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Goal Setting and Monetary Incentives: When Large Stakes Are Not Enough

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The aim of this paper is to test the effectiveness of wage-irrelevant goal-setting policies in a laboratory environment. In our design, managers can assign a goal to their workers by setting a certain level of performance on the work task. We establish our theoretical conjectures by developing a model in which assigned goals act as reference points to workers' intrinsic motivation. Consistent with our model, we find that managers set goals that are challenging but attainable for a worker of average ability. Workers respond to these goals by increasing effort and performance and by decreasing on-the-job leisure activities with respect to the no-goal-setting baseline. Finally, we study the interaction between goal setting and monetary rewards and find, in line with our theoretical model, that goal setting is most effective when monetary incentives are strong. These results suggest that goal setting may produce intrinsic motivation and increase workers' performance beyond what is achieved by using solely monetary incentives.

Data, as supplemental material, are available at http://dx.doi.org/10.1287/mnsc.2014.2068.

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1. Introduction

1.1. Work Motivation and Goal Setting

Motivating workers is a crucial dimension of labor relationships that has been studied at length in fields ranging from psychology to economics. In the economics literature, the principal–agent paradigm has emphasized the importance of monetary incentives (i.e., wages and the threat of being fired) as the most effective way to induce workers to exert effort (for reviews, see Laffont and Martimort 2002, Bolton and Dewatripont 2005). These theories highlight the role of *extrinsic motivation* by which people engage in an activity for monetary rewards while disregarding the fact that people may engage in an activity for their own sake (*intrinsic motivation*). Psychologists (Deci 1971, 1975) and behavioral economists (Frey and Jegen 2001) have pointed out the relevance of intrinsic motivation and its relationship with extrinsic (i.e., monetary) incentives. Intrinsic motivation can be interpreted as an idiosyncratic characteristic of workers that could be undermined by the presence of extrinsic incentives, because the latter may conceal the nonmonetary motives of a person's work, generating the so-called "motivation crowding-out effect" (for reviews, see Gneezy et al. 2011, Kamenica 2012). The previous approach leaves a relevant question open: Can we boost workers' intrinsic motivation and by the same token increase their level of performance? Many psychologists give a positive answer to this question by arguing that wage-irrelevant (i.e., nonbinding) performance goals enhance employees' motivation and work performance (Locke and Latham 2002). In line with this argument, workers respond to goals because their attainment creates a sense of accomplishment that increases satisfaction at work. The effectiveness of goal setting has been reported consistently in the experimental literature in psychology. Locke and Latham (2002) provide an exhaustive literature review of the topic and find that goals increase performance in more than 90% of the studies.

In this paper, we propose to test the effectiveness of goal-setting policies and assess their interaction with monetary incentives in an incentivized controlled

laboratory setting. Our experimental methodology enables us to control for confounding factors that may have interfered in the empirical evaluation of goal-setting policies, such as corporate culture and explicit and implicit incentives, as well as supervision policies. To that end, we consider a laboratory environment that reproduces several features of field settings while keeping control over the decision environment (Corgnet et al. 2015a). Our experimental approach to the analysis of goal setting is novel in many ways. First, we consider a work environment where monetary incentives prevail. The interplay between goal setting and monetary incentives is especially relevant for the economic literature on intrinsic motivation and the crowding-out effect of incentives. The idea is that if nonbinding goals enhance workers' intrinsic motivation they could also mediate the relation between the two sources of work motivation, intrinsic motivation and monetary incentives. Second, in our setting, goals are determined by participants who were assigned the role of managers rather than selected randomly or assigned arbitrarily by the experimenter (Latham and Locke 1979, Winter and Latham 1996). This was intended to mimic actual managerial practices. Third, we allow participants to undertake a real leisure activity (Internet browsing) instead of working on the task. Our intention is not only to reproduce a relevant feature of real-world organizations but also to ensure that our results are not driven by a lack of alternative activities in the laboratory. This issue has been described as the "active participation hypothesis'' (Lei et al. 2001, Corgnet et al. 2015b). Finally, we consider a multiperiod setting that allows us to evaluate the effectiveness of goal setting over time.

To establish our conjectures we develop a principal–agent (manager–worker) model where the worker's motivation to exert effort is twofold. First, as in standard models, the worker responds to extrinsic incentives that are captured by the magnitude of the monetary reward. Second, workers are intrinsically motivated to exert effort in order to attain the goals that are set by their managers. We model workers' intrinsic motivation as a goal-dependent intrinsic utility function in line with prospect theory (Kahneman and Tversky 1979). Our theoretical framework is an extension of Wu et al. (2008). In this paper the authors examine the agent's response to exogenously given goals under prospect theory preferences and in the absence of monetary incentives. In our model, we extend the previous analysis by considering the case in which the principal is in charge of setting goals. In addition, our model introduces extrinsic incentives with the aim of studying the interaction between monetary incentives and workers' responses to goals. In order to avoid gift-exchange effects (Fehr et al. 1993 and 1997) and isolate the effect of goal setting, we consider the case in which monetary incentives are outside of the control of managers.

Our experiment consists of two main treatments, which will be referred to as "baseline'' and "goal setting.'' In the goal-setting treatment, managers were able to set wage-irrelevant goals for workers, although no such option was available in the baseline treatment. Comparing the two treatments, we find that goal setting increases workers' performance. We also observe that goals increase workers' dedication to the work task, increasing effort and decreasing the time spent browsing the Internet. The effectiveness of goal setting is closely related to the fact that managers set goals that are challenging yet attainable by an average-ability worker, which is consistent with our theoretical conjectures. Moreover, the positive effect of goals disappears when restricting our analysis to nonreasonable goals that are too far away from a worker's inherent ability level. Allowing participants to set goals, we are able to analyze goal selection. In line with our model, we find that managers set higher goals when monetary incentives were high.

Importantly, the effectiveness of goal setting is magnified rather than undermined by the use of high monetary incentives because the effect of goal setting on workers' performance is found to be strongest when monetary incentives are high. This is consistent with our theoretical results, according to which high monetary incentives promote higher goals that, in turn, boost workers' motivation and performance.

Finally, we show the robustness of our findings by studying personal and computerized goals. We show that the goals set by managers effectively increase workers' production even in the case in which workers have personal goals. Also, we find the positive effect of goal setting to be robust to the case of computerized goals, which were drawn from the distribution of goals set by managers in the original goal-setting treatment. This result suggests that the effect of goal setting does not crucially depend on the interpersonal relationship between workers and managers.

Overall, our findings suggest that the effectiveness of goal setting that has been reported in the psychology literature is robust to the more general case of work environments where monetary incentives prevail.

1.2. Literature Review

The idea that specific, attainable, and nonbinding goals affect workers' motivation has received considerable attention in the psychology literature (for reviews, see Locke 1996, Latham 2000, Locke and Latham 2002).[1] The first finding of this literature is

[1] The goal-setting literature is certainly vast, according to Latham (2000, p. 161): "... the theory has been shown in more than 1,000

that specific and difficult goals (but those perceived as attainable) lead to greater performance than vague and easy goals. Second, workers are more motivated or more committed to attain goals when they perceive their goals as being relevant and difficult to attain. Finally, goals are shown to increase workers' persistence to exert effort. These results suggest that goal setting may be an effective tool to boost a worker's intrinsic motivation. Our study complements this previous research by studying an environment in which nonbinding goals and monetary incentives coexist.

In economics, the concept of intrinsic motivation has been closely linked to the idea of "motivation crowding out" (Frey and Jegen 2001). Workers' intrinsic motivation has been introduced into economic models in which monetary rewards were shown to crowd out intrinsic motives to work (e.g., Bénabou and Tirole 2003). Gneezy and Rustichini (2000) provide evidence of motivation crowding out in a controlled laboratory environment. The authors find that, although performance increases with significant monetary compensation, small monetary incentives may actually undermine performance compared to a situation with no compensation at all. More recently, Pokorny (2008) and Ariely et al. (2009) have reported experimental evidence that very high monetary rewards can also decrease performance. This evidence sheds light on the nonmonotonic relationship between monetary incentives and performance. It is not only the case that low rewards can do worse than no rewards at all—very high rewards may also have a detrimental effect on workers' motivation. Interestingly, we confirm this result in our baseline design without goal setting in which we observe that performance levels are lower under either low or high monetary incentives compared with average incentives. However, this nonmonotonic pattern as an effect of monetary incentives disappears in the goal-setting treatment, in which case large stakes increase workers' performance.

