Journal of Economic Psychology 33 (2012) 1223–1239

Contents lists available at SciVerse ScienceDirect

Journal of Economic Psychology

journal homepage: www.elsevier.com/locate/joep

Motivation through goal setting

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ARTICLE INFO

Article history:
Received 20 April 2012
Received in revised form 16 June 2012
Accepted 25 August 2012
Available online 14 September 2012

JEL classification:
D82
D86
M50
Z13

PsycINFO classification:
2360
3630
3650

Keywords:
Intrinsic motivation
Goal-setting
Reference dependent preferences
Job satisfaction

ABSTRACT

We study a principal agent model where agents derive a sense of pride from accomplishing production goals. As in classical models, the principal offers a pay-per-performance wage to the agent, determining the agent's extrinsic incentives. However, in our model, the principal uses goal setting policies as a tool to manage agents' intrinsic motivation. To capture the idea that different agents respond differently to different goals we introduce the concept of personal standards which determine what becomes challenging and rewarding to them, and hence the intensity of their intrinsic motivation to achieve goals. We show that, at the optimal contract, the agents' production, as well as the goals set by the principal, increase with the agents' personal standards. Moreover, we show that an intrinsically motivated agent gets higher surplus than an agent with no intrinsic motivation in the form of informational rents but an agent with a mid-ranged standard (and hence productivity) could end up being the one most satisfied. Therefore, our model can be helpful to explain some empirical findings in the literature of job satisfaction such as the so called "paradox of happiness".

The object of living is work, experience, and happiness. There is joy in work. All that money can do is buy us someone else's work in exchange for our own. There is no happiness except in the realization that we have accomplished something. Henry Ford, founder of the Ford Motor Company. (This and other Henry Ford quotes are available at http://www.iwise.com/R5gdr.)

1. Introduction

In 1968, the American Pulpwood Association became concerned about how to increase its loggers' productivity as mechanization alone was not increasing the productivity of its logging crews. Two Industrial Organization psychologists – Edwin A. Locke and Gary P. Latham – assured the firm's managers that they had found a way to increase productivity at no financial expense to anyone. The policy seemed too easy; it merely involved setting specific production goals for the loggers. The novelty was that these goals were wage irrelevant, in contrast with classical wage relevant goals such as bonuses. The psychologists argued that introducing a goal that was difficult but attainable, would increase the challenge of the job while making it clear to the workers what was expected from them. Although the managers were quite skeptical at the beginning, the results were surprising: the performance of logging crews increased 18% and the firm's profits rose as well.[1]

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[1] We can find this study in Latham and Locke (1979), which also includes similar empirical evidence for a case study with typists.

0167-4870/$ - see front matter
http://dx.doi.org/10.1016/j.joep.2012.08.010

This example was followed by many studies in the psychology literature on what is known as ''goal setting'' (e.g., Yukl & Latham, 1978; Shane, Locke, & Collins, 2003; Anderson, Dekker, & Sedatole, 2010).[2] The theory states that wage irrelevant goals are an important determinant of employees' motivation to work and hence affect their productivity (see Locke (1996) and Locke and Latham (2002) for a literature review). The effectiveness of goal-setting is very consistent across studies. According to Locke and Latham (2002) the probability that performance increase after a goal has been set is above 90%.

Although in principle we can think about standard explanations of the goal setting evidence, for instance, a goal may be an implicit benchmark for being retained or for future promotions, it is important to remark that there are numerous laboratory experiments showing that individuals who have been assigned specific wage irrelevant goals solve more arithmetic problems or assemble more tinker toys than do people without goals (see Locke, 1996). Therefore, this evidence indicates that there is an important component of individuals motivation through goal setting policies that cannot be explained with classical ''carrot and stick'' (i.e., wage and threat of fire) arguments.[3]

Our purpose in this paper is to take this motivation theory addressed in psychology and management and make it precise in standard economic theory. In particular, we propose a model where workers do have a sense of self-achievement and may care about pay-off irrelevant goals. This sense of achievement is different for workers with different personal standards, which is private information to them. In our model, a worker with a high personal standard can only be motivated to accomplish a sufficiently demanding goal.

Before describing the key elements of the model, we start by summarizing the main findings in the goal setting literature. The most important and robust finding is that the more difficult the goal is, the greater the achievement will be. This result applies as long as the individual is committed to the goal (i.e., he cares about it).[4] The reason why goals affect workers' achievement is that goals affect the challenge of the job and hence the satisfaction workers obtain from the work itself. As Judge (2000) says:

> *The most effective way an organization can promote job satisfaction of its employees is to enhance the mental challenge in their jobs, and the most consequential way most individuals can improve their own satisfaction is to seek out mentally challenging work* (Judge (2000, p. 107).

Therefore, goals are an important determinant of workers' satisfaction because they help develop a sense of achievement. According to the goal setting literature, goals serve as a reference point of self-satisfaction, with harder goals leading to better achievements.

Since goals are reference points, it is also plausible that a higher goal lowers the workers' satisfaction. In fact, supporting this reasoning, Mento, Klein, and Locke (1992) have found that those who produce the most, those with difficult goals, are the least satisfied.[5] The question then is why do people accept these goals? According to Locke and Latham (1990), Locke and Latham (2002), the driving force behind this result is that those people with high goals demand more from themselves, thus they are dissatisfied with less. Therefore, their personal standards are higher.[6] As Locke and Latham (1990) indicate:

> ...*a person with higher standards has to accomplish more to feel that he or she has performed adequately or successfully than the person with lower standards* (Locke and Latham (1990, p. 242).

Bandura (1988) also argues that individuals use standards for judging the adequacy of their performance. Similarly, Erez and Zidon (1984) and Locke, Latham, and Erez (1988) provide experimental evidence that individuals only accept goals if they are higher than their personal standard. According to this evidence, the accomplishment of an easy goal can only be rewarding for those individuals with low personal standards. As we will see, this personal standards' idea is going to play a key role in our analysis.[7]

The previous findings are difficult to support with traditional economic models, such as the classical principal agent model, in which only the goals that are directly linked to the agents' wage (e.g., bonuses) affect their incentives to work. Our purpose here is to fill this gap by introducing goal setting into an economic model of managerial incentives. Therefore, we look at the following questions: Can a manager increase the workers' productivity by using goals that are linked to the job's challenge? How should the manager define the workers' goals? What are the determinants of job satisfaction?

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[2] In management literature, goal setting is known as ''management by objectives'' (MBO). Several studies find empirical evidence that MBO programs improve workers' performance (e.g., Ivancevich (1974), Bush (1998) and Mosley, Schutz, and Breyer (2001)).

[3] We can also think about other non-standard explanations of the loggers' evidence. For instance, goals may act as a peer pressure device increasing performance even if goals are wage irrelevant. Although we think that this could be an important issue of goal setting policies, here we focus on individual goal setting, where peer pressure cannot play a role. In fact, most of the experiments cited in Locke (1996) are individual goal setting experiments.

[4] The ability to attain a goal is also important for the goal setting effectiveness. However, in the present model we assume that an individual can always achieve a goal if he exerts a sufficiently high effort.

[5] This result applies for both, ''self-set'' and ''assigned'' goals. However, it is important to remark that through the paper we consider assigned goals instead of self-set goals. Therefore, people with difficult goals are people who have accepted jobs with high goals instead of people who have set a high goal for themselves in their jobs.

[6] Another example is that, even considering researchers with the same ability, we observe that some of them need to publish their papers in very high ranked journals in order to get a sense of self-achievement while others are just as happy publishing in low ranked journals.

[7] There are other results in the goal setting literature that we do not describe because they are beyond the scope of this paper, such as the definition of specific or explicit goals, the influence of the individual's self-confidence on the level of the goals accepted, or the importance of feedback showing progress for the effectiveness of the goal.

To answer these questions we propose a principal agent model where the agent's motivation to work is twofold. First, as in standard models, the agent works in response to *extrinsic* incentives, which in our model are a pay-per-performance wage. Second, the agent has an *intrinsic* motivation to work because he derives an internal sense of achievement from accomplishing goals.[8] Coming back to our introductory example, we can easily imagine harvesting timber to be a monotonous and boring task. However, as we have seen, by setting demanding production goals, the managers were able to increase the challenge of the job and provide the loggers with a sense of accomplishment that increased their intrinsic motivation to work and hence their performance. In this paper, we capture this effect with a *goal payoff function*, which measures the intrinsic satisfaction that an agent receives from his production with respect to the goal set by the principal. Thus, an agent gets a positive goal payoff if he produces above and beyond the target set but a negative goal payoff otherwise. Workers, however, differ in their perception of how challenging goals may be. For instance, we may observe that for loggers who demand more from themselves, only those goals that require a greater amount of timber to be harvested will be found challenging. On the other hand, for those loggers who demand little from themselves, lower goals may be just as challenging. We model this *goal commitment* effect with a reference dependent function in which the reference point is the agent's own standard. In particular, we consider that those workers with high personal standards are only committed to high goals.[9]

