Stand by Me
Experiments on Help and Commitment in Coordination Games

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Abstract: We present experiments studying how high ability individuals use help to foster efficient coordination. After an initial phase that traps groups in a low productivity equilibrium, incentives to coordinate are increased, making it possible to escape this performance trap. The design varies whether high ability individuals can offer help and, if so, whether they must commit to help for an extended period. If help is chosen on a round by round basis, the probability of escaping the performance trap is slightly reduced by allowing for help. The likelihood of success significantly improves if high ability individuals must commit to help for an extended time period. We develop and estimate a structural model of sophisticated learning that provides an explanation for why commitment is necessary. The key insight is that potential leaders who are overly optimistic about their ability to teach their followers are too fast to eliminate help in the absence of commitment.

Keywords: Incentives, Coordination, Experiments, Organizations, Heterogenous work teams

JEL Classification Codes: C92, D23, J31, L23, M52

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1. Introduction

A group’s performance is often constrained by its lowest performing individual. An assembly line moves no faster than the slowest person in the line, a report doesn’t get finished until the last person completes their section, and a meeting can’t start when a key attendee is late. Groups with such strong complementarities can easily become stuck in a performance trap: everyone understands that all would benefit if all group members put forth their best effort, but, since no individual can unilaterally change the outcome for the better, all group members shirk in the belief that any attempt to break out of the performance trap is wasted effort.

When a firm (or any organization) is stuck in a performance trap, spontaneous escape is unlikely given the need for coordinated change. Leadership is usually required – somebody has to take the initiative to start the process of change. Managerial leadership is an obvious possibility, but leadership by workers can also play an important role. Help, defined as a voluntary activity by high ability types that makes the job of low ability types easier, at some cost for the high ability types, is a natural instrument that workers can use to provide leadership.\(^1\) Intuitively, work teams often contain some workers that have higher ability than others. If workers are rewarded based on team production, then high ability workers can have an incentive to help their less able colleagues.\(^2\) Help between workers has received little attention from researchers in economics and management.\(^3\)

The purpose of this paper is to present laboratory experiments exploring the use of help as a leadership tool. The provision and impact of help are complex phenomena involving interplay between the effects of material incentives, beliefs, and non-pecuniary motivations. Laboratory experiments are well suited for studying settings where such factors interact.\(^4\) The advantages of laboratory experiments for studying help are due to the control and observability available in experimental settings. We exogenously control whether help is possible and directly observe how much help is provided. We can therefore cleanly determine whether help is responsible for observed changes in performance as opposed

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\(^1\) Other natural instruments that can be used to lead the way out of a performance trap include leading by example (Brandts and Cooper, 2006; Hyndman, Terracol, and Vaksmann, 2009) and communication (Blume and Ortmann, 2007, Brandts and Cooper, 2007).

\(^2\) Hamilton et al. (2003, 2004) provide a real world example of this. They study the productivity of worker teams in a garment plant. Teams with heterogeneous abilities become more productive as the spread in ability increases (holding the average fixed). Hamilton et al. conjecture that is due to mutual learning, a specific form of help where high ability types help low ability types understand how work should be done and pull them up to a higher level.

\(^3\) See Drago and Harvey (1998) for a questionnaire study on the effects of promotion incentives on help. See also Brown and Heywood (2009) for a field study on help in settings with individual performance pay and Antonetti and Rufini (2008) for a theoretical analysis of training of low ability types by high ability types. To the best of our knowledge, there exist no previous experimental papers on the topic of help.

\(^4\) For examples, see Zwick and Chen (1999), Brandts and Charness (2003), Weber and Camerer (2003) and Harbring and Irlenbusch (2009).
to other factors. We can also observe the details of the interactive process of giving help and reacting to help, rather than only observing the final outcome, all of which makes it possible to pin down the mechanism by which help affects performance. While it is risky to generalize conclusions from a lab experiment to managerial choices in field settings, we believe that laboratory experiments are a valid tool for studying the effects of help.

Our experimental results show that help is only effective if high ability types are forced to commit to providing help for an extended period of time. To explain this result, we develop and estimate a structural model of learning that includes sophisticated learners. This exercise indicates that the root cause of poor performance with help, in the absence of forced commitment, is “over-optimism” by high ability types: believing incorrectly that they have taught others to play an efficient equilibrium, high ability types tend to prematurely abandon the provision of help. This finding has implications for leadership in many settings and helps explains puzzling patterns from other studies of leadership.

Getting into the details, our experiments are based on the “corporate turnaround game.”\(^5\) This is an experimental setting designed to represent a corporate environment in which a group has fallen into a performance trap and needs to escape from it. The game involves repeated play between a “manager” and four "employees" of a "firm". We automate the role of the manager while employees are played by experimental subjects. In each round, the manager first chooses a bonus rate which determines the fraction of the firm's profits transferred to the employees. After seeing the bonus rate, the four employees simultaneously choose how much costly effort to expend with firm output and profits determined by the minimum effort. Critically, the four employees are not identical. Instead, each group has one high ability type with relatively low effort costs and three identical low ability types with relatively high effort costs.

Employees initially face a low bonus rate that makes the minimum possible effort a dominant strategy for low ability types, trapping groups in the worst outcome possible. The bonus rate is then exogenously increased, turning the game into a weak link game (Van Huyck, Battalio and Beil, 1990) with multiple Pareto ranked equilibria. Even with this change in incentives, the strong complementarities between workers’ efforts make a spontaneous escape from the performance trap far from certain since improved performance requires a unanimous switch to higher effort.

The key issue in our paper is whether high ability types can use help to assist the group’s escape from the performance trap. We study two specific kinds of help, indirect and direct. We first consider indirect help which involves high ability types improving the productivity of low types at the cost of decreasing their own productivity. We refer to this as “indirect” because high ability workers do not

spend time on the low ability workers’ task, but instead make it possible for the low ability workers to accomplish their tasks more efficiently. High ability types can gain by providing indirect help, even though their productivity is lowered, if low ability types increase their effort enough that the group escapes its performance trap. We defer introducing the direct help treatment until later, as the motivation for this treatment grew out of the results for the indirect help treatment.

An initial set of treatments (Experiment 1) includes four treatments that vary the ability of high ability types to provide indirect help. In the Endogenous Help treatment, the high ability worker can help his low ability co-workers and the level of help can be changed on a round-to-round basis. Behavior in this treatment is compared with outcomes from two control treatments, one where help is not possible (No Help) and one where symmetric costs are imposed exogenously for the remainder of the interaction (Symmetric Costs). More precisely, the latter treatment imposes the same cost structure as occurs when the high ability type chooses a sufficiently high level of help as to equalize effort costs. We find that the ability to provide symmetric help on a round-to-round basis has no positive effect on the likelihood of efficient coordination as minimum effort levels are lower in the Endogenous Help treatment than in either the No Help or Symmetric costs treatments, albeit weakly in the first case.

This surprisingly poor performance reflects neither a failure to use help nor a lack of responsiveness by minimum effort to changes in help. Instead, the problem seems to stem from allowing high ability types to change their level of help on a round-by-round basis. Many high ability types frequently shift the amount of help they provide up and down, causing the minimum effort to ratchet downwards for the group since the negative response to cutting help is stronger than the positive effect of increasing help. This suggests that high ability types would do better if they committed to a level of help for an extended time period, but the Endogenous Help treatment is insufficient to reach this conclusion since high ability types might be changing help frequently because their group is doing badly. In other words, there is a possibility of reverse causality.

The final treatment of Experiment 1(Forced Commitment) addresses this by forcing high ability types to commit to their chosen level of help (including zero help) for an extended period of time. Forced Commitment yields significantly higher minimum effort levels than either the Endogenous Help or the No Help treatments. Exogenously imposing commitment makes it easier to escape a performance trap because it gives groups time to equilibrate before help can be changed. Having stabilized at an efficient outcome, subsequent reductions in help have little effect on the effort of low ability types.

We develop and estimate a structural model that can explain the mechanism underlying the main regularities observed in Experiment 1. This is a simplified version of Camerer, Ho, and Chong’s (2002) sophisticated EWA model, combining the spirit of level-k reasoning with a learning model. Previous research suggests that models of this type are good at capturing the strategic teaching observed in many
Subjects are assumed to be one of two types, unsophisticated or sophisticated learners. Note that a subject being a high (low) ability type does not imply they are a sophisticated (unsophisticated) learner, as the former is exogenously assigned by the experimenters while the latter is a behavioral characteristic of the individual. Unsophisticated learners follow a simple rule closely akin to Cournot learning. Sophisticated learners anticipate the learning of unsophisticated types and can therefore engage in strategic teaching. For high ability types who are also sophisticated learners, help is an attractive tool. By giving short-term incentives for higher effort, help not only changes the behavior of low ability types in the short run, but also changes the experiences of unsophisticated types. This pushes the learning dynamic towards equilibria with coordination at higher levels of effort.

By itself, this learning model cannot explain the main features of the data. It instead predicts that Endogenous Help will increase minimum effort relative to No Help. We therefore modify the model to incorporate two more elements: (1) Over-optimism: Sophisticated types may overestimate their ability to affect the beliefs of unsophisticated types and (2) Reciprocity: Low ability workers may reward kindness (increased help) by choosing higher effort levels and punish unkind behavior (decreased help) by moving to lower effort levels. The modified model successfully tracks the main features of Experiment 1, specifically that help will only improve minimum effort when coupled with forced commitment. Surprisingly, the parameter capturing over-optimism is significant and positive, but the estimated reciprocity parameter is tiny and not significant. Over-optimism helps the model track the data because it leads to the type of excessive changing of help that is observed in the data. A high ability type who is sophisticated and over-optimistic will abandon help too rapidly, believing he has led his group to the efficient equilibrium before this has actually occurred. Reciprocity is a powerful force in many experimental settings (see Cooper and Kagel, forthcoming), but adding a simple and natural version of reciprocity to our model harms the model’s ability to track the data. In our model, sophisticated types believe the other subjects are unsophisticated types who noisily optimize subject to beliefs. If reciprocity is added to the utility function, sophisticated types should anticipate the effect of this on optimization by unsophisticated types, specifically anticipating punishment if help is cut. Adding reciprocity to the model therefore decreases the likelihood a high ability type who is sophisticated reduces the amount of help provided to low ability types, making it more difficult to capture the excessive changing of help that plays such an important role in our data.