Our results contribute to the economic literature on intrinsic motivation in two different ways. First, they indicate that it is possible to produce intrinsic motivation by using wage-irrelevant goals. Second, the complementarity between goals and monetary incentives indicates that, when large stakes are detrimental to workers' performance, goal-setting policies can be used to alleviate the crowding-out effect of monetary incentives.

studies to predict, influence and explain the behavior of thousands of people in numerous countries (e.g., Australia, Canada, the Caribbean, England, Germany, Israel, Japan, and the USA), in both laboratory and field settings, involving more than 100 different tasks in occupations that included logging, word processing, engineering, and university scholarship."

To our knowledge, ours is the first work that assesses the joint effect of wage-irrelevant goals and monetary incentives on workers' effort and performance. From a theoretical standpoint, our paper relates to the economics and management literature including the work of Wu et al. (2008), who study workers' responses to goals in a context in which goals are exogenously given and monetary incentives are absent.[2] Wu et al. (2008) find that performance increases with goals that are attainable but that it may decrease otherwise. As we will see, this result will play an important role in our model with monetary incentives in which goals are endogenously selected by managers. Gómez-Miñambres (2012) studies a principal–agent model where agents derive utility from attaining nonbinding goals. In his model, the principal is willing to use goal-setting policies to increase agents' intrinsic motivation to work, which in turn increases performance and reduces the wage bill. Likewise, a number of theoretical papers (e.g., Koch and Nafziger 2011, Hsiaw 2013) have considered the effects of personal (i.e., self-set) goals in attenuating self-control problems. At the empirical level, in a recent study, Goerg and Kube (2012) study the impact of setting personal goals in a field experiment where participants have to search for and relocate books at a large library. The authors consider a standard piece-rate compensation treatment as a baseline. They compare this baseline with several other treatments: a purely nonbinding personal goal; a binding personal goal for which the compensation increases with the goal if it is attained, but no money is received otherwise; and two standard bonus contracts. The authors show that the highest increase in performance levels is achieved when workers are allowed to set personal goals even if goals do not entail monetary consequences.

This paper proceeds as follows. Section 2 presents the experimental environment, and the theoretical framework and the hypotheses are derived in §3. Main results are exposed in §4, and robustness checks are presented in §5. Section 6 concludes.

2. Experimental Design

2.1. Virtual Workplace with Real Effort and Real Leisure

We use a framework in which participants can undertake a real-effort task while having access to the Internet at any point in time during the experiment. The experiment consisted of eight periods of 10 minutes each. The experimental environment is described in detail below.

[2] Wu et al. (2008) consider the utility function that was proposed by Heath et al. (1999), who considered the goal as a reference point. In that respect, goals tend to alter the psychological value of monetary outcomes in a way that is consistent with prospect theory.

Figure 1 Example of Table Summation for the Work Task

	Column1	Column2	Column3	Column4	Column5	Column6	
	3.00	0.00	0.00	2.00	3.00	0.00	
	2.00	3.00	3.00	2.00	1.00	1.00	
	1.00	1.00	2.00	0.00	0.00	1.00	
	3.00	0.00	0.00	1.00	1.00	2.00	
	1.00	3.00	0.00	3.00	2.00	1.00	
	1.00	3.00	1.00	1.00	2.00	3.00	
Sum Column:							

2.1.1. Organizational Roles. We consider organizations with two types of participants, referred to as B (worker) and C (manager). At the beginning of each of the eight periods, participants were randomly assigned to one of these two roles. As a result, participants could either be a worker or a manager depending on the period. Then, each worker was randomly matched with a single manager. During a period, and regardless of the treatment, workers could dedicate their time to either completing the work task or browsing the Internet, whereas managers could only browse the Internet. At the beginning of each period, managers could set a goal for the worker's production level on the work task in the goal-setting treatment.

2.1.2. The Work Task. We consider a real-effort task that is particularly long, laborious, and effortful compared to previous real-effort experiments that have reported the use of counting tasks (e.g., Dohmen and Falk 2011, Eriksson et al. 2009, Niederle and Vesterlund 2007). In particular, participants were asked to sum up matrices of 36 numbers comprised of values between 0 and 3 for 1 hour and 20 minutes. Participants were not allowed to use a pen, scratch paper, or calculator. This rule amplified the level of effort participants had to exert to complete the tables correctly. Our work task was designed to reduce as much as possible the intrinsic motivation derived from the task itself. An example of the work task is shown in Figure 1.

The value of a correct table was selected randomly at the beginning of each period from the following set of values: 10¢, 80¢, or 150¢. No pecuniary penalties were enforced for incorrect answers.[3] Therefore, monetary incentives varied across periods, allowing us to study the interplay between goals and monetary stakes. Total earnings were split equally between the worker and the manager at the end of each period and were displayed in the history panel located at the bottom of participants' screens. Note that managers were not in charge of assigning the incentives to workers so as to avoid a possible gift-exchange game structure and to isolate the effect of goal setting.

2.1.3. Internet Browsing. At any point during the experiment, workers could switch from the work task to the leisure activity of browsing the Internet. Each activity was undertaken separately, in a different screen so that participants could not complete tables while browsing the Internet. Participants were informed that their use of the Internet was strictly confidential. Participants were free to consult their email accounts or visit any webpage. The Internet browser was embedded in the software (see Figure 2) so that the experimenter could keep record of the exact amount of time participants spent on each activity.

The introduction of the Internet in our virtual workplace is motivated by the widespread use of the Internet at work. According to a 2005 study by *American Online* and *Salary.com*, employees spend approximately 26% of their time on activities unrelated to their work (Malachowski and Simonini 2005). Almost half of this time actually corresponds to Internet usage. An appealing feature of the Internet as an alternative to the work task is the wide range of activities that can be completed online. The consideration of leisure-related issues in the experimental literature was introduced in the analysis of labor supply by Dickinson (1999). Falk and Huffman (2007) also introduced the possibility for participants to quit the experiment when analyzing minimum wages and workfare in the laboratory.[4]

2.1.4. Goal Setting. A crucial feature of our experiment is the introduction of nonbinding goals assigned by managers to their workers. This feature will allow us to assess the effect of goal setting on workers' effort and performance. At the beginning of each period and after learning the value of monetary rewards for completing the work task (10¢, 80¢, or 150¢), managers could set a goal for their workers. The goal stated the number of correct tables to be completed by a worker during the period. Workers knew from the instructions that the goal set by

[3] This was decided so as to be able to define goals on the basis of the number of tables completed correctly rather than defining goals on the basis of the monetary value of workers' production. This difference is relevant given that workers may face different monetary incentives making it more difficult for managers to set goals. Note that there still exists an opportunity cost for completing a table incorrectly.

[4] Two related studies (Charness et al. 2010, Eriksson et al. 2009) have also introduced on-the-job leisure activities in experimental environments by giving participants access to magazines.

Figure 2 Embedded Internet Screen

Source. Google and the Google logo are registered trademarks of Google Inc., used with permission.

their manager did not entail monetary consequences so that producing more or fewer tables than the goal neither generates rewards nor induces penalties. Note that the manager could decide not to set a goal, in which case the label "no goal" would appear on the screen. After managers made their decision regarding the goal, workers were informed about their goal as well as the monetary incentives associated with completing the work task correctly. At any moment during the experiment participants had access to their past performance levels and earnings.

2.2. Treatments and Procedures

We conducted two main treatments (see Table 1). In the goal-setting treatment, managers could set wage-irrelevant goals for workers at the beginning of each period, whereas no such option was available in the baseline treatment.

Our participant pool consisted of students from a major U.S. university. We recruited people who participated in related studies (Corgnet et al. 2015a, b) so as to ensure that they had previous experience in completing the work task used in this experiment. The objective was to ensure that participants could assess with some level of accuracy the performance that can be achieved by an average worker on the task.

Table 1 Summary of the Treatments

Treatment	Description	Number of sessions (participants) [observations]
Baseline	The worker's production is split equally between the worker and the manager.	8 (94) [376]
Goal setting	The manager can set a wage-irrelevant goal for the worker. The worker's production is split equally between the worker and the manager.	8 (94) [376]

The experiments took place in March/April 2012 and in October 2013. In total, 186 participants completed the experiment, divided into 16 sessions. We conducted eight sessions for the baseline treatment and eight sessions for the goal-setting treatment. Each session consisted of eight periods (of 10 minutes each) in which participants were randomly matched to either the role of worker or manager.