In our model, agents only differ in their personal standards. Hence, agents with different standards can be motivated differently by the same goal because some of them may consider it to be challenging while others do not. Therefore, the principal will design different contracts (with different goals) for different agent types. We show that at the optimal contract, goals are met by agents and thus they derive a positive intrinsic utility. We also show that the agents' production as well as the goals set by the principal increase with the agents' standard. Thus, in our model, goals that are non-binding for the agent, i.e., they are payoff irrelevant for the principal; increase the principal's profits with respect to the classical principal agent model with no goals. As in classical principal agent models, the principal distorts the low type's contract in such a way that his production decreases with the standard of higher types. With respect to the utility that agents get in equilibrium, we show two important results. First, in our two type model, the utility of the high type is an inverted U-shaped function of the agent's standard. Thus, the most satisfied agent is a high type with a mid-ranged standard. Second, in a three type case we show that a mid-ranged agent type could be the one most satisfied. In fact, although the highest type achieves the highest production he can receive a zero utility. The intuition is as follows, if the highest type's standard is sufficiently high he does not consider the goals assigned to lower types to be challenging, thus his informational rents are zero. These are novel results in principal agent models that provide new insights for economists and psychologists. In particular, the interplay between personal standards and the optimal contract offered by the principal have important implications for a better understanding of job satisfaction and the called "paradox of happiness" where the highest levels of income do not necessarily correspond with the highest individual happiness.[10]

While in recent years the problem of goal setting has become an extremely popular topic in psychology and management, the idea of goals that are not linked to the workers' wage may have an economic effect which thus far has received very little attention. Some exceptions deserve to be mentioned. Some papers study the effects of a self-set goal to attenuate the self-control problems of dynamically inconsistent agents. For instance, Hsiaw (2009) studies an optimal stopping problem (or a project termination decision) with hyperbolic discounters in which there is an option value of waiting due to uncertainty. In her model, goals, which act as a reference point up to which agents get an additional positive utility, induce more patient behavior by providing an additional incentive to wait for a higher realization of the project's value.[11] Therefore, the main result is that endogenous goal setting attenuates the impulsiveness of an agent with present-biased time preferences. In our model we use assigned goals in a principal agent model, which makes our research questions and findings completely different.

Köszegi and Rabin (2006) study a model of reference dependent preferences, where the reference point is a person's rational expectations about outcomes. According to this theory, agents are influenced by a "gain-loss sense" that affects the maximum price they are willing to pay. For instance, if a consumer expects to buy a pair of shoes, she experiences a sense of loss if she does not buy them, and this sense of loss increases the maximum price she is willing to pay for the shoes. Daido and Itoh (2007) introduce these preferences in an agency model. They show that under risk aversion, the agent's higher expectation allows the principal to implement greater effort with lower-powered incentives. Moreover, they obtain two types of self-fulfilling prophecy: the Galatea and the Pygmalion effect. In the former an agent's self-expectation about his performance determines his actual performance, while in the latter the principal's expectation about the agent's performance has an impact on the agent's performance. Although, as in our model, they study a principal agent model with agents' reference dependent preferences, the focus of Daido and Itoh (2007) greatly differs from ours. Firstly, the results of a principal agent model with agents' preferences à la Köszegi and Rabin (2006) can only vary from the standard model if there is common uncertainty about the production function (moral hazard) and not in an adverse selection setting like ours. And more importantly, in our model the agent's reference point will be, in part, a decision variable of the principal (i.e., the goal)

[8] As Frey and Jegen (2001) argues there are at least two kinds of worker motivation: extrinsic and intrinsic. The extrinsic motivation is based on incentives coming from outside the worker such as his wage. However, there are also intrinsic motives coming from inside the worker, and that apparently give no reward except the work itself.

[9] As we shall see, in our model, personal standards do not matter unless there are goals. Thus we consider that the only source of intrinsic motivation comes from accomplishing goals.

[10] See Frey and Stutzer (2002) for a literature review on happiness and economics.

[11] We can find similar arguments in Kock and Nafziger (2011a) and Kock and Nafziger (2011b).

rather than the agent's rational expectations. This allows us to incorporate goal setting as a part of the principal's motivation policy.

Finally, this paper is related to the models that account for the individuals' intrinsic motivation to work. For instance, Bènabou and Tirole (2003) study a principal agent model in which the principal has better information than the agent about the agent's type. The authors show that, although performance incentives lead to an increment of the agent's effort in the short run, they are negative reinforcements in the long run. The idea is that if the principal pays a bonus to induce low ability agents to work (i.e., the principal increases the agent's "extrinsic" motivation), then the agent perceives the bonus as a bad signal about his own ability (which reduces his "intrinsic" motivation). Some papers have also studied the optimal incentive contract when agents have intrinsic motivation. For instance, Fischer and Huddart (2008) study a model where the agents' cost of effort is determined by a social norm; this social norm makes agents work harder in response to an increment in the average effort of their peers. These norms influence the power of financial incentives within an organization. In contrast with this literature, in our model the principal has a more active role since he can directly influence the agent's intrinsic motivation by setting the reference point of his intrinsic utility.

The paper proceeds as follows. Section 2 describes the basic model. In Section 3 we analyze the principal agent relationship by characterizing the optimal contract and studying the two type and the three type cases. Finally, Section 4 concludes.

2. The model

We study a principal agent model with one risk-neutral employer, the principal, and one worker, the agent. The principal's utility is given by the output produced by the agent, y, minus the wage he has to pay, w. We assume that the principal is on the short side of the market so he has all the bargaining power.

Output is given by the production function $y = \theta e$, where e is the agent's effort and θ is the agent's ability (i.e., his level of human capital).[12] The agent's disutility of effort, $c(e)$, is a convex function. For simplicity, we consider $c(e) = \frac{e^2}{2}$. We assume θ is observable so that, by observing output, the principal can infer the agent's effort. Thus, we abstract away from moral hazard concerns.[13] The principal offers "take-it-or-leave-it *contracts*" that are pairs $\{w, g\}$, where w is the wage and g is a production goal. We consider a pay-per-performance wage, $w(y)$, whereas the production goal is a *non-binding* goal since it does not directly affect the agent's wage.[14]

In this model, there are two ways to motivate the agent to work: an *extrinsic motivation*, which is the difference between the wage and the disutility of effort, and an *intrinsic motivation*, which is the agent's sense of achievement in having accomplished goal g with the production y. This is a psychological reward (recognition or mental good) enjoyed by the agent independently of the wage. Moreover, we consider that goals affect the intrinsic motivation differently depending on what the agents demand from themselves. We capture this effect with the personal standard parameter, s. The personal standard summarizes the psychological response of the individual towards the goal. This parameter is formed prior to the interaction with the principal and can depend on culture, family background, peer effects, self-confidence, history of previous successes and failures, etc. We assume that s is exogenous and private information for the agent. Thus, the principal knows the agent's ability, but not the degree to which he responds to goals. The asymmetric information creates an adverse selection problem. We denote by $V(y, g, s)$ the agent's intrinsic utility function and specify the agent's utility function as

$$U = w(y) + V(y, g, s) - \frac{e^2}{2}.$$

We assume that the intrinsic utility function is of the form $V(y, g, s) = \psi(g, s)\upsilon(y, g)$ if $g > 0$ and $V(y, g, s) = 0$ if $g = 0$.[15],[16] Where $\psi(g, s)$ is the agent's goal commitment, i.e., the intensity of the intrinsic utility, and $\upsilon(y, g)$ is the agent's goal payoff. Since the production function is deterministic and the agent knows his type, he is perfectly informed about the intrinsic utility when choosing a level of effort e given a goal g.[17] The *goal payoff function* $\upsilon(y, g)$ is a reference dependent function where goal g is the reference point. In order to get closed-form solutions we assume that $\psi(g, s)\upsilon(y, g)$. Thus, the goal payoff function is concave and increasing in the agent's production given the goal, where $\upsilon(y, g) \geqslant 0$ if and only if $y \geqslant g$. Note that although these properties imply the classical prospect theory features of loss aversion and diminishing sensitivity to gains, it also imply increasing

[12] We use a standard technology where θ and e are complements. Thus, the greater the agent's ability, the greater the agent's effort productivity. Similar results can be obtained using an additive function where θ and e are independent.

[13] We believe that to introduce moral hazard in a goal setting model is a very important research topic that we led to future research. However, in this paper we want to point out the effect of different personal standards on the optimal *contract* in the simplest possible model.

[14] The word "*contract*" can seem misleading in the context where not achieving the goal is not monetary punishable. To underscore that this is not a standard enforceable *contract* we write the word *contract* in italics in this paper. However, as we shall see, in our model a breach of the goal can be psychologically costly. Thus, the principal could want to include non-binding goals in the *contract* even if they are not legally enforceable.

[15] From the argument below it is clear that $\psi(g, s)\upsilon(y, g)$ is not defined for $g = 0$. However, since $\lim \psi(g, s)\upsilon(y, g) = 0$, function $V(y, g, s)$ is continuous for all $g \geqslant 0$.

[16] Note that if the principal does not assign goals, the g agents have no intrinsic motivation to work. This is a simplifying assumption stating that the only source of intrinsic motivation comes from accomplishing goals.