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6 For other experimental studies of teaching see Terracol and Vaksmann (2009), Hyndman et al. (2009), Fehr et al. (2012) and Hyndman et al. (2012).

7 To generate predictions, we first fit parameters for the model based on data from the three treatments we are trying to track, No Help, Endogenous Help, and Forced Commitment. We then simulate data for all three treatments using the estimated parameters. Given that we are fitting the parameters across treatments, the simulations can (and do) fail to track differences between treatments.
Experiment 1 studies indirect help, but this is just one of many possible ways in which help could be provided. To study whether the importance of commitment generalizes to other natural versions of help, Experiment 2 examines “direct” help. This involves high ability types spending time on the low ability types’ task, allowing the low ability types to do less work to complete their tasks. Help is direct because high ability workers do a portion of the low ability types’ work rather than making it easier for low ability types to do their own work as with indirect help. Experiment 2 studies direct help with and without forced commitment. In the first treatment high ability types choose help on a round-by-round basis while in the second they commit to their chosen level of help for an extended period of time. Without commitment the effect of allowing direct help is negative, with minimum effort levels greatly reduced relative to the relevant control, the No Help treatment. Forced commitment again improves performance. The reasons for this improvement parallel those from the indirect help treatments, as commitment prevents high ability types from undermining the positive effects of providing help by rapidly lowering help. The results of Experiment 2 reinforce the main conclusion of our paper: the efficacy of help as an instrument for leading groups out of performance traps depends critically on the commitment of leaders to providing help.

More broadly, our theoretical and experimental results suggest that stable behavior is a characteristic of successful leadership with a broad variety of tools employed for escaping performance traps. For example, in Brandts and Cooper (2007) leadership could be exercised by managers, played by subjects rather than the computer, who controlled the bonus rate. The bonus rate was changed by managers in almost 2/3 of the periods. Managers who were below the median frequency of switching earned about 50% more than managers at or above the median (398 vs 260 ECU/round). This parallels the negative effect due to excessive switching of help observed in the Endogenous Help and Direct Help treatments. The insight is the same in all cases. Recoordinating on a good equilibrium doesn’t happen instantly; it is a gradual process. Once this process has finished, the good outcome can persist even if incentives are changed, but if incentives change before equilibration has a chance to occur then coordination on a good equilibrium may likely not occur. Institutions that tie leaders’ hands can have a positive effect by preventing premature abandonment of costly yet effective instruments for overcoming coordination failure.

2. The Turnaround Game and Indirect Help

The “turnaround game” is played by a fixed group (“firm”) consisting of a manager and four employees who interact repeatedly over a number of rounds. The firm’s productivity in each round is determined by employees’ effort choices for the round, with employees’ incentives to exert effort

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8 This figure pools data from all three treatments with subjects playing as managers and controlling the bonus rate. The three treatments varied the ability of managers and workers to communicate.
depending on an ex ante profit sharing decision made by the manager. In the experiments reported below the experimenter plays the role of manager while experimental subjects fill the roles of the employees. Since our focus is on interactions between high and low ability employees, making the manager exogenous generates a more controlled environment to study their relations. Even though the manager’s decisions are exogenous, it is useful for expositional purposes to treat her as a player in the game.

The turnaround game embodies three basic design choices. First, the firm’s technology has a weak-link structure, with production (as well as profits) depending in every round on the minimum effort chosen by an employee. No employee can unilaterally increase the firm’s production. Second, the manager observes the output produced and, hence, observes the minimum effort but does not observe any of the individual effort levels. This implies that any incentives the manager gives employees cannot depend on individual effort. Finally, the firm manager can only reward employees with bonuses based on the minimum effort observed. She can change this bonus rate but cannot otherwise influence the employees’ choices. In what follows we present the main features of the turnaround game in more detail.

An experimental firm in the turnaround game consists of a fixed grouping of four subjects (employees) who interact for thirty consecutive rounds, broken into three ten-round blocks. Each block starts with the announcement of a common bonus rate (B) for the ten rounds of the block that determines how much additional pay each employee receives for each unit increase in the minimum effort of the four employees. While playing in a block with a particular bonus rate, subjects did not know what the bonus rate would be in subsequent ten-round blocks. The bonus transfers part of the firm’s profits from the manager to the employees. All four employees observe B and then simultaneously choose effort levels, where $E_i$ is the effort level chosen by the $i^{th}$ employee. We restrict an employee's effort to be in ten hour increments: $E_i \in \{0, 10, 20, 30, 40\}$. Intuitively, employees spend forty hours per week on the job, and effort measures the number of these hours that they actually work hard rather than loafing. Employees’ payoffs are determined by Equation 1 below. Note that effort is costly, with $C_i$ denoting the cost of a unit of effort for the $i^{th}$ employee. All payoffs are denominated in “experimental currency units” (ECUs). These were converted to monetary payoffs at a rate of 1 euro equals 500 ECUs:

$$\pi_i = 200 - C_i E_i + \left( B \times \min_{j=1,2,3,4} (E_j) \right)$$

In all treatments the average cost of effort equals 7, (i.e. $\frac{1}{4}(C_1 + C_2 + C_3 + C_4) = 7$). Employee 1 is a high ability type with a low initial effort cost $C_1 = 1$ while the other three employees are low ability types with high initial effort costs $C_2 = C_3 = C_4 = 9$. In treatments with help, as described in Section 3, the final effort costs will differ from these as a function of how much help is provided.
In all treatments the first ten rounds were played with \( B = 8 \) and without the possibility of help. Table 1 shows the resulting payoffs for the two ability types for the case of \( B=8 \). With \( B=8 \) the game is not a weakest-link game. For a high ability (low cost) type the best response depends on the minimum effort of the other workers, but for low ability (high cost) types it is a dominant strategy to choose zero effort. In the unique Nash equilibrium all employees exert zero effort. We use the game with \( B=8 \) in the first block of ten rounds to get play stuck in a performance trap. This cannot be classified as coordination failure since there is a unique equilibrium, but sets a strong precedent of low effort for games where coordination at high effort is possible in equilibrium.

The final twenty rounds in all treatments are played with \( B = 14 \). Table 2 shows the new payoff tables for the two types of employees if effort costs are held fixed at their original levels. The game is now a weakest-link game. Coordination by all four employees on any of the five available effort levels is an equilibrium, but consider the incentives faced by employees if they try to move upwards from the lowest minimum effort level. For simplicity assume that all employees choose 0 or 40. For a high ability (low cost) type, the incentives are fairly good. Increasing effort to 40 incurs a sunk effort cost of 40 ECUs in exchange for a potential gain of 520 ECUs. For this increase to have positive expected value, the probability of the three low ability (high cost) types all increasing to effort level 40 must only be greater than \( 1/14 \). The odds are more foreboding for low ability (high cost) types. They must sink an effort cost of 360 ECUs and can only potentially gain 200 ECUs. For a positive expected payoff, the probability of the high ability type and both low ability types increasing their effort to 40 must be greater than \( 9/14 \). Low ability types must be far more optimistic than high ability types to be willing to take the risk of increasing their effort levels.

The advantage of high ability (low cost) types only matters if they can get low ability (high cost) types to increase their effort. The flip side of high ability types having good incentives to try to coordinate is that they also have strong incentives to try to influence the turnaround process. They can do this by helping low ability types.

### 3. Experiment 1: The Effect of Indirect Help

There are many ways in which workers can help each other, and no one experiment can capture all of the possibilities. We sought kinds of help that were easily implemented in the context of the turnaround game, did not fundamentally change the nature of the game being played, and had natural analogs in relevant field settings. When implementing help in our experiment, we made choices along
several dimensions. We restricted ourselves to implementations where help is “efficiency neutral,” meaning the total surplus at the efficient equilibrium is unaffected by the provision of help. Our goal was to emphasize the use of help as a leadership tool rather than as a means of directly improving productivity. We also restricted ourselves to types of help that have a temporary effect on costs rather than a permanent one. Using help with a temporary effect goes hand in hand with making help efficiency neutral. It also simplifies the dynamic optimization problem facing subjects. We want subjects focused on the tradeoff between the current costs of help and the long term gains from coordinating on an efficient equilibrium without also needing to consider the long term implications for effort costs. Finally, both indirect and direct help are natural in the context of escaping performance traps. We examine indirect help first.

We model indirect help as a voluntary activity by which the high ability (low effort cost) worker reduces the effort cost of a low ability (high effort cost) type at the expense of increasing his own effort cost. To make this more concrete, imagine an experienced worker who volunteers to keep an eye on a junior colleague. She stops what she’s doing occasionally to check on her colleague. Possibly she catches a mistake before it becomes difficult (and time-consuming) to fix. The junior colleague does his own work, but the advice from his senior colleague makes it easier for him to do it. Of course, this has a cost for the person giving advice since she must take time and focus away from her own work to monitor her colleague.