The experiment was computerized, and all of the interactions were anonymous. The instructions were displayed on participants' computer screens. Participants had exactly 20 minutes to read the instructions. A 20-minute timer was shown on the laboratory screen. Three minutes before the end of the instruction period, a monitor announced the time remaining and handed out a printed summary of the instructions. None of the participants asked for extra time to read the instructions. At the end of the 20-minute instruction round, the instructions file was closed, and the experiment started. The interaction between the experimenter and the participants was negligible. At the end of the experiment and before payments were made, participants were asked to complete a debriefing questionnaire; see Online Appendix C (online appendices available as supplemental material at http://dx.doi.org/10.1287/mnsc.2014.2068).

Participants were paid their earnings in cash. Individual earnings at the end of the experiment were computed as the sum of the earnings in the eight periods. Participants in the baseline treatments earned on average \$37.92, and participants in the goal-setting treatment earned on average \$40.80. This includes a

$7.00 show-up fee. Experimental sessions lasted on average two hours.

3. Theoretical Framework

In this section, we develop a principal–agent model with goal-dependent preferences so as to derive a set of conjectures for our experiments.

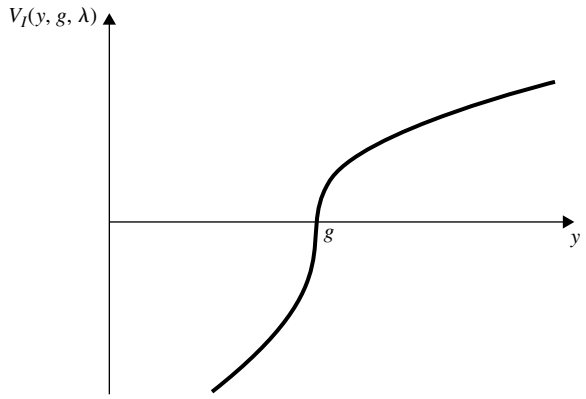
3.1. The Model

We build a model in which wage-irrelevant goals affect the intrinsic value of workers' production in a way that is consistent with prospect theory (Kahneman and Tversky 1979). We consider a principal–agent model with one risk-neutral manager (principal) and one worker (agent). Worker's production y is defined as $y = \theta e$, where e is the time that the worker dedicates to productive activities and θ is the worker's ability. There are two types of workers indexed by $i \in \{L, H\}$, where L stands for low-ability worker (θ_L) and H stands for high-ability worker (θ_H), where $\theta_H > \theta_L > 0$. Managers do not observe workers' ability levels but know the proportion $p \in [0, 1]$ of high-ability workers in the population. The worker is endowed with a total amount of time, normalized to 1, that can be dedicated to either productive ($e_i \geq 0$) or leisure ($l_i \geq 0$) activities. Hence, $e_i + l_i = 1$ for all $i \in \{L, H\}$. We consider a standard increasing and convex disutility of effort function, $c(e_i) = e_i^2/2$ (see §B.2 in Online Appendix B for a more general version of the model). We denote by $\Omega_i = Ay_i$ the monetary value of the worker's production, where $A > 0$ denotes the value of each unit of production generated by the worker, which is assumed to be exogenous. The manager and the worker share total production equally. Therefore, if we define $\alpha = A/2$, then $w_i = \alpha\theta_i e_i$ is the pay of worker i. The worker is assumed to be both extrinsically and intrinsically motivated. The extrinsic utility function of the worker coincides with the worker's pay (w_i):

$$V_E(y_i, \alpha) = w_i.$$

In addition, the worker derives intrinsic utility from achieving the goal set by the manager. We define the worker's intrinsic utility function so that it is consistent with the properties of the value function in prospect theory (Kahneman and Tversky 1979). More specifically, the reference point is assumed to be the goal (g) which is set by the manager.[5] The intrinsic utility function is defined as follows and illustrated in Figure 3:

Figure 3 **The Goal-Dependent Intrinsic Utility:** $V_I(y_i, g, \lambda)$



$$V_I(y_i, g, \lambda) = \begin{cases} (y_i - g)^{1/2} & \text{if } y_i > g, \\ -\lambda(-(y_i - g))^{1/2} & \text{if } y_i \leq g. \end{cases}$$

Thus, the goal (g) acts as a reference point that alters the intrinsic utility of the worker, dividing the space of outcomes into gains, when the goal is attained, and losses, when the goal is not attained. Note that the function $V_I(\cdot)$ satisfies the standard prospect theory properties of loss aversion and diminishing sensitivity, where $\lambda > 1$ is the coefficient of loss aversion.

We denote by $u(y_i, g, \lambda, \alpha)$ the sum of extrinsic and intrinsic motivation,

$$\begin{aligned} u(y_i, g, \lambda, \alpha) &= V_E(y_i, \alpha) + V_I(y_i, g, \lambda) \\ &= \begin{cases} w_i + (y_i - g)^{1/2} & \text{if } y_i > g, \\ w_i - \lambda(-(y_i - g))^{1/2} & \text{if } y_i \leq g, \end{cases} \end{aligned}$$

and assume that the overall utility of the worker takes the general separable form

$$U(y_i, g, \lambda, \alpha) = u(y_i, g, \lambda, \alpha) - c(e_i).$$

Although managers are not in charge of setting monetary incentives, they can assign goals that affect workers' intrinsic motivation. The manager's utility only depends on worker's production and the exogenously given monetary incentives

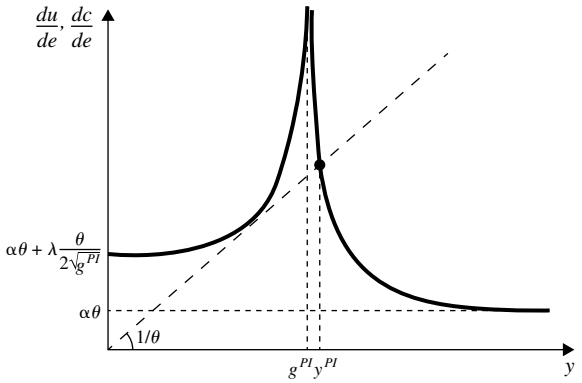
$$\Pi(y_i, \alpha) = \alpha y_i.$$

Therefore, in our framework, the manager's unique objective is to set the goal that maximizes the worker's production.[6]

[5] See Heath et al. (1999) for a formal discussion of such a value function. An alternative goal-dependent intrinsic utility function is considered by Gómez-Miñambres (2012). Most of the qualitative results of our model are robust to both specifications.

[6] Note that if the managers were in charge of setting monetary incentives, they would also want to maximize the workers' intrinsic utility in order to pay lower wages (see Gómez-Miñambres 2012).

Figure 4 **Values for Goals and Production Levels in the Perfect Information (PI) Equilibrium**



Our first result describes several properties of the optimal level of effort for a given goal, which will be useful in our subsequent analysis. The details of the proofs are available in §B.1 of Online Appendix B.

Lemma 1. *The optimal level of effort for a given goal has the following properties*:

(i) *Given a goal* (g), *effort increases with monetary incentives* (α).

(ii) $d^2U/(de_i dg) > 0$ (< 0) *if and only if* $y_i > g$ $(< g)$. *Thus,* $de_i/dg \geq 0$ (≤ 0) *if and only if* $y_i > g$ $(< g)$.

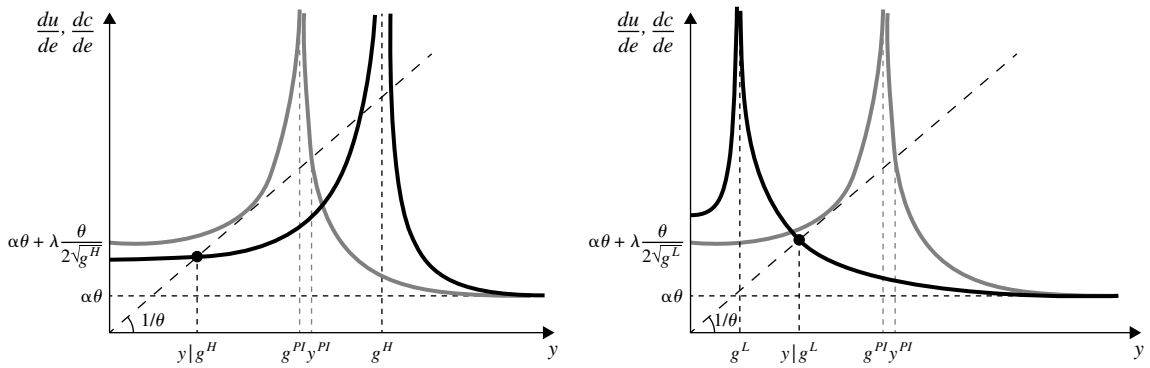
Property (i) is a standard result that follows from the fact that effort and incentives are complements in terms of extrinsic utility, i.e., $d^2V_E/(de_i d\alpha) = \theta_i > 0$. Wu et al. (2008) provide a formal proof of property (ii) using a general specification of a prospect theory value function and a convex disutility of effort (see Proposition 1 in Wu et al. 2008). An important implication of property (ii) is that performance increases with the difficulty of the goal if the goal is attainable so that goal and effort are complements. However, workers' performance decreases with goal difficulty if the goal is not attainable so that goal and effort are substitutes in that case. Therefore, property (ii) ensures that the worker's performance is higher when the assigned goal is difficult yet attainable than in the absence of goals. It also implies that a challenging but attainable goal works better than a goal that is either too easy or too difficult to attain. These properties will help us to interpret our equilibrium results; in particular, note that property (ii) implies that a goal may have very different effects depending on workers' ability levels. A goal that is seen as challenging by a low-ability worker may not motivate a high-ability worker.