[17] A *stochastic environment* would include interesting things beyond the scope of this paper. For instance, an agent could be more motivated for a goal that is uncertain to attain. Similarly, if an agent is uncertain about his ability or personal standard, self-confidence would play an important role in his motivation. Thus, the principal could use information revelation policies to motivate the agent. However, in our *deterministic environment* we are capable to capture the main idea that a difficult goal is costly to attain (cost of effort) but can be intrinsically rewarding, with the simplest possible model.

sensitivity to losses, which is the opposite of prospect theory's description. However, as we will see in the next section, in our model agents always get a nonnegative intrinsic motivation in equilibrium (Lemma 1). Thus, if we assume a goal payoff function with diminishing sensitivity to losses as the one used in Kahneman and Tversky (1979) we would obtain the same qualitative results.[18] The choice of a logarithmic function is made for the sake of exposition, because it allows us to obtain clean close form solutions maintaining the basic idea in psychology literature that the goal is a reference point for the agent's intrinsic motivation.[19] What makes our goal payoff function different from a standard reference dependent function is that the reference point, the goal g, is a decision variable of the principal affecting the agents' psychological value of production y.

The goal commitment is the most novel component of our intrinsic motivation function and it deserves more attention. As we mentioned in the introduction, psychologists (and also common sense) state that a necessary condition for goals to influence an agent's performance is that agents care about those goals, an effect that the authors called goal commitment. Although the individuals' goal commitment is a complex theme (and sometimes a loose concept) in the related literature, here we choose an easy and intuitive modeling strategy. The goal commitment is determined by the interaction between goals and personal standards; high personal standards require high goals for the agent to take higher goal commitment.[20] Formally, the *goal commitment function*, $\psi(g,s)$, is a weight function that gives a greater weight to the goal payoff if the assigned goal is greater than the personal standard. For simplicity we consider the following piecewise linear function:

$$\psi(g,s) = \begin{cases} sg & \text{if } g > s, \\ 0 & \text{if } g \leq s. \end{cases} \tag{1}$$

There are two important properties of this function. First, the agent only cares about those goals that are greater than his personal standard. When the goal is lower, the agent's intrinsic motivation is zero and he would behave as a standard agent who only cares about wages and disutility of effort.[21] From here on we say that an agent with standard s considers goal g to be challenging when $g > s$. In other words, a goal is challenging for an agent with standard s when he is committed to it.[22] The second property is that given that a goal is challenging, the agent is more committed to attain difficult goals. Note that these two properties imply different things for the agent's intrinsic utility. The second effect implies that while a high goal has a negative effect in the goal payoff function, because it is more difficult to attain, it has a positive effect on the goal commitment function, because the agent cares more about a difficult goal which leads a higher pride in accomplishment. This positive effect of goals on the agent's payoff will make that the principal can include positive goals in an optimal *contract*. In fact, as it will be clear in the next section, we can replicate some of our results with a function where only the second effect is present (i.e., $\psi(g,s) = sg$ for all s, g). However, the first property says that only the attainment of sufficiently difficult goals (challenging goals) can become rewarding for the agent. The main implication of this is that an agent with a low standard may have a higher goal commitment than an agent with a high standard when only the low type considers the goal to be challenging. This captures the idea that people who demand a lot of themselves need a difficult goal to derive some intrinsic motivation to achieve it. In other words, low goals may boost the intrinsic motivation of low types while they can be useless for very demanding agents. This property will be relevant to explain one of the most surprising findings in goal setting that we can replicate with our model (Section 3.4): the fact that very demanding (and productive) agents can get lower satisfaction.[23]

Taking into account the goal-dependent intrinsic utility, the agent's overall utility function is given by

$$U = \begin{cases} w + sg\ln\left(\frac{y}{g}\right) - \frac{e^2}{2} & \text{if } g > s, \\ w - \frac{e^2}{2} & \text{if } g \leqslant s. \end{cases}$$

Note that U is discontinuous. If $g \leqslant s$, the agent obtains zero intrinsic utility; whereas, if $g > s$, he obtains some intrinsic utility for all $y \neq g$. Thus, in order to get a positive intrinsic motivation ($V(y,g,s) > 0$), an agent not only needs sufficiently high production ($y > g$) to receive a positive goal payoff, but also a sufficiently high goal $g > s$ to get a positive goal commitment.

[18] See Heath, Larrick, and Wu (1999) for an exhaustive discussion about how goals are linked to prospect theory.

[19] See Locke (1996) and Locke and Latham (2002).

[20] There are other determinants of individual's goal commitment that we do not consider here. For instance, there is empirical evidence that core self-evaluations such as self-esteem or self-regard, affect the individuals' goal commitment (see Judge, Locke, Durham, and Klueger (1998)). Another important determinant of goal commitment is the individuals' participation in the goal setting process (see, Anderson et al. (2010)).

[21] Alternatively, we can think of other effects of goal setting that are independent of goal attainment ($y > g$). For instance, being given a difficult goal can be seen as an honor or symbol of trust to try something challenging independently of achieving it. Moreover, often times, pride in accomplishment is based on achieving more than one's peers. The incorporation of other sources of intrinsic motivation would make easier for the principal to increase the agent's production. However, the main results of the present paper would remain unchanged as long as the agent has also a motivation to achieve the goal in order to get an even higher intrinsic utility.

[22] Our notion of goal commitment excludes the possibility that if g is much bigger than s, commitment could decrease with additional increments of the goal. We can address this possibility considering a *non-linear* goal commitment function that achieves a local maximum at $g^* \in (0,\infty)$. However, note that Lemma 1 implies that the principal is already prevented to set very high goals: challenging goals that the agent does not accomplish in equilibrium. A non-linear goal commitment function only introduces an additional negative effect on very high goals. Therefore, goals could be lower in equilibrium, but the qualitative results would remain unchanged.

[23] See Mento, Klein, and Locke (1992) and Locke and Latham (2002).

The principal does not observe the agent's standard which is private information to him, thus, we have an adverse selection problem. For simplicity we begin by assuming that the personal standard can take two values $s \in \{s_L, s_H\}$, where $s_H \geqslant s_L > 0$ and $s = s_H$ with probability p.[24] In Section 3.4, we extend the analysis to three agent types.

3. The principal–agent relationship with goal-setting

In this section we characterize the optimal *contract* offered by the principal to an agent with the goal dependent preferences previously described. Applying the revelation principle, the principal designs one *contract* for each agent type, $\{w, g\} = \{(w_L, w_H), (g_L, g_H)\}$. Let us define $U(s_i, s_j) = w_j + V(y_j, g_j, s_i) - \frac{e_j^2}{2}$ as the utility of an agent with standard s_i choosing the *contract* offered to an agent with standard s_j. The principal chooses a wage structure w and sets production goals g that induce efforts $e = (e_L, e_H)$ to maximize expected profit subject to the agent's participation (IR) and incentive compatibility (IC) constraints. Thus, the principal's problem is

$$\max_{\{w,g\}} p(y_H - w_H) + (1-p)(y_L - w_L)$$

subject to, for all $i, j \in \{L, H\}$

$$w_i + V(y_i, g_i, s_i) - \frac{e_i^2}{2} \geqslant 0, \tag{2}$$

$$w_i + V(y_i, g_i, s_i) - \frac{e_i^2}{2} \geqslant w_j + V(y_j, g_j, s_i) - \frac{e_j^2}{2} \tag{3}$$

Individual rationality assures that the agent is at least as well off working for the principal as choosing an outside option (normalizing to provide a zero utility). The incentive compatibility constraints say that an agent with standard s_i cannot be better off by pretending to be another type s_j.

Our first result states that the agent gets a non-negative intrinsic utility in equilibrium.

Lemma 1. Given a contract $\{w, g\}$, in equilibrium $V(y_i, g_i, s_i) \geqslant 0$.

The intuition is simple: if agents get a positive intrinsic utility, it is easier to make them participate. If agents receive a negative intrinsic utility, the principal has to pay them higher wages to assure their participation. This can be avoided if the principal offers non-challenging goals ($g_i \leqslant s_i$) to the agents in such a way that they are not committed to them $\psi(g_i, s_i) = 0$. Thus, their intrinsic utility is zero $V(y_i, g_i, s_i) = 0$.

In order to solve the model, we need to identify a monotonicity or single crossing condition for the utility function that allows us to sort agent types. Note that this is not obvious in our environment because of the discontinuity of the utility function. In the following lemma we show that the agent with the high standard will be the one who obtains the highest surplus in equilibrium.

Lemma 2. *Given a contract $\{w,g\}$, in equilibrium $U(s_H, s_H) \geqslant U(s_L, s_L)$.*

By Lemma 2, we can apply standard results in principal agent models which state that the individual rationality of the low type, IR_L, and the incentive compatibility constraint of the high type, IC_H, are binding in equilibrium. Because of this, the next proposition follows.

Proposition 1. Given a contract $\{w,g\}$, in equilibrium, IR_L and IC_H bind, i.e., $U(s_L, s_L) = 0$, and

$$U(s_H, s_H) = U(s_H, s_L) = \begin{cases} g_L \ln(\frac{\theta e_L}{g_L})(s_H - s_L) & \text{if } g_L > s_H, \\ 0 & \text{if } g_L \leqslant s_H \end{cases}$$

The low type agent gets zero surplus in equilibrium, and the high type obtains informational rents when the low type's goal is challenging for him (i.e., $g_L \geqslant s_H$). Otherwise, the high type agent receives no intrinsic utility from taking the low type offer. Thus, the principal does not need to pay him informational rents.