To make indirect help efficiency neutral, we model the cost of help as being 1 to 1 – lowering a low ability type’s effort cost by one unit raises the high ability type’s effort cost by one unit. For example, if the high ability worker decides to reduce the effort cost of all three low ability workers by one, the effort cost of these three workers decreases from 9 to 8, while the effort cost of the high ability worker increases from 1 to 1 + (3 x 1) = 4. To simplify the experiment, low ability types are not allowed to help others. Given their already high costs, we think it is unlikely they would provide help even if allowed to do so. Only allowing one player to provide help eliminates additional coordination problems such as who is supposed to be providing leadership if more than one individual provides it.

Experiment 1 comprises a total of four treatments which are summarized in Table 3. The results of the first three treatments led us to the conjecture that commitment is crucial for performance improvement. The fourth treatment, Forced Commitment, is designed to demonstrate that there is a causal relationship between commitment and escaping a performance trap. We defer describing this treatment until after the results of the first three treatments have been presented.

[Table 3 around here]
All treatments in Experiment 1 are identical in rounds 1-10 but vary with respect to how the effort costs are determined in rounds 11 – 30. Recall that during the first ten rounds effort costs were exogenously fixed in all treatments at \( C_1 = 1, C_2 = C_3 = C_4 = 9 \). In the No Help treatment, help is not possible and effort costs remained exogenously fixed at the initial levels throughout rounds 11 – 30. In the Endogenous Help treatment, the high ability employee (Employee 1) has, in rounds 11 – 30, the option of providing each low ability employee (Employees 2 – 4) with 0, 1, 2, 3 or 4 units of help \( H \in \{1,2,3,4\} \) before effort decisions for the current round are made. In other words, the high ability type worker commits to one of the possible levels of help for the current round but not for future rounds. To keep matters simple, each low ability type must be given the same amount of help. After each round all employees are informed about effort choices in the round.

For the first three levels of help, used in 94% of all observations, offering help corresponds to:

a. \( (H = 0) \) Leaving the effort cost distribution at: 1, 9, 9, 9.

b. \( (H = 1) \) Reducing each of the three co-worker’s effort cost by 1 and increasing own effort cost by 3, leading to a cost distribution of 4, 8, 8, 8.

c. \( (H = 2) \) Reducing each of the three co-worker’s effort cost by 2 and increasing own effort cost by 6, leading to a distribution of 7, 7, 7, 7.

Help levels 3 and 4 modify the distribution of effort costs in an analogous way. At these help levels Employee 1 assists the others so much that her costs of effort are higher than those of low ability types. It is therefore not surprising that in our results the use of help levels 3 and 4 is rare.

In the Symmetric Costs treatment, the distribution of effort costs is exogenously switched for Blocks 2 and 3 to the symmetric distribution with a common effort cost of 7. This is equivalent to exogenously imposing \( H = 2 \), although without any of the intentionality (and hence the scope for reciprocity) that may be attributed to the active provision of help. Effort costs in the Symmetric Costs treatment were held constant for ten-round blocks, a fact which was common knowledge among employees. In this treatment there is effectively a commitment to \( H = 2 \) for the ten-round block.

[Table 4 around here]

Section 6 contains a formal model designed to explore why Forced Commitment increases minimum effort levels while Endogenous Help does not, but our original hypothesis about differences between the No Help and Endogenous Help treatments were more intuitive in nature. Help, whether provided endogenously or imposed exogenously, does not change the basic structure of the resulting game. Any subgame that occurs after choosing a level of help is still a weakest-link game with five Pareto
ranked equilibria, but the costs and benefits of trying to coordinate on an efficient equilibrium are changed. For example, set $H = 2$. This is the level of help imposed in the Symmetric Costs treatment and most common level of help provided in the Endogenous Help treatment. The resulting payoff table is shown in Table 4 (there is only one payoff table since all players have an effort cost of 7). Consider the incentives to move from 0 to 40. This requires a (sunk) effort cost of 280 ECUs versus a potential gain of 280 ECUs. To have a positive expected payoff, the probability of all three other players increasing their effort to 40 must be greater than 1/2. This is an improvement over the equivalent figure of 9/14 for low ability types in the absence of help. Incentives are worsened for high ability types compared to $H = 0$, but we conjecture that they provide help in the expectation of changing the behavior of low ability types and hence should be willing to provide high effort even with lowered incentives.

**Hypothesis 1:** Minimum effort will be higher in the Endogenous Help treatment than in the No Help treatment.

### 4. Procedures

Subjects were students of the University of Valencia recruited through an electronic recruitment system. All sessions were run at the LINEEX computer lab of the University of Valencia. Subjects were only allowed to participate in a single session and had no previous experience in similar experiments.

At the beginning of each session subjects were randomly seated. Printed instructions were distributed and read aloud by the experimenter. The instructions stress that there are two types of employees with differing payoff tables and that the groups were fixed for the duration of the experiment. Before beginning play, all subjects were asked to complete a short quiz about the payoffs and the rules of the experiment. The instructions for the endogenous help treatment are shown in Appendix A.

At the beginning of each ten-round block employees were informed of the bonus rate for that block. Employees were not told what bonus rates would be in subsequent blocks. Treatments differed in what happened before employees made their effort decision. In each round of the No Help and Symmetric costs treatments the four employees of a firm simultaneously chose their effort levels for the round. While choosing, the employees were shown a payoff table, similar Tables 1 and 2 above, showing their payoff as a function of their own effort level and the minimum effort level chosen by the other employees. This payoff table was automatically adjusted to reflect the current bonus rate. Subjects also had a printed copy of the payoff table for employees with different effort costs.

At the end of each round, all employees saw a feedback screen showing them their effort level, the minimum effort for their firm, their payoff for the round, and their running total payoff for the experiment. Separate windows on the feedback screen showed a summary of results from earlier rounds.
and the individual effort levels selected for all four employees in their firm. These effort levels were sorted from highest to lowest and did not include any identifying information about which employee was responsible for which effort level.  

Subjects in treatments involving help received additional printed instruction before the start of the second block explaining how help worked. These instructions explained the way in which help could take place and provided all possible payoff tables that could occur for either type of player with some feasible level of help. Subjects were not told about the possibility of help prior to this point in time, so all treatments are parallel until the beginning of the second block. Subjects in the No Help and Symmetric costs treatments did not receive new instructions prior to the second block, but did have a pause in play where they were told about changes in the bonus rate and (when relevant) cost structure.

The timing of rounds 11 – 30 in the Endogenous Help treatment (as well as subsequent treatments with help) differs from that in the other two treatments of Experiment 1. After seeing the feedback from the previous round, the high ability type selected a level of help. All employees saw the level of help selected, as well as the resulting costs for the two types, and then simultaneously made effort decisions. The payoff table shown while making this decision adjusted to reflect the amount of help provided by the high ability type. Printed payoff tables were available to see the payoffs of the other type.

At the end of the session, each subject was privately paid in cash for all rounds played plus a show-up fee. The average total payoff was €21.60, including a five euro show-up fee.

5. Initial Results and a New Treatment

Figure 1 shows average minimum effort in the four treatments of Experiment 1, including the Forced Commitment treatment that we introduce below. In round 10, the last round prior to the bonus rate increase, all firms had a minimum effort of zero. This is important since a history of low effort is a precondition for our environment to be of interest.

[Figure 1 around here]

Figure 1 shows that minimum effort is slightly lower in the Endogenous Help treatment than in the No Help sessions and higher in the Symmetric Costs treatment than in either the Endogenous Help or No Help treatments. Comparing average effort at the employee level (rather than minimum effort at the firm level) yields a similar picture.

Regression analysis contained in Appendix B (Table B.1) provides formal statistical backing for the preceding observations. The ordered probit regressions reported in Appendix B correct for clustering at the group level and include controls for behavior in the initial phase, Rounds 1 – 10. The regression

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9 Given the symmetry of help the absence of identifying information seemed to us to be the simplest choice.
results reinforce our conclusions from the raw data: Endogenous Help does not significantly increase firm production (as measured by minimum effort) relative to the baseline given by the No Help treatment. Although Symmetric Costs somewhat improves matters, the difference between this treatment and No Help is also not significant. The only significant difference we find between the three initial treatments is between the Endogenous Help and Symmetric Costs treatments in Rounds 21 – 30, and this is very weak. The data rejects Hypothesis 1.

Comparisons of payoffs across the three initial treatments reveal surprising patterns. Payoffs for high ability (low cost) types are identical in the Symmetric Costs and Endogenous Help treatments, averaging 350 ECUs over Rounds 11 – 30, but substantially lower in both cases than the average payoff of 455 ECUs with No Help.\(^{10}\) Payoffs for low ability (high cost) types are roughly the same in the Endogenous Help and No Help treatments, averaging 278 and 264 ECUs respectively across Rounds 11 – 30. Both of these figures are substantially lower than the average payoff for the Symmetric Costs treatment across this time frame, 348 ECUs.\(^{11}\) It isn’t a shock that Endogenous Help makes high ability types worse off – after all, help is costly – but it is surprising that Endogenous Help does not make low ability types better off even though they benefit from receiving help.

**Conclusion 1**: Endogenous Help and Symmetric Costs do not improve firm productivity, as measured by minimum effort. The data does not support Hypothesis 1.

One possible explanation for why the Endogenous Help treatment does not increase minimum effort levels relative to the No Help treatment could be that help is used infrequently or at very low levels. However, (strictly) positive help is provided in 70% of observations, 37 of 39 high ability types (95%) provide positive help at least once, and 36 of 39 high ability types (92%) provide positive help in at least 25% of the rounds. An average of 1.21 units of help per low ability type are provided, a level which changes little over time. The lack of a positive effect from the Endogenous Help treatment does not reflect a failure by high ability types to use their ability to provide help.