In Lemma 1 we have described important properties of the optimal level of worker's effort for a given goal. In the subsequent analysis, we determine the optimal value of the goal that maximizes workers' production levels. We start describing in Figure 4 the solution for the case of perfect information, in which managers know the worker's level of ability with certainty, so that they can design individualized goals (g_i) to motivate workers with different ability levels (see §B.1 in Online Appendix B for details). We plot marginal benefits and marginal costs of effort as a function of worker's performance (y_i) for a given goal g. The solid curve represents the marginal utility of effort (du/de) which includes extrinsic and intrinsic utility, and the dashed line represents the marginal cost of effort (dc/de).

When the level of ability of the worker is known, the optimal strategy for managers is to assign a goal that is equal to the maximum level of production that can be attained by a worker given his or her ability level. These challenging goals are such that they maximize the level of effort of workers.

As we can see in Figure 5, deviating from the equilibrium goal g_i^{PI} is not profitable to the manager. On the one hand, setting a goal higher than g_i^{PI} (g_i^H) would imply that the worker does not attain the goal so that production would decrease ($y_i \mid g_i^H < y_i^{PI}$) (left panel of Figure 5). On the other hand, if the manager sets a goal that is easier than g_i^{PI} (g_i^L), we know from property (ii) of Lemma 1 that the worker's level

Figure 5 **Values for Goals and Production Levels When the Manager Sets a More Difficult Goal, $g^H > g^{PI}$ (Left Panel) and an Easier Goal, $g^L < g^{PI}$ (Right Panel) Than the Equilibrium Goal**



of performance would also be lower ($y_i \mid g_i^L < y_i^{PI}$), because goals and effort are complements when the goal is attainable (right panel of Figure 5).

Now we proceed to describe the case in which managers do not know workers' ability levels. In that case, managers will set a single goal (g^*) for both types of workers. Note that managers will not set a goal that is lower than the goal they would set for a low-ability worker under perfect information (g_L^{PI}) or one that is higher than the goal they would set for a high-ability worker under perfect information (g_H^{PI}). Applying property (ii) of Lemma 1, we know that both types of workers will produce more with goal g_L^{PI}, which is attained by both types of workers, than with any lower goal. As a result, in equilibrium, performance is expected to be higher with goal setting than in the absence of goals.

In the next proposition we summarize the main result of our model with imperfect information.

Proposition 1 (Imperfect Information: Goal Setting). *Given parameters* $\{\alpha, \lambda, p, \theta_H\}$, *there exists a threshold* $\hat{\theta}$ *such that*

$$\begin{cases} g^* = g_L^{PI} & \text{if and only if } \theta_L \geq \hat{\theta}, \\ g^* \in (g_L^{PI}, g_H^{PI}] & \text{if and only if } \theta_L < \hat{\theta}. \end{cases}$$

Proposition 1 captures the trade-off faced by the manager between raising the goal to increase the high-ability worker's performance and keeping the goal low enough to maximize the low-ability worker's performance. If ability levels are not too different, the manager will be better off selecting a goal that is attainable by both low- and high-ability workers. By contrast, if the difference in ability levels is high enough, the manager will set a goal that can only be attained by high-ability workers.

Finally, we point out the relationship between goal setting and monetary incentives in Corollary 1, where we show that equilibrium goals and monetary incentives are complements.

Corollary 1 (Imperfect Information: Goal Setting and Monetary Incentives). *In equilibrium, the goal increases with monetary incentives, i.e.,* $dg^*/d\alpha \geq 0$.

The intuition for Corollary 1 is described as follows. Given the level of monetary incentives (α), a marginal increment in the equilibrium goal (g^*) would decrease the performance of the low-ability worker (y_L^*) while increasing the performance of the high-ability worker (y_H^*) (see property (ii) of Lemma 1). If monetary incentives increase, the performance of both types of worker will also increase (property (i) of Lemma 1). Then, the manager could take advantage of this situation by raising the goal above g^* to such a level that the performance of the low-ability worker is the same as before the increase in monetary incentives (y_L^*). This increase in the goal will lead to an increase in the performance of the high-ability worker and make the manager better off. As a result, the equilibrium goal increases with monetary incentives.

In sum, goal setting magnifies the effect of high monetary incentives, which can foster workers' motivation and performance in two ways. On the one hand, it has a direct positive effect on performance because it increases extrinsic motivation to work. On the other hand, it allows the manager to set higher goals, which further increases performance through its effect on workers' intrinsic motivation.

3.2. Theoretical Conjectures

Based on the previous analysis, we state the following conjectures regarding the impact of wage-irrelevant goals on production levels and effort, which will be measured, in our experiment, as the amount of time workers dedicate to the work task. First, we expect production and effort levels to be higher in the goal-setting treatment than in the baseline treatment. Following our model, we know that whenever workers are intrinsically motivated to attain goals, managers will use goal-setting policies to increase the workers' level of effort, which will translate to an increase in production levels.

Hypothesis 1 (Production Levels and Work Effort). *We expect work production levels and work effort to be greater in the goal-setting treatment than in the baseline treatment.*

We also conjecture that the manager will set goals that are moderately difficult, i.e., challenging for an average-ability worker (see Proposition 1).[7] In addition, we expect higher monetary incentives to lead to higher goals and performance levels (see Corollary 1).

Hypothesis 2 (Goal Setting and Incentives). (i) *We expect managers to set goals that are challenging for an average-ability worker.*

(ii) *We expect goals to be larger when monetary incentives are high.*

(iii) *We expect monetary incentives and goals to be complements so that the positive effect of goals on workers' performance will be most pronounced when incentives are high.*

[7] As a result, if managers had access to information about workers' ability levels (e.g., by having access to past performances), they could set individualized goals that would be more effective than generic goals. In that sense, our experimental design can be seen as a conservative test for the effect of nonbinding goals on workers' performance.

4. Main Results

We start the results section in §4.1 by comparing workers' production levels across treatments. In §4.2 we analyze the effect of goals on work effort and work accuracy. We study the interaction between goal setting and monetary incentives in §4.3. The selection of goals by managers is analyzed in §4.4. Goal accuracy and reaction to individual goals is studied in §4.5.

In the analysis of the results, we use two different variables to measure workers' ability in the work task. First, we construct a dummy variable that takes value 1 if a participant completed the first table correctly and value 0 otherwise. We rely on previous research showing the positive relationship between first table performance and subsequent production (Corgnet et al. 2015a, b). We also control for workers' ability levels by using a more precise measure. To do so, we assessed participants' summation skills in the spirit of Dohmen and Falk (2011) in a total of 26 experimental sessions.[8] Upon arrival at the laboratory and before receiving instructions for the corresponding treatment, participants were asked to sum as many series of five one-digit numbers as they could during two minutes. Each correct answer was rewarded with 10¢. The number of correct answers is what we refer to as *summation skills*. Both measures are significantly correlated and show a positive and significant correlation with production levels, while not differing significantly across treatments (see Tables A.1 and A.2 in Appendix A). We present most of our results using *first table correct* as a control for participants' ability, given that this variable is available for the whole participant pool, but we find similar results for the subset of observations for which we can use *summation skills*.[9] We specifically use *summation skills* for the analysis of goal selection by managers (§§4.4 and 4.5) and robustness checks (§5).

4.1. Goal Setting and Workers' Performance

We define production as the total number of correct tables completed by workers. In Table 2, we present descriptive statistics regarding workers' production levels on the work task in both the baseline and the goal-setting treatments. For the goal-setting treatment, we present separately the descriptive statistics for those participants who were assigned a goal (left column) and for those who were not assigned a goal (right column).