Note that the principal is tempted to set a challenging goal to both agent types and to pay a wage just enough to make them participate (i.e., $U(s_i, s_i) = 0$). In this case, the principal could pay a low wage to the high standard agent, because his intrinsic motivation is high, so he would work for less money. He would be able to follow that profit maximizing strategy under perfect information. However, since the principal cannot identify agent types (adverse selection) the high type agent can pretend to be the low type when his utility of choosing the low type *contract* (wage and goal) is higher than his utility of choosing the high type offer. Therefore, at the optimal *contract* the high type overall utility is his utility of choosing the low

[24] Note that if $s_H = s_L = s = 0$ then $V(y,g,s) = 0$, so the model becomes a standard principal agent model with complete information. Moreover, as we shall show in the next section, if $s_H > s_L = 0$, in equilibrium $g_L = 0$ so the principal will set the high type agent goal such that his intrinsic utility is maximized, i.e., $g_H = \text{argmax}_g V(y_H, g, s_H)$. By restricting our attention to positive personal standards we focus on the more interesting case where the principal can motivate both agents through goal setting.

type offer ($U(s_H, s_H) = U(s_H, s_L)$). This creates a positive overall utility for the high type (informational rents) when the low type goal is challenging for him, because by picking the low type *contract* he would receive a positive overall utility. However, if the low type goal is not challenging for him, the principal does not need to compensate him for his private information since he would receive zero overall utility choosing a different wage and goal. In other words, the high type is locked in by his high standard because he cannot credibly pretend to be a lower standard agent.

The next lemma provides a useful result regarding the agents' intrinsic utility in equilibrium.

Lemma 3. Given a contract $\{w, g\}$, in equilibrium, for all $i \in \{L, H\}$

(i) $V(y_i, g_i, s_i) > 0$ if and only if $y_i > s_i$.
(ii) $V(y_i, g_i, s_i) = 0$ if and only if $y_i \leqslant s_i$.

By Lemma 3, we know that the agent gets a positive intrinsic utility in equilibrium if and only if the agent's production is greater than his standard. On the one hand, if $y > s$, the principal can design a goal which is both challenging ($g > s$) and can be successfully accomplished by the agent ($y > g$). Note that this is the best situation for the principal because IR constraints are relaxed and the principal can offer lower wages. On the other hand, if $y < s$, there is no way to design a goal that is both challenging and can be successfully accomplished by the agent. In this case, the principal prefers to offer non-challenging goals ($g < s$) in order to avoid negative intrinsic utilities.

Since $y = \theta e$, by Lemma 3, it is immediate that when the agent's ability, θ, is high, the principal can always offer a challenging goal to both agent types. This is the content of the next corollary.

Corollary 1. *Given a contract $\{w, g\}$ and the agent's standard s_i, if θ is sufficiently high, in equilibrium, $V(y_i, g_i, s_i) > 0$ for all $i \in \{L, H\}$.*

To simplify the analysis, from here on we assume that the condition in Corollary 1 holds, so that agents are intrinsically motivated in equilibrium. We relegate the cases where agents' intrinsic motivation can be zero to the Appendix A.2.[25]

Before setting the equilibrium *contract*, we begin by studying two cases that may arise in equilibrium (see Proposition 1): an informational rents case ($g_L > s_H$), in which the high type agent gets a positive utility in equilibrium, and a rent extraction case ($g_L < s_H$), in which both agents obtain a zero utility in equilibrium.[26] Therefore, the rent extraction case will be equivalent to a complete information benchmark where the principal knows both the agent's ability and his degree of intrinsic motivation.

3.1. The informational rents case

As a starting point, we assume that there is an equilibrium in which the low type's goal is challenging for the high type agent ($g_L > s_H$), so that he gets positive informational rents. Then, applying Proposition 1, we have

$$U(s_H, s_L) = g_L \ln\left(\frac{\theta e_L}{g_L}\right)(s_H - s_L) > U(s_L, s_L) = 0.$$

Therefore, the equilibrium of the model is given by the solution to the principal's problem, where the binding constraints can be rewritten as

$$w_L = \frac{e_L^2}{2} - s_L g_L \ln\left(\frac{\theta e_L}{g_L}\right), \quad IR_L$$

$$w_H = \frac{e_H^2}{2} - s_H g_H \ln\left(\frac{\theta e_H}{g_H}\right) + g_L \ln\left(\frac{\theta e_L}{g_L}\right)(s_H - s_L). \quad IR_H$$

Denoting by e Euler's number, the solution to the principal's problem is

$$e_H = \theta\left(1 + \frac{s_H}{\mathrm{e}}\right) \text{ and } g_H = \left(\frac{\theta}{\mathrm{e}}\right)^2 (\mathrm{e} + s_H),$$

$$e_L = \theta\left(1 + \frac{s_L - p s_H}{(1-p)\mathrm{e}}\right) \text{ and } g_L = \left(\frac{\theta}{\mathrm{e}}\right)^2 \left(\mathrm{e} + \frac{s_L - p s_H}{(1-p)}\right).$$

Fig. 1 shows some comparative statics. We fix the standard of the low type and plot the results as a function of the high type standard. This allow us to see the effect of the high type standard on the low type *contract* and hence on the informational rents.

[25] We skip these cases here because results are very similar and the intuitions are the same.

[26] There is also a third case ($g_L = s_H$) that can arise in the optimal *contract* (Proposition 2). This is a corner solution where both types get zero surpluses in equilibrium but the principal distorts the low type *contract*. Since this case is not relevant for the intuition of the results, we relegate it to Section 3.3 where the optimal *contract* is fully characterized.

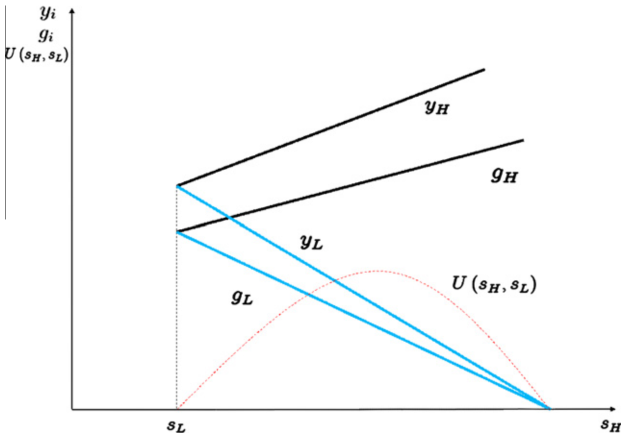

Fig. 1. The solution with positive informational rents.

Since Corollary 1 is satisfied, i.e., agents are committed to goals assigned to them in equilibrium, it is immediate that the principal sets goals that maximize the agent's intrinsic motivation, $g_i = \text{argmax}_g sgln(\frac{y}{g})$, thus $g_i = \frac{y_i}{e}$. Therefore, the principal sets goals that agents can accomplish, $y_i > g_i$. The idea is that the principal uses goals to maximize the agent's intrinsic utility in order to pay lower wages. As we can see in Fig. 1, the high type's effort, e_H, as well as his goal, g_H, increase with his standard, s_H. The rationale behind this result is clear: as the agent types' standards increase, the principal offers them tasks with demanding goals. By doing so, the principal motivates agents to work hard so that they can reach a high production level. For the low type, both, his effort and his goal, decrease with the high type standard, s_H. The principal distorts the *contract* offered to the low type in order to extract greater surplus from the high type. As s_H increases, the high type is more important than the low type for the principal, so he further distorts the low type *contract*. For the same reason, the lower the proportion of high types, p, the lower the distortion of the low type *contract* will be. In fact, if $p = 0$, there is no distortion at all.

We can see in Fig. 1 that as the high type's standard increases, the production of the high (low) type increases (decreases) at a higher rate than his assigned goal. Thus, in equilibrium, the intrinsic utility of the high (low) type agent is an increasing (decreasing) function of the high type's standard. Therefore, the principal distorts the low type's *contract* so that his intrinsic motivation, $V(y_L, g_L, s_L)$, decreases with s_H.

Regarding the high type's informational rents, we have the following trade-off: On the one hand, as the high type's standard increases, the agent's goal commitment increases as well. This has a direct positive effect on the informational rents. On the other hand, we have a negative effect, since the greater the high type's standard is, the more will be the principal's distortion of the low type's *contract*, so that the utility extracted by the high type when choosing the low type *contract* is lower. Formally, the informational rents function is $g_L v(y_L, g_L)(s_H - s_L)$, where $(s_H - s_L)$ is increasing in s_H and $g_L v(y_L, g_L)$ decreases with s_H as we have just shown. Due to the concavity of the goal payoff function, the negative effect dominates the positive effect when s_H is sufficiently high. This is the intuition of the inverted U-shape of the informational rents function illustrated in Fig. 1.[27]

To complete the characterization of the *contract*, we depict the equilibrium wages in Fig. 2.