Looking at changes in help rather than levels provides a better idea for why minimum effort is unexpectedly low in Endogenous Help. High ability types frequently changed how much help they provided. The median number of changes in 20 rounds was 6, or roughly one change every three rounds.

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\(^{10}\) Running OLS regressions with high ability type profits as the dependent variable and using equivalent specifications to those described in Appendix B, the difference in high ability type payoffs between the No Help and the Endogenous Help (Symmetric Costs) Help treatment is statistically significant at the 5% (1%) level in Rounds 11 – 20 and at the 10% (10%) level in Rounds 21 – 30.

\(^{11}\) Regression analysis finds that the differences in low ability type payoffs between the Symmetric costs treatment and the Endogenous Help and No Help treatments are statistically significant in Rounds 11 – 20 at the 5% level and at the 1% level in Rounds 21 – 30.
About a quarter of the high ability types, 10 of 39, changed the level of help in at least half of the rounds. There are only three help levels that get frequent use, so many high ability types oscillated back and forth between high and low help levels. Figure 2 shows the relation between the number of changes in help and both the minimum effort levels of low ability types and the payoffs of high ability types. Firms from the Endogenous Help treatment are broken into categories by how many times the level of help was changed in Rounds 11 – 30. There is an obvious negative relationship between instability in help levels and either minimum effort or profit levels.

To help understand what is behind these negative relationships, Figure 3 shows the effect of the high ability type changing the level of help on the average minimum effort level of the three low ability types in a firm. Data is taken from Rounds 12 – 30. Round 11 is excluded since the effect of help is confounded with the bonus rate increase. Changes in the amount of help unambiguously affect the minimum effort of the three low ability types. When the lagged minimum effort of the low ability types is 0, an increase is the only possible change. Such improvement mainly occurs when help is increased. If the lagged minimum effort for the three low ability types is 40, only decreases are possible. This is far more likely after a decrease in the level of help. The most interesting case is when the lagged minimum effort level for low ability types is 10, 20, or 30. Given that most groups which successfully coordinate do so gradually, these cases are critical ones in determining a firm’s success. Increasing help or holding it constant only has a moderate effect on minimum effort levels for low ability types, but decreasing help has a strong negative on their minimum effort levels.

Figure 3 suggests that the response to changes in help are asymmetric, but only roughly controls for the lagged minimum effort, provides no control for the time effects that are obvious in Figure 1, and does not disentangle effects of changing help from the effect of the current level of help. To address these issues more formally, we ran ordered probit regressions that included controls for lagged minimum effort, time effects, and individual effects. The technical details and results of these regressions are presented in Appendix B (Table B.2). Summarizing the results, either increasing or decreasing help leads to statistically significant changes in the minimum effort by low ability types. By itself, the current level of help does not have a significant relationship with changes in effort. Changing help, not the level of help, causes changes in effort. The negative effect of decreasing help is estimated to be almost three times as large as the positive effect of increasing help. It follows that the constant shifting of help causes a

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12 An observation here is the minimum effort by the three low ability types in a firm for a single round.
racheting down in the minimum effort of low ability types and, by extension, the payoffs of high ability types.

This raises the question of why high ability (low cost) workers decrease help when doing so has such a negative impact. It turns out that changes in help are more likely to be increases when lagged minimum effort is low and decreases when lagged minimum effort is high.\textsuperscript{13} This is a bad strategy given the disproportionate negative response by low ability types to decreased help. Just as things are going well, high ability types tend to throw a wrench in the works by decreasing help.

This tendency to cut help when things are going well likely stems from attempts at profit taking by high ability types. They are too optimistic about having gotten the firm out of its performance trap and seek to reap their reward by reducing the help they provide, failing to anticipate a drop in the effort of others. In support of this interpretation, consider observations in Rounds 12 – 30 where the minimum effort of others in the previous round was strictly positive (10, 20, 30, or 40). In cases where help is cut, 93% of high ability types either choose the same effort level as the previous period or increase it. Increased effort is more than four times as likely as decreased effort.\textsuperscript{14} This tendency by high ability types to couple decreases in help with increases in their own effort only makes sense if the low ability workers are not expected to react to the decrease in help by cutting their effort.

Conclusion 2: Our analysis of the dynamics in the Endogenous Help treatment suggests that a lack of commitment by high ability types, especially a tendency to slash help when things are going well, leads to poor performance in the treatment.

Conclusion 2 is largely based on the negative relationship between frequent changes in help and the minimum effort achieved by a firm, as illustrated by Figure 2, but the evidence provided by the Endogenous Help treatment is not sufficient to establish a causal relation between these two variables. Frequent switches might be caused by poor performance rather than the other way around. The Forced Commitment treatment, the final treatment in Experiment 1, is designed to establish a causal relationship between commitment and increased minimum effort.\textsuperscript{15} In this treatment, the high ability (low cost) type

\textsuperscript{13} An increase of help is 64\% more likely than a decrease when the lagged minimum effort of low ability types is zero, and a decrease of help is 70\% more likely than an increase when the lagged minimum effort of low ability types is strictly positive.

\textsuperscript{14} There are 23 increases and 5 decreases out of 69 total observations. If we limit the sample to cases where the lagged effort was neither 0 nor 40, so changes in both directions are possible, these figures become 14 increases and 3 decreases out of 27 total observations.

\textsuperscript{15} The Symmetric Costs treatment also introduces an element of commitment, since workers are told in Rounds 11 and 21 that effort costs will be set equal across all four workers for the next ten rounds. This is mathematically equivalent to imposing a commitment to provide two units of help. However, the comparison with the Endogenous Help treatment is not clean due to multiple confounds: help is forced to be at a high level, help cannot be adjusted in reaction to the initial response of the low ability types, and help is imposed exogenously rather than being set by one of the four workers.
chooses how much help to provide only in Rounds 11 and 21. In these two rounds, she sets the level of help in exactly the same fashion as in the Endogenous Help treatment, choosing from $H \in \{1, 2, 3, 4\}$. The effort cost of all three low ability (high cost) types is lowered by $H$ and the high ability type’s effort cost increases by $3H$. As in the Endogenous Help treatment, the same amount of help must be provided to all three low ability types. Unlike the Endogenous Help treatment, where help is chosen for each round, in the Forced Commitment treatment the high ability type must stick to his decision for the entire ten-round block. This prevents the frequent changes to the level of help observed in the Endogenous Help treatment. Effort levels are still chosen round-by-round as in the other treatments.

Hypothesis 2 follows from our interpretation of behavior in the Endogenous Help treatment. Without forced commitment, overly optimistic high ability types tend to decrease help too soon. In the presence of forced commitment this premature reduction of help is not possible, facilitating successful equilibration at a higher effort level.\textsuperscript{16}

\textit{Hypothesis 2: Minimum effort will be higher for the Forced Commitment treatment than for either the No Help or Endogenous Help treatments.}

Returning to Figure 1, we now focus on the Forced Commitment treatment. This treatment yields obviously higher minimum efforts than either the No Help or Endogenous Help treatments, a difference that grows between the first and second block. Minimum efforts in the Forced Commitment treatment are also moderately higher than in the Symmetric costs treatment for both blocks. Looking at effort rather than minimum effort leads to similar conclusions – the Forced Commitment treatment leads to a substantial and persistent increase in effort levels over the No Help and Endogenous Help treatments.

Payoffs improve for both types in the Forced Commitment treatment relative to the Endogenous Help treatment, with average payoffs over Rounds 11 – 30 of 413 vs. 350 ECUs for high ability types and 348 vs. 278 ECUs for low ability types. Over the final ten rounds, average payoffs for both types are (roughly) as high in the Forced Commitment treatment as in the best of the other three treatments.\textsuperscript{17} Unlike the Endogenous Help treatment, which is the worst of all worlds, the Commitment treatment is the best of all worlds!

\textsuperscript{16} When looking at the data from the first three treatments of Experiment 1, we noticed that groups which performed poorly were often held back by low effort choices from a single worker. This suggested that allowing for asymmetric provision of help, with different levels of help provided to different workers, might be more effective than the symmetric help allowed in Endogenous Help. We tested this hypothesis with a treatment that allowed asymmetric provision of help. This improved minimum effort levels, but the effect was small and not statistically significant. For details, see Brandts, Cooper, and Fatas (2011).

\textsuperscript{17} For high ability types, average payoffs over Rounds 21 – 30 are 476 ECUs, 381 ECUs, 377 ECUs, and 467 ECUs in the No Help, Symmetric Costs, Endogenous Help, and Forced Commitment treatments. Analogous figures for low ability types are 288 ECUs, 383 ECUs, 302 ECUs, and 377 ECUs.
The regression analysis described in Appendix B (Table B.1) supports our conclusions about Forced Commitment. Compared with either the No Help or Endogenous Help treatments, the Forced Commitment treatment leads to significantly higher minimum effort and effort levels in Rounds 21 – 30 than in either the No Help or Endogenous Help treatments. Payoffs for both types in the final block are also significantly higher in the Forced Commitment treatment than in the Endogenous Help treatment. For low ability types, payoffs in both blocks are also significantly higher than in the No Help treatment. As should be expected since help is costly, the difference in high ability payoffs between the Endogenous Help with Commitment and No Help treatments is never statistically significant.

Conclusion 3: The Forced Commitment treatment has a large persistent effect on effort. Compared with the No Help treatment, Forced Commitment makes low ability types better off without harming the high ability types. The data supports Hypothesis 2.