Production levels were on average 15.2% higher under the goal-setting treatment than under the baseline treatment when we restricted our analysis to those workers who were assigned a goal in the goal-setting treatment. This corresponds to an increase of \$5.28 in average hourly production or two-thirds of the minimum hourly wage where the experiments were conducted. Workers' performance in the goal-setting treatment differs whether or not a participant had been assigned a goal. In particular, the average production of workers who did not receive a goal was 37.1% lower than the average production of workers who received a goal. This result is in line with our theoretical model in which zero goals (i.e., no goals) undermine production compared to a situation with positive but attainable goals. Interestingly, we also find that the average production of the workers who did not receive a goal was 27.6% lower than the average production in the baseline treatment, where setting goals was not available. This additional result, which is not accounted for by our theoretical framework, stresses that failing to provide goals to workers in an environment in which they are expected may undermine motivation because it may be perceived as a lack of interest in the worker's task. Managers recognize the negative effect of not setting goals and choose this option in only 5.8% of the cases. In the management literature, caring about workers' tasks has been recognized as a fundamental dimension of leadership (e.g., Goffee and Jones 2000, Corgnet and Hernán González 2014).

Table 2 Workers' Production on the Work Task

		Goal setting	
	Baseline ($n = 376$)	Goals ($n = 354$)	No goals ($n = 22$)
Mean	9.66	10.76	7.41
Std. dev.	4.55	4.31	5.70

We study the statistical significance of our results by conducting a regression analysis assessing the effect of goal setting on workers' production. To that end, we use a linear panel regression with random effects. In our regression analysis (see Table 3), we measure the effect of the goal-setting treatment by introducing a *goal-setting dummy*, which takes value 1 for goal setting and value 0 for the baseline. We also include as an independent variable a *no goal dummy* variable, which takes value 1 if a manager decided not to set any goal for the worker in the goal-setting treatment and value 0 otherwise. To control for incentives, we construct an *average (high) incentives* dummy, which takes value 1 if monetary incentives for producing a table correctly were equal to 80¢ (150¢) and value 0 otherwise. We also control for dynamics by including a *time dummy*, which takes value 1 for the second half of the experiment (periods 5–8) and value 0 otherwise. We introduce an interaction

[8] We collected this measure of ability in the 26 (of 42) sessions that were added to the original version of the paper following a referee's suggestion.

[9] Results using *summation skills* as a control for participants' ability are available upon request.

Table 3 Linear Regression with Random Effects for Production

Intercept	8.726***	6.219***
	(0.443)	(0.586)
Goal-setting dummy	0.955**	1.427***
	(0.463)	(0.543)
No goal dummy	—	−0.130
		(0.203)
First table correct	—	2.953***
		(0.413)
Incentive dummies		
Average incentives	1.517***	1.333***
	(0.316)	(0.267)
High incentives	1.458***	1.575***
	(0.308)	(0.205)
Trend and dynamics		
Time dummy	—	1.064***
		(0.184)
Time dummy × *Goal-setting dummy*	—	−0.526*
		(0.295)
Worker in previous period	—	−0.390***
		(0.146)
Incentives in previous period	—	0.0002
		(0.002)
No. of observations (sessions)	$n = 752$ (16)	$n = 564$ (16)
R^2	0.029	0.132

Note. Estimation output using robust standard errors is clustered at the session level (in parentheses).
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

variable between the *time dummy* and the *goal-setting dummy* to assess the evolution of the effect of goal setting over time. We also control for a participant's role in the previous period with a *worker in previous period* dummy variable, which takes value 1 if a given participant was a worker in the previous period and value 0 otherwise. The variable *incentives in previous period* takes value 10¢, 80¢, or 150¢ dependent on the incentives with which a given participant was endowed in the previous period.

In line with Hypothesis 1, we show that goal setting affects workers' performance positively since *goal-setting dummy* is positive and significant. The coefficient on *goal-setting dummy* (regression in the right column of Table 3) implies that goal setting increased the number of correctly completed tables by 1.43 per period, which corresponds to an increase of 1.14¢ ($6.86) per 10 minutes (hour). It follows from the negative and marginally significant interaction term between *time dummy* and *goal-setting dummy* that the effect of goal setting slightly decreased in the second half. The coefficient associated with our measure of ability is positive and significant, showing that participants who completed the first table correctly produced 2.95 more correct tables per period than those who did not. This corresponds to an increase in period production of $2.36. Second, workers who were not assigned a goal by their manager in the goal-setting treatment performed worse than those who were assigned a goal, although this difference was not statistically significant. These findings are consistent with the results of the debriefing questionnaire in the goal-setting treatment in which we asked participants whether goal setting had a negative, neutral, or positive effect on their level of production and motivation using a seven-point scale (see Online Appendix C). A large proportion of participants reported that goal setting had a significantly positive effect for both motivation and production levels (61.0% and 72.9% of the participants, respectively) whereas only 2.1% and 6.0% of the participants reported a negative effect. In the debriefing questionnaire, we also asked participants to report how they felt, had they produced more or less than the goal set by their manager. In line with previous results, a large proportion of participants (77.1%) reported that attaining goals made them feel good, whereas most of the participants (64.0%) reported not attaining the goal set by the manager made them feel bad. These results support the idea that workers value nonbinding goals and that the goal acts as a reference point, consistent with our theoretical model.

We summarize our results regarding the effect of goal setting on workers' performance as follows.

Result 1 (Production). *Workers' production levels were significantly greater in the goal-setting treatment than in the baseline treatment. This positive effect slightly decreased in the second half of the experiment.*

After identifying differences in production levels across treatments, we propose to pinpoint the origin of these differences by investigating workers' effort and accuracy levels.

4.2. Goal Setting, Work Effort, and Work Accuracy

We assess the effect of goal setting on work effort, which can be measured by the amount of time workers spent working on the task and by the number of tables they completed. We observe that workers spent a higher proportion of their available time on the work task (rather than on the Internet) in the goal-setting treatment (95.2%) compared with the baseline treatment (90.6%), consistent with Hypothesis 1. We test for differences across treatments by conducting a regression analysis for the proportion of available time spent on the work task and for the number of completed tables (see Table A.3 in Appendix A).[10] The coefficient of the dummy variable for the goal-setting treatment is positive and significant for both

[10] We provide results for the *first table correct* ability measure. Similar results are obtained by controlling for workers' ability using *summation skills*.

variables. To assess differences in the quality of the workers' output, we define an accuracy variable as the ratio of the number of tables that were completed correctly over the total number of completed tables. We find that accuracy levels were not significantly different between the goal-setting (84.1%) and the baseline (85.2%) treatments (see Table A.3 in Appendix A). We summarize our results as follows.

Result 2 (Work Effort and Accuracy). (i) *The proportion of available time spent on the work task was significantly larger in the goal-setting treatment than in the baseline treatment.*

(ii) *The number of completed tables was significantly greater in the goal-setting treatment than in the baseline treatment.*

(iii) *Accuracy levels did not differ across treatments.*

4.3. Goal Setting and Monetary Incentives

In our experimental design, monetary incentives were assigned on a random basis at the beginning of each period. Regardless of the treatment, the monetary reward for completing one table correctly was 10¢, 80¢, or 150¢. In this section, we study the effect of monetary incentives on workers' production and effort levels as well as the interaction between monetary incentives and goal setting. It is worth noting how significant the differences in incentives are. An average performer who only receives low incentives for the duration of the experiment would generate an average earning of \$4 compared to \$60 in the case of high incentives. The value of average incentives (80¢) was selected so that a participant who only worked under this incentive scheme would earn an average of \$32, which corresponds to the typical average payment for a two-hour experiment at the laboratory in which the study was conducted.

In the baseline treatment without goal setting, production levels were greater under average (10.4) monetary incentives than under low (9.1) and high (9.6) incentives. These results are in line with Pokorny (2008) and Ariely et al. (2009) who report a nonmonotonic relationship between monetary incentives and production levels, suggesting an adverse effect of high monetary incentives. In the goal-setting treatment, however, we observe a monotonic relationship between production levels and incentives. Production levels under high (11.4) incentives were higher than under average (10.9) and low (9.5) incentives.

We provide a statistical analysis in Table 4 by displaying the results of linear panel regressions with random effects. We assess incentive effects for both treatments separately and report the coefficients for the dummy variables capturing incentive effects after controlling for workers' ability levels.