Let us recall that from IR_L

$$w_L = \frac{e_L^2}{2} - V(y_L, g_L, s_L).$$

Thus, the low type agent's wage equals the disutility of effort minus his intrinsic utility. As we have seen, the low type agent's effort, as well as his goal and his intrinsic utility, decrease with the high type's standard, s_H. Due to the concavity of the intrinsic utility function and the convexity of the disutility of effort, the reduction of the intrinsic utility effect dominates the reduction of effort effect if s_H is sufficiently high, so that w_L has a U-shaped form.

Similarly, from IC_H,

$$w_H = \frac{e_H^2}{2} + U(s_H, s_L) - V(y_H, g_H, s_H).$$

Thus, the wage of the high type agent equals the disutility of effort plus the informational rents minus the intrinsic utility. As we know, the high type agent's effort, as well as his goal and intrinsic utility, increase with s_H. If s_H is sufficiently high the intrinsic utility effect dominates the increment in the disutility of effort and the informational rents effect, so that w_H presents an inverted U-shaped form.

[27] We can easily check that with a linear goal payoff function the informational rents function is concave and increasing in s_H.

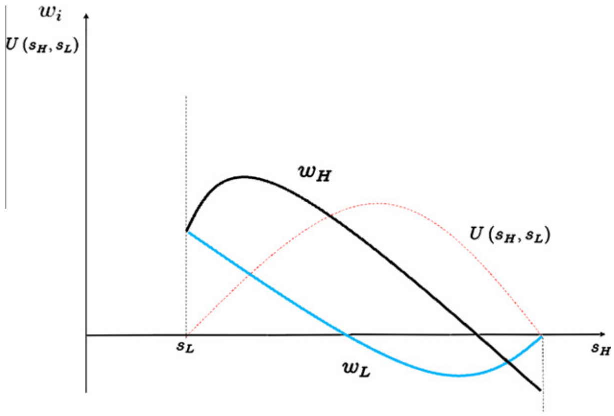

Fig. 2. The wages with positive informational rents.

Note that when agents' standards are not very distant the high type gets a higher wage than a low standard agent. However, if s_H is sufficiently high, w_H decreases and it could be negative. It is immediate that an agent with no intrinsic motivation (i.e., $V(\cdot) = 0$) and zero productivity (i.e $\theta = 0$) receives a zero wage in this model. Therefore, a negative wage means that an intrinsically motivated agent could get a lower wage than an agent with no intrinsic motivation. In other words, in our model the sense of achievement motivates the agent supply of effort which implies that the principal can increase performance and still pay lower wages. However, an agent with no intrinsic motivation always gets a zero utility in equilibrium while an intrinsically motivated agent may get positive surplus in the form of informational rents.

3.2. The rent extraction case

Here we study the case in which the low type goal is not challenging for the high type ($g_L < s_H$) whereas the high type is given a challenging goal ($g_H > s_H$) because of Corollary 1. Therefore, the informational rents are zero (Proposition 1).[28] Thus, the principal can "extract" the agent's intrinsic motivation and do not worry about incentive compatibility, so the high type wage will be lower than with informational rents. Note that this case is equivalent to a complete information benchmark where the principal knows the agent's standard. Hence, we can rewrite the IR_L and IC_H constraints as

$$w_L = \frac{e_L^2}{2} - s_L g_L \ln\left(\frac{\theta e_L}{g_L}\right), IR_L$$

$$w_H = \frac{e_H^2}{2} - s_H g_H \ln\left(\frac{\theta e_H}{g_H}\right) \; IC_H$$

Therefore, the solution of the principal's problem is, for all $i \in \{L, H\}$

$$e_i = \theta\left(1 + \frac{s_i}{\mathrm{e}}\right),$$

$$g_i = \left(\frac{\theta}{\mathrm{e}}\right)^2 (\mathrm{e} + s_i).$$

For both agent types, the effort, e_i, as well as his goal, g_i, increase with his standard, s_i. In this case, the low type's *contract* does not depend on the high type's standard. In other words, the principal does not distort the low type's *contract* as in the previous case.

3.3. The optimal contract

We proceed to fully characterize the optimal *contract* offered by the principal in the two type's case. We have studied above two cases that may arise in equilibrium: the informational rent case and the rent extraction case. While in the former the low type's goal is challenging for the high type agent, and hence he gets positive informational rents, in the latter the low type's goal is non-challenging for the high type and thus the principal can extract the entire surplus of both agent types. Let us consider the informational rents case depicted in Fig. 1. In this case, the high type agent is committed to the low type's goal, thus $g_L > s_H$ so that $\psi(g_L, s_H) > 0$. As s_H increases, g_L decreases, therefore there is $s_H = \bar{s}_I$ such that both variables coincide. Thus $\psi(g_L, s_H) = 0$, so the informational rents are zero. The next proposition fully characterizes the equilibrium.

[28] If $g_L = s_H$ the informational rents are also extracted. However, the solution can be slightly different as we shall prove in the next section.

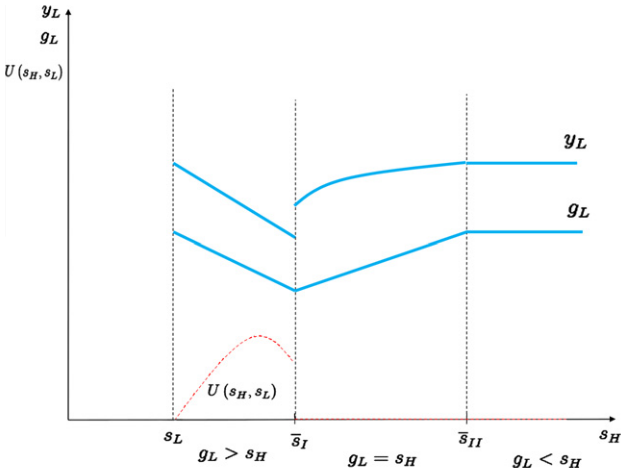

Fig. 3. Comparative statics: Low type's equilibrium and informational rents.

Proposition 2. *Given* $p \in (0,1)$ and $s_L \geqslant \frac{e}{1+\left(\frac{e^2}{p\theta^2}\right)}$, *the optimal production goals are*

$$g_H^* = \left(\frac{\theta}{e}\right)^2 (e + s_H), \quad g_L^* = \begin{cases} (\frac{\theta}{e})^2 (e + \frac{s_L - p s_H}{(1-p)}) & \text{if } s_H \in (s_L, \bar{s}_I), \\ s_H & \text{if } s_H \in [\bar{s}_I, \bar{s}_{II}], \\ (\frac{\theta}{e})^2 (e + s_L) & \text{if } s_H > \bar{s}_{II}. \end{cases}$$

While the optimal efforts provided by agents are

$$e_H^* = \theta\left(1 + \frac{s_H}{e}\right), \quad e_L^* = \begin{cases} \theta(1 + \frac{s_L - p s_H}{(1-p)e}) & \text{if } s_H \in (s_L, \bar{s}_I), \\ \frac{\theta + \sqrt{4 s_L s_H + \theta^2}}{2} & \text{if } s_H \in [\bar{s}_I, \bar{s}_{II}], \\ \theta(1 + \frac{s_L}{e}) & \text{if } s_H > \bar{s}_{II}. \end{cases}$$

where $\bar{s}_I = (\frac{\theta^2 (s_L + e(1-p))}{p\theta^2 + e^2(1-p)})$ and $\bar{s}_{II} = (\frac{\theta}{e})^2 (e + s_L)$.

Under the assumption that $s_L \geqslant \frac{e}{1+(\frac{e^2}{p\theta^2})}$ we can get rid of the cases where the principal sets $g_L = 0$ to completely eliminate high type's informational rents. Therefore, by setting s_L sufficiently high we can focus on the more interesting cases where the principal does not exclude the low type from the goals setting process.

By Proposition 2 we know that if $s_H \in (s_L, \bar{s}_I)$, we are in the informational rents case; whereas, if $s_H \geqslant \bar{s}_I$, we are in the rent extraction case. If $s_H \in [\bar{s}_I, \bar{s}_{II}]$, we have a corner solution in which $g_L^* = s_H$, while if $s_H > \bar{s}_{II}$ then $g_L^* > s_H$.[29] Therefore, if in equilibrium $g_L^* > 0$, in other words, the principal never wants to exclude the low type from the *contract*.

It is straightforward to show that in our principal agent model with no goals, which leads to $V(\cdot) = 0$, the effort exerted by the agent is $e = \theta$.[30] Therefore, Proposition 2 shows that, when the agents have goal dependent preferences, the principal includes positive goals in the optimal *contract* because they boost the agent's pride in accomplishment. As a result, while goal setting is payoff irrelevant, since it does not directly affects the agents' wage, it does increase the agent's output and hence the principal's profits. In addition to this, the higher the agent's standard, the greater the principal's profits will be.

Note that, in equilibrium, the goal offered to the high type agent, and hence his effort, has the same functional form independently of whether he gets positive informational rents or not, while the *contract* of the low type is different in the two situations. This is the standard "non-distortion at the top, distortion at the bottom" result in adverse selection models. The next figure illustrates some comparative statics. In particular we fix the standard of the low type and plot the low type's production and his assigned goal as well as the informational rents as a function of the high type's standard, s_H (see Fig. 3).