The positive effect of Forced Commitment is probably not due to an increase in the level of help offered, as the average level of help over rounds 11 - 30 is higher in the Forced Commitment treatment than in the Endogenous Help treatment (1.40 vs. 1.21) but not dramatically so. As in the Endogenous Help treatment, high ability types in the Forced Commitment treatment often cut help for successfully coordinated firms – of twelve firms coordinated at 40 in Round 20, four cut help for the second block. The difference between the Endogenous Help and Forced Commitment treatments is that forced commitment gives time for groups to strongly converge to a new equilibrium in the first block with help (Rounds 11 – 20). In the groups where play was coordinated at 40 in Round 20 and help decreased for the final block, all four employees had been choosing 40 since at least Round 14. These groups had a firmly established norm of coordinating on the efficient outcome. Two of the groups saw a brief decrease in Round 21, in both cases due to a change by a single employee, but every employee in these four groups chose effort level 40 in Rounds 22 – 30. Increasing help for the final block leads to increased minimum effort, but, unlike the Endogenous Help treatment, a decrease in help in the Forced Commitment treatment does not cause a decrease in effort by low ability types. For the seven groups where help decreased, the average minimum effort increased slightly between blocks (23.7 for Rounds 11 - 20 vs. 24 for Rounds 21 - 30). In the five groups where help increased for Rounds 21 – 30, the average minimum effort increased strongly between the two blocks (5.2 for Rounds 11 – 20 vs. 25.6 for Rounds 21 – 30). With forced commitment, the changes in help cause effort to ratchet upwards rather than down. We conjecture that forcing commitment gives the time for strong convergence to the efficient equilibrium to occur before the high ability types can disrupt things by changing help, a conjecture formally examined by the model contained in Section 6.

18 Running a t-test on the average help provided low ability types, the difference is not statistically significant at even the 10% level (59 obs; t = 0.98; p = .33).
6. An Estimated Model of Behavior in Experiment 1

We now introduce a structural model designed to explore the causes of the two key regularities observed in Experiment 1: (1) Forced Commitment leads to an increase in minimum effort relative to No Help, and (2) Endogenous Help, lacking forced commitment, does not increase minimum effort relative to No Help because help is changed too frequently. We also examine some of the secondary features of the data, specifically the tendency to simultaneously decrease help and increase effort by high ability (low cost) types.

See Appendix C for a more detailed description of the model. Our model is a simplified version of the sophisticated EWA model of Camerer, Ho, and Chong (2002). The model is modified to include the possibilities of over optimism, a miscalibration of sophisticated types’ beliefs about the learning of unsophisticated types, and reciprocity.

The model includes two types of individuals, unsophisticated and sophisticated learners. Individuals are randomly assigned types with the probability of being a sophisticated type given by the parameter $\alpha$. Note that both high and low ability types are equally likely to be sophisticated learners, as the ability type (high or low) is assigned exogenously by the experimenter while the individuals learning type (sophisticated or unsophisticated) is an exogenous characteristic of the individual subject.

Unsophisticated players follow a simple adaptive learning rule closely related to Cournot learning. The choice of Cournot learning rather than a more flexible learning rule like noisy fictitious play, reinforcement learning, or EWA is driven by the structure of information in the experiment. Sophisticated learners have to be able to model the learning of unsophisticated types. In our experiment, subjects can observe the choices of the other three individuals in their group, but not in a way that is identifiable. This means that it is impossible to track an individual’s choices across periods. Modeling Cournot learning by others does not require this information, but models like noisy fictitious play, reinforcement learning, and EWA require the ability to track individuals across periods. We therefore use a model that does not require sophisticated types to use information they don’t possess.

There are two types of unsophisticated learners which vary only in their initial beliefs about others’ behavior. Optimists initially believe that all other players will choose 40, the highest possible

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19 For example, suppose in two consecutive periods, the effort choices by the other three players in my group are 40, 20, 30 followed by 20, 40, 30. My feedback displays choices ordered from highest to lowest without IDs. So in both periods I receive feedback showing 40 30 20. I have no way of knowing whether individuals have changed their effort levels between periods or not.

20 We explored models that resolved this problem by having sophisticated types track misspecified versions of noisy fictitious play or EWA. We are unenthusiastic about this approach, as the modeling becomes too ad hoc in our opinion. We would have lived with this if it substantially improved our ability to track the data, but it did not.
effort level, while pessimists initially believe that all other players will choose 0. The initial beliefs of an unsophisticated type are randomly drawn, with parameter \( \theta \) giving the probability of a pessimist. After each decision round, unsophisticated players update their beliefs, with the new beliefs being a weighted average of the other group members’ effort levels in the previous round and initial beliefs given by (1).

\[
q_u(m) = \omega(t) \eta_u(m) + (1 - \omega(t)) q_{u_0}(m) \quad \text{for } u \in \{ \text{optimist, pessimist} \} \text{ and } \forall m
\]  

Specifically, an unsophisticated player’s beliefs \( q_u(m) \) give weights for each possible minimum effort \( m \in \{0, 10, 20, 30, 40\} \) for the other three players. The weight on the previous round’s outcome is given by \( \omega(t) \). This weight changes over time according to (2), where \( \gamma \) is a parameter fit from the data, \( \omega(1) = 0 \), and \( \omega(2) = \bar{\omega} \). The function \( \eta_u(m) \) gives the weight on minimum effort \( m \) if the probability of each effort level is given by the observed frequency in the preceding period\(^{22}\) and \( q_{u_0}(m) \) is the initial weight on minimum effort \( m \) subject to the individual’s type (optimist or pessimist). The model allows for a reset of beliefs in Round 11 to account for the underlying game changing when the bonus rate is increased and, possibly, help is allowed. This is captured by subtracting the parameter \( \rho \) from \( \omega(10) \), which puts less weight on experience from Round 10 and more weight on initial beliefs.

\[
\omega(t) = \omega(t - 1) + \gamma \text{ if } t \geq 3
\]  

Based on these beliefs, expected payoffs can be generated for each of the five available effort levels. Two transformations are made to the expected payoffs to generate “attractions” for each effort level. First, extra weight is put on the effort level that was chosen in the previous period. This weight is captured by a parameter \( \delta \) multiplied by the number of times the same choice has been repeated. This extra weight on repeated choices allows the model to capture the fairly obvious hysteresis in the data. Earlier fitting exercises of learning models have found significant improved fits when hysteresis is incorporated into the model (i.e. Cooper and Stockman, 2002; Camerer, Ho, and Chong, 2002; Wilcox, 2006).

Second, reciprocity by low ability (high cost) types is incorporated into the model. Positive weight is put on the expected payoff of the high ability type, as a function of the low ability type’s effort, if the high ability type has been kind by increasing the amount of help provided. Likewise, negative weight is put on the high ability type’s expected payoff if he has been unkind by decreasing the amount of help provided. The amount of weight put on the high ability type’s expected payoff in these

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\(^{21}\) Adding these types helps the model capture the bimodal distribution of behaviour in the data. Adding more types (or more sophisticated versions of heterogeneous initial beliefs) complicates the model, making it more difficult to fit, without improving its ability to track the experimental data.

\(^{22}\) For example, suppose the other three group members chose 0, 20, and 40 in the preceding period. Unsophisticated types then assign a probability of 1/3 to each of these three effort levels. A probability distribution over the others’ minimum effort is generated by assuming that each of the other three individual group member’s effort levels is independently drawn with equal probability over 0, 20, and 40.
circumstances is given by the parameter $\kappa$ which is fit from the data.$^{23}$ This is a simple and intuitive way of adding reciprocity to the model, similar to the way reciprocity is added to the Charness and Rabin (2002) model, and has a natural effect on the choices of low ability types. Low ability types try to help (harm) high ability types who have helped (harmed) them by choosing a higher (lower) effort than they would otherwise select.

The choice of an unsophisticated type is generated from beliefs using a logit decision rule, with the parameter $\lambda$ determining the level of noise. In the Endogenous Help and Forced Commitment treatments, we also have to model help decisions by unsophisticated high ability types. This is done in a manner that parallels the choice of effort levels described above, although a separate noise parameter, $\lambda^H$, is estimated for the choice of help.

Sophisticated types anticipate the learning of unsophisticated types and are forward looking, engaging in strategic teaching. They understand that their current actions affect the beliefs of unsophisticated players in the subsequent round. This makes help attractive as a tool for pushing unsophisticated types toward higher effort levels.

Going into details, sophisticated types assume that all of the other group members are unsophisticated types. This departs from the sophisticated EWA model in which sophisticated types place positive weight on other players also being sophisticated types. Our model therefore does not nest QRE and is more in the spirit of a level-k model. If sophisticated types believe that others may also be sophisticated, it becomes necessary to calculate a fixed point as part of fitting the model, greatly increasing the computational complexity of the exercise. Given that the simpler model does a good job of tracking the data and gives useful insights into the underlying processes, we apply Occam’s Razor.

Sophisticated types have all the information necessary to calculate beliefs and attractions for the other three members of their group (assuming the others are unsophisticated). Applying the relevant logit decision rule, they can generate a distribution over choices and minimum efforts for the other three group members. These serve as a sophisticated type’s beliefs about current actions. Sophisticated types also have all the information needed generate a probability distribution over the beliefs of unsophisticated types in the upcoming period, and by extension to generate a distribution over the future choices of others as a function of their own current choice.

Underlying the preceding is an assumption of rational expectation; sophisticated types are assumed to have a correctly specified model of how unsophisticated types form beliefs and then make choices. Our model departs from this assumption by allowing for “over-optimism” by sophisticated

$^{23}$ For simplicity we assume that this weight is equal for positive and negative reciprocity. We doubt these weights are truly equal given experimental results to the contrary (i.e. Offerman, 2002) but allowing for greater weight on negative reciprocity would not affect the intuition underlying our results.
types. Sophisticated types may believe that unsophisticated types learn faster from experience (are more responsive to new information) than is the case in reality, and therefore may be overly optimistic about their ability to affect the beliefs of unsophisticated types. This is incorporated into the model by allowing the possibility that sophisticated types overestimate the weight that unsophisticated players give to observed past behavior vs. their initial beliefs. Specifically, sophisticated types calculating the beliefs of unsophisticated types replace $\omega(t)$ with $\omega(t) + \mu$, where $\mu$ is an over-optimism parameter fit from the data.