Table 4 Incentives Dummies for Linear Regressions with Random Effects for Production

	Baseline	Goal setting
Average incentives	1.069**	1.643***
	(0.428)	(0.305)
High incentives	0.561*	1.624***
	(0.292)	(0.350)
Test equality of coefficients (p-value)	0.074	0.946

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Not surprisingly, average incentives significantly outperformed low incentives in both treatments (see the first row in Table 4). However, high incentives outperformed low incentives by only 5.4% in the baseline treatment, and this difference is only marginally significant ($p = 0.054$). The coefficient on the *high incentives* dummy (left column) implies that in the baseline treatment participants who received high incentives (150¢ per table) produced only half a table more, approximately, per 10-minute period than those who received low incentives (10¢ per table). In the goal-setting treatment, production was 20.0% higher, 1.624 tables more, under high incentives than under low incentives ($p < 0.001$). In addition, high incentives led to lower production levels than average incentives in the baseline treatment ($p = 0.074$), whereas production levels did not significantly differ in the goal-setting treatment (p-value $= 0.946$).[11] In sum, the adverse effect of high incentives that was found in the baseline treatment disappeared in the presence of goal setting.

These results suggest that the effect of goal setting may have been most pronounced under high incentives. Indeed, average production in the goal-setting treatment was 21.0% higher than in the baseline treatment under high incentives, whereas the production gap between treatments was equal to only 8.3% and 5.2% in the low and average incentives, respectively. We conduct linear regressions with random effects to assess goal-setting effects for low, average, and high incentives, separately (see Table A.4 in Appendix A).[12] We find that workers' production levels were significantly greater in the goal-setting treatment than in the baseline treatment under high monetary incentives, whereas the positive effect of goal setting was not

[11] Comparing high incentives with both low and average incentives, the corresponding p-value for the *high incentives* dummy is equal to 0.005 (0.541) in the goal-setting (baseline) treatment.

[12] See Table A.5 in Appendix A for the same analysis for the proportion of available time spent on the work task, the number of completed tables, and work accuracy.

significant under low and average incentives. These findings are consistent with our theoretical conjectures (property (iii) of Hypothesis 2). We summarize our findings regarding the effects of goals and incentives on workers' production levels as follows.

Result 3 (Goals and Incentives). (i) *Incentive effects were observed in both treatments because average incentives outperformed low incentives.*

(ii) *We found evidence of an adverse effect of high monetary incentives in the baseline treatment that disappeared under goal setting.*

(iii) *Workers' production levels were significantly greater in the goal-setting treatment than in the baseline treatment under high monetary incentives. Under low and average monetary incentives, the gap in workers' production between the goal-setting treatment and the baseline treatment was not statistically significant.*

Although properties (i) and (iii) of Result 3 are consistent with our theoretical predictions, our model does not capture the adverse effect of high monetary incentives in the baseline treatment (property (ii) of Result 3). Ariely et al. (2009) account for this effect by the excessive arousal and preoccupation produced by the presence of large stakes ("choking under pressure") that can lead to a decrement in performance. However, we observe that, in our baseline treatment, accuracy levels were slightly higher under high incentives (84.6%) than under low and average incentives (83.9%). This seems to be inconsistent with choking under pressure; we would expect, under this assumption, that high incentives would engender more mistakes and lower accuracy levels. Alternatively, the adverse effect of high monetary incentives can be accounted for by the presence of reference earnings (see Pokorny 2008). In §B.3 of Online Appendix B, we extend our model, building upon the work of Pokorny (2008), to include reference earnings. We find that our main results (Proposition 1 and Corollary 1) are robust to this more general framework.

4.4. An Analysis of Goal Selection

In the goal-setting treatment, the average goal was set at 10.3 tables, which was challenging for an average-ability worker, given that average production in the baseline treatment was equal to 9.7 tables. Under goal setting, workers produced on average slightly more (10.8 tables) than their assigned goals so that they were able to attain their goal in 59.8% of the cases. This suggests that goals were chosen to be challenging yet accessible, in line with our theoretical conjecture (property (i) of Hypothesis 2). We observed that goals increased significantly over time with an average goal of 8.5 in the first period compared with 11.2 in the last period. This positive trend in goals follows from the fact that average production also increased over time from 9.0 in the first period to 11.7 in the last period. The coefficient associated with the period trend indicates that managers increase their goals by 0.31 tables on average every period.

In line with the previous results, we find that a significant proportion of participants (41%) reported in the debriefing questionnaire setting goals that they considered challenging yet attainable for an average-ability worker. Also, 18% of the participants mentioned that they set goals to equal their own maximum attainable performance. Similarly, 21% of the participants mentioned that their goal was based on their own past performance.

In a regression analysis (see Table A.6 in Appendix A), we show that managers set higher goals after performing well in the previous period as a worker. The coefficient associated with previous period production indicates that managers increased their goal by 0.25 tables for each table produced in the previous period as workers. Consistently, more able managers, as measured with *summation skills*, were also inclined to set higher goals. However, we see no evidence that being assigned the role of worker or manager in the previous period affected managers' goals. Also, the goals experienced by managers in the previous period as workers did not significantly affect their goal-setting strategy. Finally, we find that goals were significantly greater under high (10.8) incentives than under either average (9.9) or low (10.1) incentives. This result, which is consistent with our theoretical conjectures (property (ii) of Hypothesis 2), is crucial to understanding why goal setting is most effective when monetary incentives are high: high monetary incentives promote challenging goals that in turn increase workers' motivation.

Result 4 (Goal Selection). (i) *Managers set goals that were challenging for an average-ability worker.*

(ii) *Managers increased the difficulty of the goal over time so as to respond to the increase in workers' production levels.*

(iii) *Managers used information regarding their own performance on the task to set their goals. Managers with higher ability levels on the task set higher goals.*

(iv) *Goals were greater for high monetary incentives than for low and average incentives.*

4.5. Goal Accuracy and Reaction to Individual Goals

After assessing the aggregate effect of goals in previous sections, we turn to the analysis of the effect of individual goals in the goal-setting treatment. Our objective is to deepen our understanding of the effect

of goals and connect our findings to our theoretical framework. To understand the effect of individual goals, we need to identify those goals that were reasonably accurate in the sense of being attainable by workers of a given ability level.

We start by using our measure of *summation skills* to predict the number of tables a given participant should be able to complete correctly in the work task. We denote this predictor of performance by *work task ability*. This variable is constructed for each participant i as follows.

$$work\ task\ ability_i = \hat{\alpha}_0 + \hat{\alpha}_1 \times summation\ skills_i,$$

where the coefficients $\hat{\alpha}_0$ and $\hat{\alpha}_1$ are estimated with the following linear panel regression:

$$number\ of\ correct\ tables_{it} = \alpha_0 + \alpha_1 \times summation\ skills_i + \epsilon_{it}$$

using the data from the baseline treatment. We obtain $\hat{\alpha}_0 = 3.871$ ($p < 0.0001$) and $\hat{\alpha}_1 = 0.381$ ($p < 0.001$), for a regression with $R^2 = 0.21$. The difference between workers' production levels in the baseline treatment and their estimated *work task ability* was less than one table (two tables) [three tables] in 28.17% (53.7%) [71.5%] of the cases.

We define reasonably and nonreasonably accurate goals on the basis of *work task ability*. Reasonably (nonreasonably) accurate goals are defined such that the difference—in absolute terms—between the goal set by the manager and the estimated *work task ability* of the worker (using the parameters estimated above) is less (more) than two tables. Using this criterion, 43.7% of the goals in the goal-setting treatment are classified as reasonably accurate. We obtain similar results by using either a wider ($+/-3$ tables, in which case 58.0% of goals are classified as reasonably accurate) or a narrower range ($+/-1$ table, in which case 19.1% of goals are classified as reasonably accurate) for the definition of reasonably accurate goals. The difference between a worker's maximum and minimum levels of production in the baseline treatment was on average equal to 2.5 tables, indicating that, on average, a goal within $+/-2$ or $+/-3$ tables of *work task ability* is likely to correspond to a normal range of values of production for a given participant.

In line with our theoretical setting, the accuracy of the goal is crucial to understanding the effectiveness of goal setting. We find that higher goals led to higher production levels when goals were reasonably accurate, whereas such a positive effect of goals was absent for the case of nonreasonably accurate goals (see Table 5). In particular, the coefficient associated with *goal value* indicates that, in the case of reasonable goals, an increase by one table of the goal set by the manager leads to an average increase of 0.40 in the number of correctly completed tables.