An important feature of the optimal *contract* is that the high type agent gives the maximum informational rents when he has an intermediate standard. This result arises for two reasons. Firstly, because of the inverted U-shaped informational rents function discussed previously, thus if s_H is sufficiently high with respect to s_L, the principal distorts the low type *contract* so much that the informational rents decrease with s_H. Secondly, because if $s_H \geqslant \bar{s}_I$, the low type goal designed by the principal

[29] All the technical details are relegated to the Appendix, in which we additionally provide the solution of the cases that violate the condition of Corollary 1, for all of which the high type agent gets zero informational rents.

[30] Note that there is no unemployment in equilibrium. This is because even an agent with no intrinsic motivation ($V(\cdot) = 0$) provides a profit of $\frac{\theta^2}{2} > 0$ for the principal. If we would allow for the possibility of unemployment (for instance considering capacity constraints) in the model, the principal would hire high type agents firstly, so low type agents could be excluded.

is not challenging for the high type and so his intrinsic utility when taking the low type *contract* (i.e., the informational rents) is zero. Therefore, an agent gets a zero surplus if he is a low type, or he is so demanding that the low type goal is not challenging enough to derive a sense of achievement in accomplishing it. This is an important result stating that an agent with goal dependent preferences can benefit from having the highest personal standard but he can be too demanding, when, in equilibrium, he does not consider as challenging other goals in the *contract*. In this case, although the high type achieves the highest production, he cannot obtain any benefit with respect to the low type agent and the principal extracts the complete agents' surplus.

These results provide new insights not only for economist but also for psychologist. In the introduction we have discussed several experiments in psychology that provides a good support for the existence of a goal-dependent intrinsic utility for the agent. However, to our knowledge, there are no experiments testing how optimal goals set by principals should be in an adverse selection environment. Our theoretical model provides some testable predictions. In particular, goals are used by a profit maximizing principal and set taking into account not only the agents' goal-dependent intrinsic motivation but also the informational rents that they can reach.

In this section we have shown that, compared with the low type, a high type agent can get the same, but never lower, utility when his standard is sufficiently high. One reasonable question is whether in a model with more agent types a high type can get lower satisfaction than lower types. This is the content of the next section.

3.4. The three types model

Here we show that the model can be easily extended to a three types case, i.e., $s \in \{s_L, s_M, s_H\}$ with $s_H \geqslant s_M \geqslant s_L > 0$. First of all, we can check that Lemma 1, Lemma 3 and hence Corollary 1 apply as well to the three types case.[31] For simplicity we consider that the condition of Corollary 1 satisfies such that in equilibrium $V(y_i, g_i, s_i) > 0$. In the next proposition, we find which constraints bind.

Proposition 3. Given a contract $\{w, g\} = \{(w_L, w_M, w_H), (g_L, g_M, g_H)\}$, in equilibrium, IR_L, $IC_{M,L}$ and $IC_{H,M}$ bind, i.e.,

$$U(s_L, s_L) = 0,$$

$$U(s_M, s_M) = U(s_M, s_L) = \begin{cases} g_L \ln\left(\frac{\theta e_L}{g_L}\right)(s_H - s_L) & \text{if } g_L > s_H, \\ 0 & \text{if } g_L \leqslant s_H. \end{cases}$$

$$U(s_H, s_H) = U(s_H, s_M) = \begin{cases} g_M \ln\left(\frac{\theta e_M}{g_M}\right)(s_H - s_M) & \text{if } \quad g_M > s_H, \\ 0 & \text{if } \quad g_M \leqslant s_H. \end{cases}$$

Note that when $g_L \in (s_M, s_H)$ and $g_M > s_H$, the higher the individual standard the higher the informational rents will be. However, as in the two types case, if s_H is sufficiently high, he does not consider as challenging other goals in the *contract* so his informational rents are zero. In this case, the mid-ranged type will obtain positive informational rents while the high type will not. Therefore, with three consumer types, a mid-ranged agent (not only a mid-ranged standard of the high type as before) could be the most satisfied.[32]

It is important to remark how the properties of the goal commitment function $\psi(g, s)$ affect agent's satisfaction results. To obtain the result that the equilibrium high type's utility may decrease with his standard if this is very high (the inverted U-shaped informational rents function) it is enough to assume that higher goals lead to higher goal commitment for both types, (i.e., $\psi(g, s) = sg$ for all s, g). However, the stronger result obtained in this section, that the high type can be actually worse off, depends on the assumption that the personal standard is a reference point that determines whether a goal boosts intrinsic motivation or not. Thus, if an agent is very demanding, the only possible way to get a positive intrinsic utility is to choose the high goal offer designed for him, choosing any other offer in the *contract* gives him zero intrinsic utility because he is not committed to lower goals. Therefore, the principal does not need to pay him informational rents. However, a less demanding agent (s_M) can get satisfaction from accomplishing the lowest goal and the principal needs to pay him informational rents in order to prevent him from choosing the low type's offer.

The main lesson of this result is that in contrast with classical principal agent models, where the most productive agent gets the highest informational rents, in our model, the agent who produces the most – the one with the highest standard – can be worse off than lower types when he does not consider lower goals to be challenging and hence cannot get informational rents. In other words, being very demanding can be detrimental.[33] We can think about anecdotic evidence of the

[31] These results are a consequence of our goal dependent intrinsic utility function specification rather than the number of agent types.

[32] It is immediate that this equilibrium always exists when s_M and s_L are sufficiently close and s_H is sufficiently high.

[33] As we mentioned in the introduction, we can find evidence of the detrimental effect of high standards in the psychology literature. For instance, in an experiment with undergraduate students, Mento et al. (1992) found that, controlling for the students ability, the highest degree of satisfaction is reached by students with a grade goal of C (i.e., students with a mid-ranged standard) while the lowest one was attained by students with a grade goal of A (i.e., students with a very high standard).

detrimental effect of high standards. For instance, a researcher intrinsically motivated to achieve a certain challenging goal is locked in because he cannot derive intrinsic motivation from an easier goal. Since the researcher cannot credibly pretend to choose an easier goal, a manager does not need to worry about incentive compatibility and can offer him a low wage.

To finish, we want to point out that it is possible to relate these results to the literature of job satisfaction and the so called "paradox of happiness" (e.g., Drakopoulos and Theodossiou (1997) and Phelps (2001)). In particular, we can see our goal commitment function as a kind of "Archimedean preferences" which rationalize a "hierarchical behavior" (see Drakopoulos, 2008). Under this interpretation, our notion of personal standards would represent the individual aspiration level of task difficulty beyond which the individual is intrinsically motivated. In our model we have proved that the principal finds optimal to design goals to deal with the agents' personal standard and, as we have argued, this policy has non-standard implications for the agents' job satisfaction. If an agent has the highest personal standard he gets the highest production and possibly the highest wages to compensate for the disutility of effort (see Fig. 2) but not the highest job satisfaction which is consistent with the findings that higher income do not necessarily correspond with higher individual happiness.[34]

4. Conclusion

Psychologists and experts in management have long documented the importance of goal setting in workers' motivation. In particular, they have found that when workers are committed to challenging but attainable goals, their performance increases even if those goals are not directly linked to wages. In this paper, we have introduced goal setting in a principal agent model of managerial incentives. Agents care about goal setting because achieving those goals creates a sense of achievement and accomplishment that modifies their intrinsic motivation to work. We have shown that, in an optimal *contract*, more challenging objectives increase agents' performance and that the goals set by the principal increase with the agent's standard. Therefore, goals that are payoff irrelevant, since they do not directly affect agents' extrinsic incentives, increase the principal's profits. We have also shown that a mid-ranged standard gives the highest satisfaction to an agent and that a mid-ranged agent type could be the most satisfied among all the agent types. Therefore, being very demanding can be detrimental.

There are some promising lines for future research. First of all, our goal commitment function is a very simple one; an agent is committed to a goal when it exceeds his personal standard sufficiently for him to consider the goal to be challenging. Psychologists have found that there are other determinants of goal commitment that should be studied in an economic model, such as the agents' self-efficacy (i.e., ability confidence) and the agents' participation in the goal setting processes (see Anderson et al., 2010; Bush, 1998). Moreover, if we consider a more realistic model with production uncertainty, an agent can be satisfied from trying hard even if the goal is not achieved. Similarly, the agent could be dissatisfied from not having tried hard enough because he suffers from self-control problems: being tempted to be lazy when deciding effort and suffering regret from not achieving a goal after production take place. Therefore, the principal could use assigned goals to attenuate workers' self-control problems. This extension would link our model with the existing self-set goals models (Hsiaw, 2009; Kock and Nafziger, 2011a; Kock & Nafziger, 2011b) with present-biased preferences.

A very interesting line of future research is to endogenize the personal standard parameter. There are several ways to do this. First, in a model with different abilities we can imagine that the agent's standard is in part determined by his ability. Second, we can think that the personal standard is determined by the agent's rational expectation about outcomes. This would provide a very good link between the present model with goal dependent preferences and the reference dependent utility from expectations literature (such as models with preferences à la Köszegi and Rabin (2006)). In fact goal setting can provide an additional explanation of the formation of reference states. For instance, with an experimental study Matthey (2010) finds evidence that apart from an individual's own past, present and expected future outcomes and the outcomes of relevant others, reference states also depend on environmental factors that do not influence outcomes. Therefore, the kind of payoff irrelevant goals studied in this paper could affect reference states in a similar way, so an experimental study in the area is very appealing.