Based on their beliefs about current and future actions by the other three players, sophisticated types can calculate expected current and future payoffs as a function of their current actions (effort and, if a high ability type, help). Reciprocity is incorporated in the model for sophisticated low ability types in exactly the same manner as for sophisticated high ability types. Choices are reached via a logit decision rule where attractions are given by the sum of expected payoffs for the current and upcoming periods along with any adjustment for reciprocity.\(^{24}\)

The model’s parameters were fit to data from the three treatments of interest, No Help, Endogenous Help, and Forced Commitment, using the simulated method of moments (see Appendix C for details on how the model was fit to the data). The estimated parameters and standard errors (in parenthesis) are presented in Table 5 below. All of the parameters are significantly different from zero, except for $\gamma$, the time trend for the weight unsophisticated types’ beliefs put on their most recent experience, and, surprisingly, the reciprocity parameter $\kappa$. We estimate that a high proportion (65.7%) of subjects are sophisticated types. The estimated fraction of pessimistic unsophisticated types is quite low, 0.089, so most unsophisticated types are optimists. Finally, the over-optimism parameter is significant and positive. Sophisticated types believe that unsophisticated types are putting significantly more weight (about 23% more) on their most recent experience than is actually the case.

\(^{24}\) Equal weight is put on current and future expected payoffs. This restriction is made to simplify the model. Also to simplify the model, we assume the noise parameter is the same for sophisticated and unsophisticated types.
It is not true that any version of the model fit to data from all three treatments would have reproduced the main features of the data. The model’s ability to track the data depends critically on the inclusion of over-optimism and the de facto exclusion of reciprocity. To illustrate the relative importance of over-optimism and reciprocity, we conduct a 2x2 counterfactual exercise. Figure 5 presents the average minimum efforts from simulation of four different versions of the learning model. In the top row, we set $\kappa = 0$ ($\kappa$ is the parameter determining the strength of reciprocity). In the bottom row, we set $\kappa = 1$. In the left column, we set $\mu = 0$ ($\mu$ gives the level of over-optimism for sophisticated types). In the right column, we set $\mu$ to be the same as in the fitted model. Other than $\kappa$ and $\mu$, the parameter values used in all four panels are taken from the fitting exercise. Because $\kappa$ is not significantly different from zero in the fitted model, the top right panel, titled “No Reciprocity and Over-optimism,” is almost identical to the simulated data from the fitted model.

The fitted model (“No Reciprocity and Over-optimism”) is the only case that captures the main features of the data. For the model without reciprocity or over-optimism (“No Reciprocity and No Over-optimism”), the simulations predict no difference between the three treatments. For either version of the model with reciprocity (“Reciprocity and No Over-optimism” and “Reciprocity and Over-optimism”), the simulations predict that Endogenous Help should increase minimum effort relative to No Help. In the former case, the simulations also predict that Forced Commitment will not increase minimum effort relative to No Help. The model’s success in tracking the experimental data depends critically on the inclusion of over-optimism and the failure to find a significant effect from reciprocity.

The importance of including over-optimism is largely due to the expected reason, the effect of over-optimism on changing levels of help. We previously noted the negative relation between frequent changes in the level of help and a group’s minimum effort and conjectured that over-optimism would increase switching, with high ability types abandoning help too quickly in the false belief that the group had converged to an efficient equilibrium, allowing them to take profits. Looking at the simulated data, this is exactly the pattern we observe. In the simulated data from the model with neither reciprocity nor over-optimism, the average number of times a high ability type changes help in Rounds 11 – 20 is 0.93. This jumps to an average of 1.56 switches for the model with over-optimism (but not reciprocity).

25 The fitted value of $\kappa$, the reciprocity parameter, is so small that it has virtually no impact on the simulated data to set $\kappa = 0$. 
Adding over-optimism doesn’t so much push up minimum efforts in the Forced Commitment treatments as it pushes down minimum effort in the Endogenous Help treatment.$^{26}$

The intuition for why reciprocity harms the ability of the model to track the experimental data also relates to the frequency of switching help. If reciprocity is significantly larger than zero, high ability types are rewarded for increased help levels, and are punished for decreased help levels. Critically, sophisticated types model the decision process of other players and therefore anticipate these effects. The effects of reciprocity, when anticipated, make increasing help more attractive and decreasing help less attractive. In simulated data from the model with over-optimism but no reciprocity, high ability types average 0.81 increases and 0.75 decreases to help in the Endogenous Help treatment. The total number of switches increases with the addition of reciprocity to the model and the distribution between increases and decreases changes dramatically with an average of 1.73 increases versus only 0.42 decreases. Adding reciprocity makes help more likely to be provided and reduces the tendency to undercut the positive effect of help by removing it too quickly. This is the reason that the average minimum effort in Endogenous Help is much higher in the bottom right panel with $\kappa = 1$ than the top right panel where $\kappa = 0$. $^{27}$

We do not claim that the structural model presented above perfectly tracks the experimental data or provides the best possible fit. We have simplified the model in many ways to make it easier to implement, and a more complex model could no doubt improve the fit. The point is that a relatively simple structural model is able to track the most important feature of the date from Experiment 1, the positive effect of help only when coupled with forced commitment, and provides a clear intuition for why this result occurs: high ability types who are over-optimistic will be too fast to abandon help, undercutting their own attempts at leadership. Forcing high ability types to commit to their chosen level of help for an extended period of time prevents this self-defeating behavior. The model also provides a simple intuition for why adding a straight-forward form of reciprocity does not help explain the main features of the data. A critical feature of the data is overswitching by high ability types. Anything, such as the form of reciprocity incorporated into our model, that reduces the tendency of high ability types to undercut their own attempts at leadership will reduce the model’s ability to explain the data.

Conclusion 4: A model of sophisticated and unsophisticated learners with over-optimism, but without reciprocity, best explains the key regularities of the experimental data.

$^{26}$ Average minimum effort is also decreased by over-optimism in the No Help treatment. Over-optimism leads to too much switching by sophisticated types who increase their effort levels in an attempt at strategic teaching.

$^{27}$ The choice of $\kappa = 1$ was arbitrary. Other values of $\kappa > 0$ yield the same qualitative results with the magnitude of the effect varying with the magnitude of $\kappa$. 

7. Experiment 2: Direct Help

Experiment 1 models help in a very specific way: indirect, efficiency neutral, and temporary in effect. This is a natural way to model help, in our opinion, but there is no doubt that it could be modelled many other ways. It is therefore natural to ask whether commitment would be equally important if help was modelled differently. In this section we model help as being direct rather than indirect: high ability types provide help by doing some of the work of low ability types. Finding that forced commitment has a powerful effect with a second, equally natural version of help reinforces for our main conclusion that commitment plays a critical role in the efficacy of help.

The new direct help treatments parallel the Endogenous Help and Endogenous Help with Commitment treatments as much as possible. A low bonus rate (B = 8) is used in Rounds 1 – 10 to trap groups at low effort levels, and then the bonus rate is raised to B = 14 for Rounds 11 – 30. Low ability types can help high ability types in Rounds 11 – 30. The high ability type chooses a level of help before the four workers make effort choices. The difference between Experiments 1 and 2 is how help is provided. In addition to working on his own task (up to a maximum of 40 hours), the high ability type can also allocate time in 10 hour units to the low ability types’ tasks. To keep help efficiency neutral, the effort cost of a high ability type doing the work of a low ability type is the same (9 ECU/hr) as it would be for a low ability type. Intuitively, we model costs as reflecting the difficulty of the tasks rather than the ability of the workers, but high ability types have the capacity to work more hours than low ability types.28 Mirroring the Endogenous Help treatment, the same amount of help must be given to each low ability type. When help is provided, the “effective” number of hours provided by a low ability worker is the sum of the hours received as help plus the hours worked directly by the low ability worker.

To illustrate how direct help alters the coordination game, Table 6 shows the payoff tables for high and low ability types if one unit (10 hours) of help is provided.29 In the left-hand panel, the payoff table for high ability types, the minimum effort level by other employees goes from 10 to 50 (instead of 0 to 40), since the high ability type has already provided 10 hours of work to each of the low ability types. Similarly, in the right-hand panel, the payoff table for low ability types, the effective hours provided by a worker go from 10 to 50 reflecting the 10 hours of help that have been provided. The minimum effective effort by other employees can still be zero since the high ability worker has the (perverse) option to not work at his own job, in spite of the fact that he has put in some work at the others’ jobs.

28 In designing Experiment 2, we retained the feature that only one player could provide help so there was no issue of coordinating on who should lead or provide help. To keep the basic structure of the game fixed, we let the high ability type work more than 40 hours but restricted the amount he could work on his own task.

29 Subjects were allowed to provide more units of help, but this is sufficiently expensive that we did not anticipate higher levels of help being used. On rare occasions we observed provision of two units of help.
Coordinating at effective effort levels 10, 20, 30, and 40 are Nash equilibria of the subgame shown in Table 6. There are four equilibria rather than five as previously, but the equilibria remain Pareto ranked, the efficient equilibrium remains 40, and the basic properties of a weak link game are preserved.