Table 5 Linear Regressions with Random Effects for Production as a Function of Goals, in the Cases of Reasonably and Nonreasonably Accurate Goals

	Reasonable goals	Nonreasonable goals
Intercept	−1.842	0.628
	(1.988)	(2.098)
Goal value	0.404**	−0.098
	(0.187)	(0.128)
Summation skills	0.636***	0.516***
	(0.201)	(0.059)
Incentive dummies		
Average incentives	0.652	1.914***
	(0.563)	(0.331)
High incentives	0.776	2.910***
	(0.531)	(1.109)
Trend and dynamics		
Time dummy	−0.356	1.309***
	(0.428)	(0.215)
Worker in previous period	−1.279	0.322
	(0.820)	(0.499)
Incentives in previous period	−0.004	0.006*
	(0.009)	(0.003)
No. of observations (sessions)	$n = 83$	$n = 55$
R^2	0.478	0.665

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

The absence of a positive effect of goals was robust to considering nonreasonably low (more than two tables below workers' estimated *work task ability*) or nonreasonably high (more than two tables above workers' estimated *work task ability*) goals as the coefficients (p-value) associated with *goal value* were −0.163 (0.157) and −0.06 (0.540), respectively.

Finally, we show that reasonably accurate goals led to significantly higher production levels than inaccurate goals after controlling for ability levels and incentives (see Table A.7 in Appendix A).

Result 5 (Reaction to Reasonably Accurate Goals). *Higher goals led to higher production levels when goals were in a reasonable range of a worker's ability level. Nonreasonable goals did not affect production.*

Also consistent with our model, participants reported in the debriefing questionnaire a significant decrease in effort after the goal was achieved (Wilcoxon signed-rank test, $p < 0.01$).[13]

[13] In four of the eight sessions of the goal-setting treatment (48 participants), we asked participants what were their levels of effort, using a seven-point scale, before and after the goal was achieved.

5. Robustness Checks

In this section we conduct a series of robustness checks, which are described below and introduced in the regression analysis presented in Table 6.

5.1. Social Preferences

We elicited social preferences à la Bartling et al. (2009) by asking participants to make four choices between two possible allocations of money between themselves and another anonymous participant with whom they were randomly matched. Participations had to decide between option A, which always yielded an even distribution of money ($2 to the self and the other participant), and option B, which yielded uneven payoffs: ($2, $1), (3$, $1), (2$, $4), and (3$, $5) for (themselves, other participant). Following Bartling et al. (2009), we classify participants into four social preferences categories: prosocial, costly prosocial, envious, and costly envious. Prosocial types prefer to distribute income equally (i.e., increasing the other participant's payoff to the egalitarian level) even when they have the possibility to earn more than the other participant, in which case they are categorized as costly prosocial. Envious types dislike earning less than the other participant even if it implies a lower payoff to themselves, in which case they are categorized as costly envious.

5.2. Personal Goals

In addition to being assigned goals during the experiment, participants may have set their own personal goals, which may have acted as a confounding factor when measuring the effectiveness of goal setting. To control for the effect of personal goals, we asked participants whether they set a goal for themselves. We created a *personal goal* dummy variable, which takes value 1 if a participant set a personal goal and value 0 otherwise. The proportion of participants who set a goal for themselves was similar across treatments (39.1% for the baseline and 37.0% for the goal-setting treatments; proportion test, $p = 0.836$).[14]

5.3. Computerized Goals

We conducted an additional treatment in which goals were computerized so as to control for possible confounding factors in the effect of goals in the original goal-setting treatment. In particular, the assignment of goals by managers introduced an interaction between the manager and the worker that was not present in the baseline treatment and that may have fostered social preferences, leading workers to exert higher levels of effort under goal setting. In addition, computerized goal setting allows us to assess the possibility of a "ratchet effect" (e.g., Charness et al. 2011), according to which workers may refrain from exerting high effort so as to avoid managers raising goals in future periods. In the computerized goals treatment this possible ratchet effect is eliminated because goals are not selected by the managers and cannot be affected by workers' production patterns.[15]

We conducted four sessions involving a total of 50 participants. The set of possible values that was used to draw the computerized goals was taken from the goals set by the managers in the original goal-setting treatment. To allow for a valid comparison of the relative effectiveness of human and computerized goals, the set of possible values used for computerized goals was made contingent on both the period and the value of a correct table. Both dimensions appeared to be crucial for managers to set goals in the original goal-setting treatment, as is shown in §4.4.

5.4. Matching Process: Fixed Roles[16]

We conducted two additional treatments to inquire on the possible effects of fixing participants' roles on the effectiveness of goal setting, instead of selecting each participant's role randomly at the beginning of each period. Fixing participants' roles eliminates the possibility that workers may have perceived their managers as peers, which may have exaggerated the effectiveness of goal setting. We conducted a total of five sessions for each treatment, recruiting 54 participants for the baseline treatment with fixed roles and 56 participants for the goal-setting treatment with fixed roles.

5.5. Results

We summarized our findings in Table 6. We show that the positive effect of goal setting is robust to controlling for different measures of participants' ability on the task (*first table correct* or *summation skills*; see the first and third columns); social preferences (see the second column); and personal goals (see the fourth column), since the *goal-setting dummy* is

[14] We elicited personal goals for a total of eight sessions (92 participants) including 46 participants from the baseline and 46 participants from the goal-setting treatments. We did not elicit *summation skills* for these sessions and use *first table correct* as a measure of ability.

[15] Our experimental design also limits the possible existence of ratchet effects. Roles are randomly selected and partners are randomly matched at the beginning of each period, limiting the dynamic strategic interaction between workers and managers. In addition, participants did not receive any feedback about the production of other workers.

[16] Following a referee's comment, for these two treatments we varied one sentence of our original set of instructions regarding Internet usage to avoid unintended deception, stating explicitly that "the computer can record the time spent on the Internet." We did not find participants' browsing behavior to be affected by this change. (More details are available upon request from the authors.)

Table 6 Linear Regressions with Random Effects for Production: Robustness Checks

	Computerized goals, fixed roles, and social preferences			Personal goals
Intercept	5.923***	5.862***	−0.075	4.614***
	(0.587)	(0.980)	(0.827)	(1.191)
Goal-setting dummies				
Goal-setting dummy	1.212***	0.848**	1.054**	2.165**
	(0.386)	(0.393)	(0.486)	(1.069)
Goal-setting dummy (*fixed roles*)	1.161***	1.017**	0.887**	—
	(0.403)	(0.444)	(0.470)	—
Computerized goal dummy	2.379***	2.131***	0.948**	—
	(0.451)	(0.461)	(0.418)	—
No goal dummy	−0.141	−0.376	−0.082	−0.280
	(0.661)	(0.713)	(0.952)	(0.310)
Personal goal	—	—	—	1.284
				(0.930)
Ability measures				
First table correct	2.580***	2.246***	—	4.000***
	(0.365)	(0.419)		(0.511)
Summation skills	—	—	0.494***	—
			(0.048)	
Incentive dummies				
Average incentives	2.414***	2.682***	2.891***	1.549***
	(0.407)	(0.528)	(0.571)	(0.404)
High incentives	2.671***	2.953***	3.246***	1.748***
	(0.372)	(0.458)	(0.491)	(0.438)
Trend and dynamics				
Time dummy	0.636**	0.358	0.196	1.317***
	(0.261)	(0.284)	(0.310)	(0.266)
Time dummy × *Goal-setting dummy*	−0.143	0.339	0.271	−1.107
	(0.342)	(0.316)	(0.384)	(0.692)
Time dummy × *Goal-setting dummy* (*fixed roles*)	−0.400	−0.151	−0.180	—
	(0.415)	(0.420)	(0.471)	
Time dummy × *Computerized goal dummy*	−0.685	−0.426	0.018	—
	(0.572)	(0.625)	(0.791)	
Worker in previous period	−0.373*	−0.407	−0.398	−0.265
	(0.220)	(0.327)	(0.278)	(0.356)
Incentives in previous period	0.002	0.002	0.002	−0.005*
	(0.002)	(0.002)	(0.002)	0.003
Social preferences				
Prosociality	—	0.122	—	—
		(0.887)		
Costly prosociality	—	0.177	—	—
		(0.945)		
Envy	—	0.126	—	—
		(0.731)		
Costly envy	—	0.186	—	—
		(0.874)		
No. of observations (sessions)	$n = 1099$ (42)	$n = 823$ (26)	$n = 823$ (26)	$n = 240$ (8)
R^2	0.163	0.362	0.362	0.157

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

positive and significant regardless of the controls.[17] In addition, computerized goals are also found to increase workers' performance because the *computerized goal dummy*, which takes value 1 for the sessions in which a computerized goal was set and value 0 otherwise, is positive and significant. Our findings are also robust to using fixed roles instead of randomly assigned roles because the *goal-setting dummy* (*fixed roles*), which takes value 1 for the goal-setting sessions in which roles were fixed and value 0 otherwise, is positive and significant. Although the *computerized goal dummy* is significantly higher than the other two *goal-setting* dummies (p-value = 0.01 for equality of coefficients) when using *first table correct* as a control for ability, this difference is no longer significant when controlling for ability using *summation skills* (see the third column) (p-value = 0.699 for equality of coefficients).

