p(S-\beta^B)} < \frac{hp}{n\left(p + \eta\frac{\partial k_{PA}(h^B,t^B,\beta^B)}{\partial \beta}p(S-\beta^B) - \eta k_{PA}(h^B,t^B,\beta^B)p\right)} \quad \text{(A34)}$$

That is,

$$\left(\frac{h^B p}{n}\frac{\partial k_{PA}(h^B,t^B,\beta^B)}{\partial t} - \frac{\partial k_{PA}(h^B,t^B,\beta^B)}{\partial \beta}\right)\eta(S-\beta^B) > 1 - \eta k_{PA}(h^B,t^B,\beta^B) \quad \text{(A35)}$$

When this inequality holds, $\beta^B = 0$.

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