The two treatments with direct help, Direct Help and Direct Help with Forced Commitment, involve the provision of symmetric direct help without and with forced commitment and are analogous to the Endogenous Help and Forced Commitment treatments in Experiment 1. The mechanism through which forced commitment is expected to have a positive effect on average minimum effort is the same as for indirect help. Forced commitment prevents over-optimistic high ability (low effort cost) types from decreasing help before the equilibration process has finished. Our hypotheses about the effects of direct help are summarized by the following. Note that the No Help treatment from Experiment 1 continues to serve as the baseline.

**H4:** In the long run, average minimum effort will be higher in Direct Help than in the No Help treatment and average minimum effort will be higher in Direct Help with Forced Commitment than for Direct Help.

We ran 6 additional sessions with 136 subjects participating in the additional two treatments (56 subjects in Direct Help and 80 in Direct Help with Forced Commitment). General procedures were identical to the ones described for Experiment 1 and subjects made an average of €19.04.

Figure 6 shows the average minimum effort for the two direct help treatments as well as the No Help treatment from Experiment 1. Note that this is the effective minimum effort which includes any help provided by the high ability type as part of the effort for each low ability type. Compared to the No Help treatment, the effect of the Direct Help treatment is dramatic and negative. There is a slight increase between Rounds 10 and 11, but average minimum effort stabilizes below 5. The addition of commitment once again improves performance as average minimum effort in the Direct Help with Forced Commitment treatment rapidly stabilizes in the neighborhood of 20. This closely tracks performance in the No Help treatment. Adding forced commitment to direct help overcomes the miserable performance without commitment but does not lead to an overall improvement.

Regression analysis described in Appendix B confirms the obvious. Compared with either the No Help or Endogenous Help treatments from Experiment 1, the Direct Help treatment leads to a statistically significant decrease in both effective minimum effort and effort. The Direct Help with Forced

---

30 For example, suppose the high ability type provides one unit of help and picks effort level 10. Even if all of the low ability types choose effort level 0, the effective minimum effort is 10 since the high ability types is providing 10 hours of work on each of the low ability types’ tasks.
Commitment treatment has no significant effect relative to the No Help and Endogenous Help Treatments, but significantly improves effective minimum effort relative to the Direct Help treatment.

The extraordinarily low minimum effort levels in the Direct Help treatment are explained in part by factors similar to those responsible for weak performance in the Endogenous Help treatment from Experiment 1. A majority of the high ability types (8 of 14) try offering help at least once, and offering help leads to improved performance. Following an increase in help, the average effective minimum help increases by an average of 14.0 and average minimum effort of the three low ability types increases by 5.7 units. The problem is that the lack of commitment by high ability types is even more extreme in the Direct Help treatment than the Endogenous Help treatment from Experiment 1. In 18 of the 23 cases where help is increased, the increase is reversed in the following round. There is no case of help being offered for more than three consecutive rounds. This is far worse than the Endogenous Help treatment where only 32 of 81 increases in help are immediately reversed and 30 of 39 high ability types had at least one run of four or more rounds where a positive amount of help was offered without any decreases. For every single case in the Direct Help treatment where help is decreased, the minimum effort immediately returns to 0. The inability of high ability types to stick with positive levels of help undoes any positive effects of the initial increases. Average effective minimum effort is actually slightly higher in the groups where help is never offered (4.2) than in groups where help is offered at least once (3.0).

Cutting help does not cause effective minimum effort to collapse in Direct Help with Commitment. In this treatment, 12 of the 20 high ability types offer positive levels of help in Round 11. For Rounds 16 – 20, average minimum effective help for these twelve groups is 23.8 as compared to 7.5 when no help is provided. Help is eliminated in ten of the twelve groups for Rounds 21 – 30. The response is negative but not as extreme as without commitment. Minimum effort falls for six of the ten groups in Round 21, but only two collapse to a minimum effort of zero. Comparing the average effective minimum efforts for Rounds 16 – 20 and Rounds 26 – 30, there is only a slight decrease from 22.6 to 18.8 for these ten groups. As with indirect help, forced commitment with direct help allows groups time to converge to equilibrium so that a later reduction in help is less disruptive.

Conclusion 4: The effect of Direct Help is strongly negative, reducing minimum effort to almost the lowest possible level. Forced commitment reverses this effect, but does not lead to minimum effort levels above the No Help treatment from Experiment a.

8. Final remarks

The purpose of this paper is to study whether high ability employees can use help as an effective tool for leading groups out of performance traps. Help turns out to be a double-edged sword that can harm as much as it helps. Increasing help leads to improved performance, but prematurely decreasing help in an effort to take profits undoes any positive effects from the initial provision of help. Forcing
high ability types to commit to a stable level of help over time consistently improves the effect of help on groups’ performance in the turnaround game. A relatively simple structural model shows that the importance of commitment can be explained by over-optimism, the belief by sophisticated types that learning by unsophisticated types is faster (and hence their ability to engage in strategic teaching is greater) than is actually the case.

Our work suggests that it is not sufficient for managers to encourage help among workers (for example by forming work teams as in Hamilton et al. (2003)). Management must also encourage stability in how help is provided. This need not be overly complicated. Simply holding a meeting on a monthly basis where employees discuss what they will do for the upcoming month, including what help they will provide others, may serve as a useful device for fostering more stable commitments to help. Keeping work groups together for an extended period of time rather than re-matching workers also has the effect of creating a more stable environment where levels of help are more likely to be steady.

Our work does not address endogenous commitment to help. In the Endogenous Help treatment, high ability workers have no mechanism to commit that they will not change the level of help in the future, while in the Forced Commitment treatment they have no choice but to keep the level of help fixed for an entire block. It would be useful to know if high ability types would take advantage of a commitment device if one was offered but not required. We believe that they would not – if subjects understood the value of commitment, they probably wouldn’t be undercutting successful coordination in the first place – but the question is ultimately an empirical one.

Finally, there is a broader point to be taken away from our work. This paper focuses the effectiveness of help in escaping performance traps, but the importance of commitment is likely to be a more general phenomenon. Escaping a performance trap is just one of many cases where leaders might seek to overturn an existing norm in favor of a more socially desirable one, and help is just one of a multitude of tools available to potential leaders. Establishing a new more desirable norm is a gradual process, and one that can be disrupted by negative changes along many dimensions. As described in the introduction, the same insights that this paper generates about excessive switching of help by high ability workers also seem to apply to excessive switching of bonus rates by managers acting as leaders. We imagine there are many further examples to be discovered where a self-defeating tendency to declare victory and cease costly attempts at leadership undercuts the benefits of leadership, and an important element of our ongoing research is to generalize this phenomenon. Assuming that our basic insights generalize as expected, a good strategy for individuals to follow in attempting to escape from coordination failure (or, more generally, in attempting to establish a new socially desirable norm) is to pick an approach and stick with it. If effective methods share a common element of strategic teaching, even the best of approaches will fail if used inconsistently.
References


APPENDIX A
INSTRUCTIONS FOR THE ENDOGENOUS HELP TREATMENT

The purpose of this experiment is to study how individuals make decisions in certain contexts. The instructions are simple and if you follow them carefully you will at the end of the sessions confidentially obtain a sum of money in cash, given that nobody will know the payments received by any of the other participants. You can ask us at any time any questions you may have by raising your hand. Apart from these questions, any kind of communication between you is prohibited and may lead to immediate exclusion from the experiment.

1. For participating in this experiment you obtain an initial payment of 2500 ECUs (a virtual money unit). This experiment consists of various blocks of 10 rounds each. The conditions of the experiment are identical within each block and although some of the conditions can vary between on block and the next, you will at each point informed about whatever changes are introduced. In each round you are part of the same group of 4 participants. The composition of these groups which are called firms will not vary during the experiment. Given that nobody will know the identity of the members of each group, all the actions you take during the experiment will be absolutely anonymous.

2. As a worker of your firm you have to decide how to split your working week of 40 working hours between two activities: Activity A and Activity B. Given that the hours that you don’t assign to one of the activities is automatically assigned to the other we will just ask you that you decide how many weekly hours you spend on Activity A. Given that the available options are to spend 0, 10, 20, 30 or 40 hours on Activity A, this automatically implies spending 40, 30, 20, 10 or 0 on Activity B (respectively).

3. In each round you will receive a base salary of 200 ECUs. Your payoff will depend on this base salary, on your decisions and on a bonus that depends on the minimum number of hours spend on Activity A by any of the members of your group. This bonus is chosen by the central server of the lab, which simulates the decisions of the firm’s management. Before making any decision, you will receive information about the value of this bonus.

4. Your earnings in each round depend on the hours you spend on Activity A, on the number of hours by the other workers in your firm on Activity A, on the bonus B selected by management and on Ce a variable that represents your cost of effort at work. Your earnings are given by the following formula:

\[
\text{Earnings of worker} = \frac{\text{Base salary}}{200} - \frac{\text{Effort}}{(Ce \times H_f)} + \frac{\text{Bonus}}{(B \times \min(H_A))}
\]

where \(H_f\) is the number of hours that you spend on Activity A and \(\min(H_A)\) is the minimum number of hours that a worker of your firm spends on Activity A. You don’t need to memorize this formula: the computer will show you an earnings table whenever you have to make a decision.