We summarize our robustness findings below.

Result 6 (Robustness Checks). (i) *Goal setting affected production levels positively after we controlled for summation skills, social preferences, and personal goals.*

(ii) *The effectiveness of goal setting was robust to the case of computerized goals as well as to the case in which participants' roles were kept constant.*

6. Conclusions

The purpose of this paper was to test the effectiveness of wage-irrelevant goal-setting policies in the laboratory and their interactions with monetary rewards. Although goals did not entail any monetary consequences, we found that they significantly increased both production levels and effort. These results suggest that the intuitive appeal of goal setting, which has been reported at length in the psychology literature, is robust to the more general case of work environments in which monetary incentives prevail.

We found that the effectiveness of goal setting was magnified, rather than undermined by the use of high monetary incentives. The complementarity between monetary incentives and goals, which was highlighted in our theoretical model, follows from the fact that high monetary incentives promote higher goals, which in turn increase motivation and performance. The fact that wage-irrelevant goals were particularly effective when combined with high monetary incentives contributes to the understanding of the literature documenting the crowding-out effect of high incentives on workers' intrinsic motivation (for reviews, see Gneezy et al. 2011, Kamenica 2012). In particular, we showed that the negative effect of large stakes on performance (Pokorny 2008 and Ariely et al. 2009) vanished once we introduce goal setting. Our results suggest that management tools that enhance workers' intrinsic motivation, like goal setting, may help to alleviate the crowding-out effect of high monetary incentives.

The current design also allowed us to study the managers' selection of goals. In particular, we observed that managers set goals that were challenging yet attainable by an average-ability worker. In line with the complementarity argument between goals and incentives, we found that managers set higher goals under high monetary incentives than under average and low incentives.

Our findings suggest that managers not only should care about both intrinsic and extrinsic incentives but should also make sure to design these incentive schemes in tandem. This finding is particularly relevant in light of the behavioral economics literature, which postulates that economic and psychological phenomena should not be studied in isolation.

[17] In Table A.8 in Appendix A, we show that the effect of goals subsists even if we restrict our sample to the participants who set a personal goal for themselves.

Supplemental Material

Supplemental material to this paper is available at http://dx.doi.org/10.1287/mnsc.2014.2068.

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Appendix A

Table A.1 Correlation Across Production and Ability Measures

	Production	*First table correct*	*Summation skills*
Production	1		
First table correct	0.2678***	1	
Summation skills	0.5861***	0.2000***	1

***$p < 0.01$.

Table A.2 Comparison of Ability Measures Across Treatments

	First table correct	*Summation skills*
Proportion test (p-value)	0.498	—
Wilcoxon rank sum test (p-value)	—	0.336

Table A.3 Linear Regressions with Random Effects for Work Dedication, Number of Completed Tables, and Accuracy

	Work dedication	Number of completed tables	Accuracy
Intercept	0.735***	8.575***	0.695***
	(0.034)	0.895	(0.023)
Goal-setting dummy	0.052*	1.415**	0.001
	(0.029)	(0.672)	(0.020)
No goal dummy	−0.048	−0.172	0.007
	(0.072)	(0.248)	(0.047)
First table correct	0.145***	2.073***	0.165***
	(0.021)	(0.522)	(0.014)
Incentive dummies			
Average incentives	0.119***	1.850	0.001
	(0.021)	(0.323)	(0.013)
High incentives	0.121***	2.070	0.001
	(0.021)	(0.273)	(0.013)
Trend and dynamics			
Time dummy	0.033	0.934***	0.012
	(0.026)	(0.264)	(0.016)
Time dummy × *Goal-setting dummy*	−0.039	−0.398	−0.001
	(0.036)	(0.332)	(0.022)
Worker in previous period	−0.038**	−0.470**	−0.006
	(0.018)	(0.218)	(0.011)
Incentives in previous period	−0.001	−0.001	0.001*
	(0.001)	(0.002)	0.001
No. of observations (sessions)	$n = 564$	$n = 564$	$n = 545$
R^2	0.168	0.085	0.199

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Table A.4 Linear Regressions with Random Effects for Production Across Incentive Schemes

	Low incentives	Average incentives	High incentives
Intercept	7.018***	8.210***	7.174***
	(1.260)	(0.742)	(0.579)
Goal-setting dummy	0.779	0.698	1.976***
	(0.742)	(0.772)	(1.710)
No goal dummy	−1.187	−0.411	−0.626
	(0.970)	(2.788)	(0.437)
First table correct	4.038***	2.687***	2.368***
	(0.754)	(0.544)	(0.399)
Trend and dynamics			
Time dummy	0.471	0.670	1.963***
	(0.808)	(0.503)	(0.348)
Time dummy × *Goal-setting dummy*	−0.527	0.136	−1.3456*
	(1.045)	(0.810)	(0.764)
Worker in previous period	−1.218***	−0.367	−0.124
	(0.349)	(0.249)	(0.423)
Incentives in previous period	−0.002	−0.001	0.001
	(0.006)	(0.004)	(0.003)
No. of observations (sessions)	$n = 196$	$n = 184$	$n = 184$
R^2	0.175	0.097	0.111

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
*$p < 0.10$; ***$p < 0.01$.

Table A.5 Goal-Setting Dummy Coefficients of Linear Regressions with Random Effects for Work Dedication, Number of Completed Tables, and Accuracy Across Incentive Schemes

	Low incentives	Average incentives	High incentives
Work dedication	0.066	0.055	0.065
	(0.082)	(0.040)	(0.046)
Number of completed tables	0.886	1.195	1.911***
	(1.071)	(0.978)	(0.688)
Accuracy	−0.008	−0.012	−0.004
	(0.033)	(0.032)	(0.032)
No. of observations (sessions)	$n = 564$	$n = 564$	$n = 545$
R^2	0.168	0.085	0.199

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
***$p < 0.01$.

Table A.6 Linear Regression with Random Effects for Managers' Goals

Intercept	4.065***
	(0.791)
Summation skills	0.222***
	(0.063)
Period trend	0.309***
	(0.074)
Dynamics	
Goal assigned in previous period	0.027
	(0.040)
Worker in previous period	1.194
	(1.248)
Production in previous period	0.253**
	0.113
Earnings in previous period	−0.004
	(0.004)
Incentive dummies	
Average incentives	0.167
	(0.322)
High incentives	0.645***
	(0.111)
No. of observations	$n = 168$
R^2	0.205

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
**$p < 0.05$; ***$p < 0.01$.

Table A.7 Linear Regression with Random Effects Comparing Production for Reasonable and Nonreasonable Goals

Intercept	0.196***
	(1.144)
Reasonable goal dummy	0.626*
	(0.376)
Summation skills	0.591***
	(0.078)

Table A.7 (Continued)

Incentive dummies	
Average incentives	1.219*
	(0.663)
High incentives	1.901**
	(0.782)
Trend and dynamics	
Time dummy	0.790*
	(0.416)
Worker in previous period	−0.544
	(0.558)
Incentives in previous period	−0.001
	(0.004)
No. of observations	$n = 138$
R^2	0.535

Notes. Estimation output using robust standard errors clustered at the session level (in parentheses). *Reasonable goal dummy* is a dummy variable that takes value 1 if the goal set by the manager is characterized as reasonable (see §4.5) and value 0 otherwise.
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

Table A.8 Linear Regression with Random Effects for Production of Participants Who Set a Personal Goal

Intercept	8.047***
	(2.574)
Goal-setting dummy	2.244**
	(1.145)
No goal dummy	−1.282
	(1.422)
First table correct	2.966*
	(1.663)
Incentive dummies	
Average incentives	1.096
	(1.132)
High incentives	1.973
	(1.344)
Trend and dynamics	
Time dummy	0.685
	(0.606)
Time dummy × Goal-setting dummy	−1.645
	(1.424)
Worker in previous period	−1.282***
	(0.422)
Incentives in previous period	−0.003
	(0.006)
No. of observations	$n = 91$
R^2	0.105

Note. Estimation output using robust standard errors clustered at the session level (in parentheses).
*$p < 0.10$; **$p < 0.05$; ***$p < 0.01$.

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