Another topic would be to introduce competition in the model. If we consider that firms compete for workers, we should reconsider our result that very demanding (and hence productive) agents may be the least satisfied. With competition we have two opposite effects. On the one hand, as we have shown in this paper, very demanding workers may get lower satisfaction than lower types. But, on the other hand, firms compete for more demanding agents offering them more attractive offers (wages and goals), which has a positive effect on the satisfaction of very demanding agents.

Finally, there is evidence that goal setting policies have more impact on agents' performance as time goes by Ivancevich (1974) finds that in a manufacturing company a goal setting program significantly improves workers' performance within 6 months after implementation. Therefore, it would be interesting to extend our model to allow for dynamic considerations. One possibility is to consider personal standards changing with past goals. Thus, after achieving a certain goal the agent's personal standard increases so he will be more committed to higher goals in the future. This captures the intuitive idea of goal setting as a motivation tool to push the agent's limits. When standards at any point depend on the goal-setting history, some interesting effects, like addition to goals, may arise.

[34] We are grateful to Nikolaos Georgantzís to point out the link between the present paper and the literature of job satisfaction.

Acknowledgements

I'm particularly indebted to Mª Angeles de Frutos and Susanna Esteban for their valuable advice and suggestions. The paper has benefited from comments by Antonio Cabrales, Marco Celentani, Gerard Llobet, Emma Moreno, Miguel Ángel Malo, Klaus M. Schmidt, Albert Ma, Dan Kovenock and Nikolaos Georgantzis. I am also grateful to two anonymous referees, participants of 7th IMEBE and 11th SAET Conferences, as well as audiences from several seminars, for their numerous helpful comments. All remaining errors are attributable to me.

Appendix A

A.1. Proofs of propositions and lemmas

Proof of Lemma 1. The proof is by way of contradiction. Let $\{w,g\}$ be a *contract* such that $y < g$ (i.e., $\upsilon(y,g) < 0$), so that $V(y,g,s) = \psi(g,s)\upsilon(y,g) < 0$ as $\psi(g,s) > 0$. The utility of the agent in such a *contract* is

$$U = w + V(y, g, s) - c < w - c.$$

Because of this, one can design a *contract* $\{w^d, g^d\}$ with $g^d < s$ (i.e., $\psi(g^d, s) = 0$) and $w^d < w$, which is feasible since $U^d = w^d - - c \geqslant U$, and gives larger profits to the principal, as $w^d < w$ *and* $y^d = y$.

Proof of Lemma 2. Given a fixed pair of agents' standards s_L, s_H, all the possible cases that can arise are:

$$(i)\ \max\{g_L, g_H\} \leqslant s_L, (ii)\ g_L \leqslant s_H \leqslant g_H, (iii)\ s_L < g_L \leqslant s_H, (iv)\ \min\{g_L, g_H\} > s_h.(v)\ g_H < s_L < g_L, (vi)\ g_L \leqslant s_L \leqslant g_H \leqslant s_H, (vii)\ s_L \leqslant \{g_L, g_H\} \leqslant s_H, (viii) s_L < g_H < s_H < g_L.$$

First we show that (vi)–(viii) will not emerge in an optimal *contract*. In (vi)–(viii), $V(y_H, g_H, s_L) > 0$ as $g_H > s_L$ as and we have

$$U(s_L, s_H) = w_H + s_L g_H \upsilon(y_H, g_H) - \frac{e_H^2}{2} > w_H - \frac{e_H^2}{2} = U(s_H, s_H).$$

Therefore, as is standard in principal–agent models, in equilibrium, the optimal $\{w,g\}$ satisfies IR binding for the "low" type (here L) and IC binding for the "high" type (here H), i.e., $U(s_H, s_H) = 0$ and $U(s_L, s_L) = U(s_L, s_H) > 0$ However, the following *contract* is feasible and yields higher profits to the principal

$$\{w^d, g^d\} = \{(w_L^d, w_H), (g_L, g_H^d)\},$$

where $g_H^d < s_L$ (i.e., and $V(s_L, s_H) = 0$), $w_L^d = \frac{e_L^2}{2} < w_L = \frac{e_L^2}{2} + s_L g_H \upsilon(y_H, g_H)$ and $(y_L^d, y_H^d) = (y_L, y_H)$. Consequently, (vi)–(viii) can be ruled out.

Regarding the remaining cases, note that only in case (iv) we may have positive informational rents because $g_L > s_H$. In the other cases, (i)–(v), it is immediate that, in equilibrium, the principal can extract the entire agents' surplus so that $U(s_H, s_H) = U(s_L, s_L) = 0$. Therefore, the monotonicity condition, $U(s_H, s_H) \geqslant U(s_L, s_L)$, is satisfied in all cases (i)–(v). □

Proof of Proposition 1. By IR and IC the *contract* $\{w,g\}$ must satisfy $U(s_L, s_L) = 0$ and $U(s_H, s_H) = U(s_H, s_L)$. Therefore, $U(s_H, s_L) = \psi(g_L, s_H)\upsilon(y_L, g_L)$, where $\psi(g_L, s_H) > 0$ iff $g_L \leqslant s_H$. □

Proof of Lemma 3. By Lemma 1, any optimal $\{w,g\}$ satisfies $V(y_i, g_i, s_i) \geqslant 0$, thus $V(y_i, g_i, s_i)$ is either positive or zero.

(i) First note that the if part, $V(y_i, g_i, s_i) > 0 \Rightarrow y_i > s_i$, follows straightforwardly. We show the only if part by contradiction. Suppose that $y_i > s_i \Rightarrow V(y_i, g_i, s_i) = 0$.

For the low type we have $y_L > s_L \Rightarrow V(y_L, g_L, s_L) = 0$, thus $g_L \leq s_L$ since $\psi(g_L, s_L)$. The following deviation is feasible and yields higher profits,

$$\{w^d, g^d\} = \{(w_L^d, w_H), (g_L^d, g_H)\},$$

where $g_L^d \in (s_L, s_H)$ (i.e., $V(y_L, g_L, s_L) > 0$ and $V(y_L, g_L, s_H) = 0$), $w_L^d = w_L - V(y_L, g_L, s_L)$ and $(y_L^d, y_H^d) = (y_L, y_H)$.

For the high type if, $y_H > s_H \Rightarrow V(y_H, g_H, s_H) = 0$ thus $g_H \leqslant s_H$ since $\psi(g_H, s_H) = 0$. The following deviation is feasible and yields higher profits,

$$\{w^d, g^d\} = \{(w_L, w_H^d), (g_L, g_H^d)\}$$

where $g_H^d \geqslant s_H$ (i.e., $V(y_H, g_H, s_H) > 0), w_H^d = w_H - V(y_H, g_H, s_H)$ and $(y_L^d, Y_H^d) = (y_L, Y_H)$. Moreover $U^d(s_L, s_L) = U(s_L, s_L) = 0$ by Proposition 1.

(ii) First note that the if part, $V(y_i, g_i, s_i) = 0 \Rightarrow y_i \leqslant s_i$, follows straightforwardly. We show the only if part by contradiction. Suppose that $y_i \leqslant s_i \Rightarrow V(y_i, g_i, s_i) > 0$, thus $s_i < g_i$ since $\psi(g_i, s_i) > 0$.Therefore $y_i < g_i$ which leads to $V(y_i, g_i, s_i)$. □

Proof of Corollary 1. Immediate from Lemma 3. □

Proof of Proposition 2. See below the solution of the optimal *contract* with two types when $V(y_i, g_i, s_i) > 0$ for all $i \in \{L, H\}$. □

Proof of Proposition 3. Under the condition of Corollary 1 we have that $V(y_i, g_i, s_i) > 0$ so that $g_i > s_i$ for all i. Therefore we have four possible cases: (i) $s_L < g_L < s_M < g_M < s_H < g_H$, (ii) $s_L < g_L < s_M < s_H < min\{g_M, g_H\}$, (iii)$s_L < s_M < min\{g_L, g_H\} < s_H < g_H$ and (iv) $s_L < s_M < g_M < s_H < \min\{g_H, g_L\}$. However, case (iv) will not emerge in an optimal *contract* because it does not satisfy incentive compatibility since $U(s_M, s_L) = w_L + s_M g_L v(y_L, g_L) - \frac{e_L^2}{2} > w_L + s_L g_L v(y_L, g_L) - \frac{e_L^2}{2} = U(s_L, s_L)$.

Note that in case (i) agents do not get any intrinsic utility from imitate the others. Therefore agents do not get informational rents and in equilibrium, $U(s_L, s_L) = U(s_M, s_M) = U(s_H, s_H) = 0$. In case (ii) type H is committed to the goal of type M, therefore applying standard results in principal agent models we have that in equilibrium $U(s_H, s_H) = g_M ln\left(\frac{\theta e_M}{g_M}\right)(s_H - s_M) > U(s_M, s_M) = U(s_L, s_L) = 0$. Finally in case (iii) we have that type M is committed to the goal of type L. Therefore, in equilibrium, $U(s_M, s_M) = g_L ln\left(\frac{\theta e_L}{g_L}\right)(s_M - s_L) > U(s_H, s_H) = U(s_L, s_L) = 0$. □

A.2. The solution of the optimal contract with two types

A.2.1. The optimal contract when $V(y_i, g_i, s_i) > 0$ for all $i \in \{L, H\}$

We first solve the principal agent model under the condition of Corollary 1, i.e.,$V(y_i, g_i, s_i) > 0$ for all $i \in \{L, H\}$. Therefore, cases (iii) and (iv) of Lemma 2 are the only possible cases.

Assume first $g_L < s_H$. In this case the participation constraint is binding for both agent types. Therefore, the principal's problem simplifies to:

$$\max_{\{e_H, g_H, e_L, g_L\}} p(\theta e_H - w_H) + (1 - p)(\theta e_L - w_L)$$

subject to

$$w_L = \frac{e_L^2}{2} - s_L g_L \ln\left(\frac{\theta e_L}{g_L}\right),$$

$$w_H = \frac{e_H^2}{2} - s_H g_H \ln\left(\frac{\theta e_H}{g_H}\right)$$

Denoting by e to the Euler's number, the solution of this problem is:

$$e_H = \theta\left(1 + \frac{s_H}{\mathrm{e}}\right) \text{ and } g_H = \left(\frac{\theta}{\mathrm{e}}\right)^2 (\mathrm{e} + s_H),$$

$$e_L = \theta\left(1 + \frac{s_L}{\mathrm{e}}\right) \text{ and } g_L = \left(\frac{\theta}{\mathrm{e}}\right)^2 (\mathrm{e} + s_L),$$

We can also check that second order conditions are satisfied under the condition $s_L \geqslant \frac{e}{1+\left(\frac{e^2}{p\theta^2}\right)}$.

Note that this case is not feasible when s_H and s_L are sufficiently close, i.e., if $\left(\frac{\theta}{e}\right)^2(e + s_L) \geqslant s_H$. Under this situation the principal may want to set $g_L = s_H$, so that the high type agent still gets zero information surplus, this is the next situation we analyze. By substituting in the principal's problem g_L by s_H and solving the new principal's problem we get that the *contract* offered to the high type is the same as the previous case, while the *contract* offered to the low type i

$$e_L = \frac{1}{2}\left(\theta + \sqrt{\theta^2 + 4 s_L s_H}\right) \text{ and } g_L = s_H.$$

Assume finally $g_L > s_H$. In this case the high type gets positive informational rents in equilibrium, thus

$$U(s_H, s_L) = g_L \ln\left(\frac{\theta e_L}{g_L}\right)(s_H - s_L) > U(s_L, s_L) = 0.$$

Therefore, the principal's problem become

$$\max_{\{e_H, g_H, e_L, g_L\}} p(\theta e_H - w_H) + (1-p)(\theta e_L - w_L)$$

subject to

$$w_L = \frac{e_L^2}{2} - s_L g_L \ln\left(\frac{\theta e_L}{g_L}\right),$$

$$w_H = \frac{e_H^2}{2} - s_H g_H \ln\left(\frac{\theta e_H}{g_H}\right) + g_L \ln\left(\frac{\theta e_L}{g_L}\right)(s_H - s_L),$$

The solution of this problem is the following:

$$e_H = \theta\left(1 + \frac{s_H}{\mathrm{e}}\right) \text{ and } g_H = \left(\frac{\theta}{\mathrm{e}}\right)^2 (\mathrm{e} + s_H),$$

$$e_L = \theta\left(1 + \frac{s_L - p s_H}{(1-p)\mathrm{e}}\right) \text{ and } g_L = \left(\frac{\theta}{\mathrm{e}}\right)^2 \left(\mathrm{e} + \frac{s_L - p s_H}{(1-p)}\right).$$

A.2.2. The optimal contract in the remaining cases

Previously we have solved cases (iii) and (iv) of Lemma 2, here we proceed by solving the remaining cases (i), (ii) and (v).

- *Case (i)*: $\max\{g_L, g_H\} \leqslant s_L$.

In this case $V(y_i, g_i, s_i) = 0$ for all $i \in \{L, H\}$. Therefore, applying Proposition 1, we have that the principal's problem is

$$\max_{\{e_H, g_H, e_L, g_L\}} p(\theta e_H - w_H) + (1-p)(\theta e_L - w_L)$$

subject to

$$w_L = \left(\frac{e_L^2}{2}\right),$$

$$w_H = \left(\frac{e_H^2}{2}\right).$$

The solution of this problem is

$$e_H = e_L = \theta,$$

$$w_H = w_L = \frac{\theta^2}{2}.$$

- *Case (ii)*: $g_L \leqslant s_L < s_H \leqslant g_H$.

In this case we have that $V(y_H, g_H, s_H) = s_H g_H \ln(\frac{\theta e_H}{g_H}) > 0$ while $V(y_L, g_L, s_L) = 0$. By Proposition 1 we know that in this case the high type gets zero informational rents. Therefore, the principal's problem is

$$\max_{\{e_H, g_H, e_L, g_L\}} p(\theta e_H - w_H) + (1-p)(\theta e_L - w_L)$$

subject to

$$w_L = \left(\frac{e_L^2}{2}\right),$$

$$w_H = \left(\frac{e_H^2}{2}\right) - s_H g_H \ln\left(\frac{\theta e_H}{g_H}\right).$$

The solution entails

$$e_L = \theta, \quad e_H = \theta\left(1 + \frac{s_H}{\mathrm{e}}\right),$$

with

$$g_H = \left(\frac{\theta}{\mathrm{e}}\right)^2 (\mathrm{e} + s_H).$$

- *Case (v)*: $g_H < s_L < g_L$.

In this case we have that $V(y_H, g_H, s_H) = 0$ while $V(y_L, g_L, s_L) = s_L g_L \ln\left(\frac{\theta e_L}{g_L}\right) > 0$. By Proposition 1 we know that in this case the high type gets zero informational rents. Therefore, the principal's problem is

$$\max_{\{e_H, g_H, e_L, g_L\}} p(\theta e_H - w_H) + (1-p)(\theta e_L - w_L)$$

subject to

$$w_L = \frac{e_L^2}{2} - s_L g_L \ln\left(\frac{\theta e_L}{g_L}\right),$$

$$w_H = \frac{e_H^2}{2}$$

Whose solution is

$$e_H = \theta, \quad e_L = \theta\left(1 + \frac{s_L}{\mathrm{e}}\right),$$

with

$$g_L = \left(\frac{\theta}{\mathrm{e}}\right)^2 (\mathrm{e} + s_H).$$

In the following graph we plot the equilibrium profits as a function of θ, to order all the possible cases (see Fig. 4).

Since goals are an increasing function of θ, if we rank the cases with respect to θ, keeping the other parameters constant, we have that the first case, i.e., the one that emerges when θ is very low, is case (i). The interior solution of this case emerges when $\theta \in (0, \hat{s}_{\mathrm{I}})$, while if $\theta \in (\hat{s}_{\mathrm{I}}, \hat{s}_{\mathrm{II}})$ we have a corner solution in which $g_L = s_L$. After this case we have either case (ii) or (v) depending on the other parameter values, it is immediate to check that both cannot hold simultaneously. The interior solution of these cases emerges when $\theta \in (\hat{s}_{\mathrm{II}}, \hat{s}_{\mathrm{III}})$, while if $\theta \in (\hat{s}_{\mathrm{III}}, \hat{s}_{\mathrm{IV}})$ we have a corner solution, i.e., either $g_H = s_H$ or $g_L = s_L$. Finally, when θ is sufficiently high we have the cases studied in the previous section, i.e., cases (iii) and (iv). The interior solution of case (iii) emerges when $\in (\hat{s}_{\mathrm{VI}}, \hat{s}_{\mathrm{V}})$, if $\theta \in (\hat{s}_{\mathrm{V}}, \hat{s}_{\mathrm{VI}})$ we have that $g_L = s_H$, and if $\theta > \hat{s}_{\mathrm{VI}}$ we are in case (iv) which is the only case in which the high type agent gets positive informational rents.

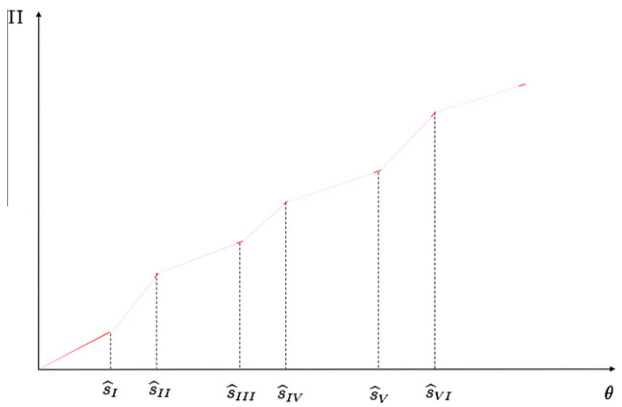

Fig. 4. Profits as function of θ.

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