5. In each firm there are two types of workers: 1 worker of type 1 and 3 workers of type 2. At the beginning of the session you will be informed of what type of worker during the whole experiment, since types will not vary. The two types of workers will differ exclusively in their initial effort cost \((Ce)\), which is higher in on the types relative to the other type. During the first 10 rounds:
   a. Workers of type 1 have an effort cost of \(Ce = 1\) and their earnings are calculated according to the following formula:
      \[
      \text{Earnings of type 1} = 200 - 1 \times H_f + B \times \min(H_A)
      \]
   b. Workers of type 2 have an effort cost of \(Ce = 9\) and their earnings are calculated according to the following formula:
      \[
      \text{Earnings of type 2} = 200 - 9 \times H_f + B \times \min(H_A)
      \]

6. Although none of the participants will receive earnings as manager of the firm, you will be shown information about its earnings, which depend on the hours spent on Activity A by the workers of the firms and on the bonus B, as shown in the following formula (which again you don’t need to memorize):

\[
\text{Firm profit} = 100 + (52 - 4 \times B) \times \min(H_A)
\]

7. In each round, the computer will show you a table similar to those that are shown below. The payoffs that are shown adjust to the (variable) values of \(B\). In the examples that follow we use \(B = 8\). Note that this
information is shown in the upper part of the payoff table. For players of type 1 with an effort cost equal to 1 the payoff table is the following:

\[
B = 8 \\
\text{Firm profit} = 100 + 20 \times \min(HA)
\]

<table>
<thead>
<tr>
<th>My hours spent on Activity A</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
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<td>160</td>
<td>240</td>
<td>320</td>
<td>400</td>
<td>480</td>
</tr>
</tbody>
</table>

For players of type 2, with an effort cost equal to 9, the payoff table is:

\[
B = 8 \\
\text{Firm profit} = 100 + 20 \times \min(HA)
\]

<table>
<thead>
<tr>
<th>Minimum of hours spent on Activity A by the other workers</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
</tr>
<tr>
<td>-----------------------------</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>10</td>
</tr>
<tr>
<td>20</td>
</tr>
<tr>
<td>30</td>
</tr>
<tr>
<td>40</td>
</tr>
</tbody>
</table>

8. Each worker chooses the number of hours spent on Activity A using the buttons located on the right side of the screen. You can change your choice as often as you want, but once you click “OK” this decision is irreversible.

9. When you make your choice you will not know what the other workers of your firm have done, but, after each round you will be informed of the number of hours that the workers of your firm have spent on Activity, the profit of your firm, your earnings in that round and your accumulated earnings. You will also be able to see a summary of results from previous rounds.

10. At the end of the experiment, your accumulate earnings will be converted from ECUs to euros at an exchange rate of 500 ECUs = €1.
Example

Before starting the experiment, please go over the following questions. For each of the questions assume that $B = 8$ and that you are a worker of type 1 with an effort cost of 1.

Using your earnings table shown on the previous page suppose that you choose spending 10 hours on Activity A and that the other workers of your firm decide to spend 30, 20 and 40 hours on Activity A.

In this case:
- The minimum number of hours that a worker of your firm spends on Activity A is 10.
- Your earnings are 270 ECUs.

Now consider that you are a worker of type 2 with an effort cost equal to 9. The relevant earnings table would be the second on the previous page. Suppose that you choose to spend 20 hours on Activity A and that the other workers of your firm spend 30, 20 and 40 hours on Activity A.

In this case:
- The minimum number of hours that a worker of your firm spends on Activity A is 20.
- Your earnings are 180 ECUs.
A little test

Imagine that you are a worker of type 1 (effort cost = 1). Using your earnings table suppose that you choose to spend 20 hours on Activity A. The other workers of your firm choose to spend 30, 0 and 20 hours on Activity A. 
  The minimum number of hours that a worker of my firm spends on A is _____.
  My earnings in ECUs are _____.

Suppose you decide to spend 0 hours on Activity A. The other workers of your firm choose to spend 20, 30 and 10 hours on Activity A.
  The minimum number of hours that a worker of my firm spends on A is _____.
  My earnings in ECUs are _____.

I will be in the same firm during the whole experiment: □ True. □ False.
My actions and earnings will be confidential: □ True. □ False.

Imagine that you are a worker of type 2 (effort cost = 9). Using your earnings table suppose that you choose to spend 20 hours on Activity A. The other workers of your firm choose to spend 30, 0 and 20 hours on Activity A.
  The minimum number of hours that a worker of my firm spends on A is _____.
  My earnings in ECUs are _____.

Suppose you decide to spend 0 hours on Activity A. The other workers of your firm choose to spend 20, 30 and 10 hours on Activity A.
  The minimum number of hours that a worker of my firm spends on A is _____.
  My earnings in ECUs are _____.

I will be in the same firm during the whole experiment: □ True. □ False.
My actions and earnings will be confidential: □ True. □ False.
From this round on there are two changes in the experiment: (i) the value of the bonus becomes 14 and (ii) the worker of type 1 in each group has the possibility of reducing the effort costs of the workers of type 2 of his group by increasing his own effort cost. The type 1 worker will make this decision before the effort decisions for the round are made. For each unit by which he reduces the effort costs of the three workers of type 2, the effort cost of the type 1 worker will increase by 3 units. The reduction will have to be the same for all workers of type 2 in the group, so that the concrete options available to the type 1 worker will be the following:

<table>
<thead>
<tr>
<th>Help level</th>
<th>Effort cost for type 1</th>
<th>Effort cost for type 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
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<td>6</td>
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<tr>
<td>4</td>
<td>13</td>
<td>5</td>
</tr>
</tbody>
</table>

The possibilities of modifying the effort costs lead to different payoff tables. Given that the possible effort costs are 1, 4, 5, 6, 7, 8, 9, 10 and 13 below we show the payoff tables for each of the possible effort costs:

\[
\begin{align*}
\text{Ce} &= 1 \\
B &= 14 \\
\text{Firm profit} &= 100 - 4 \times \min(HA) \\
\text{Minimum of hours spent on Activity A by the other workers} \\
\begin{array}{cccccc}
\text{My hours spent on Activity A} & 0 & 10 & 20 & 30 & 40 \\
0 & 200 & 200 & 200 & 200 & 200 \\
10 & 190 & 330 & 330 & 330 & 330 \\
20 & 180 & 320 & 460 & 460 & 460 \\
30 & 170 & 310 & 450 & 590 & 590 \\
40 & 160 & 300 & 440 & 580 & 720 \\
\end{array}
\begin{align*}
\text{Ce} &= 4 \\
B &= 14 \\
\text{Firm profit} &= 100 - 4 \times \min(HA) \\
\text{Minimum of hours spent on Activity A by the other workers} \\
\begin{array}{cccccc}
\text{My hours spent on Activity A} & 0 & 10 & 20 & 30 & 40 \\
0 & 200 & 200 & 200 & 200 & 200 \\
10 & 160 & 300 & 300 & 300 & 300 \\
20 & 120 & 260 & 400 & 400 & 400 \\
30 & 80 & 220 & 360 & 500 & 500 \\
40 & 40 & 180 & 320 & 460 & 600 \\
\end{array}
\end{align*}
\]
Ce = 5
B = 14
Firm profit = 100 + \(-4 \times \text{min(HA)}\)

**Minimum of hours spent on Activity A by the other workers**

<table>
<thead>
<tr>
<th>My hours spent on Activity A</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
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<tbody>
<tr>
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<td>420</td>
<td>560</td>
</tr>
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</table>

Ce = 6
B = 14
Firm profit = 100 + \(-4 \times \text{min(HA)}\)

**Minimum of hours spent on Activity A by the other workers**

<table>
<thead>
<tr>
<th>My hours spent on Activity A</th>
<th>0</th>
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<th>20</th>
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</tbody>
</table>

Ce = 7
B = 14
Firm profit = 100 + \(-4 \times \text{min(HA)}\)

**Minimum of hours spent on Activity A by the other workers**

<table>
<thead>
<tr>
<th>My hours spent on Activity A</th>
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<th>10</th>
<th>20</th>
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</tr>
</tbody>
</table>
Ce = 8  
B = 14
Firm profit = 100 + -4 \times \min(HA)

Minimum of hours spent on Activity A by the other workers

<table>
<thead>
<tr>
<th>My hours spent on Activity A</th>
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<tbody>
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<td>300</td>
<td>440</td>
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</table>

Ce = 9  
B = 14
Firm profit = 100 + -4 \times \min(HA)

Minimum of hours spent on Activity A by the other workers

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<th>My hours spent on Activity A</th>
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<th>20</th>
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</thead>
<tbody>
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<tr>
<td>40</td>
<td>-160</td>
<td>-20</td>
<td>120</td>
<td>260</td>
<td>400</td>
</tr>
</tbody>
</table>

Ce = 10  
B = 14
Firm profit = 100 + -4 \times \min(HA)

Minimum of hours spent on Activity A by the other workers

<table>
<thead>
<tr>
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<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
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</thead>
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<td>-200</td>
<td>-60</td>
<td>80</td>
<td>220</td>
<td>360</td>
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</tbody>
</table>
Ce = 13  
B = 14  
Firm profit = 100 + 4 \times \min(HA)

<table>
<thead>
<tr>
<th>My hours spent on Activity A</th>
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<th>20</th>
<th>30</th>
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APPENDIX B

Treatment Effects: The regressions shown in Table B.1 provide a formal statistical backing for our conclusions about the effects of the various treatments on subject choices. Models 1 and 1a look at firm-level data with the minimum effort as the dependent variable while Models 2 and 2a look at employee-level data with effort as the dependent variable. Given that these dependent variables are ordered categories, use of an ordered probit specification is natural. Both data sets include all observations from all seven treatments for Rounds 11 – 30. Since there are four employees per firm, Model 2 has four times as many observations as Model 1. The independent variables include a dummy for Rounds 21 – 30 and interaction terms between treatment dummies and dummies for Rounds 11 – 20 and Rounds 21 – 30. These interaction terms capture differences between the treatment and the base for the time period in question. Models 1 and 1a differ only in what treatment is used as the base – the No Help treatment in Model 1 and the Endogenous Help treatment in Model 1a. Models 2 and 2a differ in the same manner.

[Table B.1 about here]

Since there are multiple observations from each firm, correcting for firm effects is a central issue in the regressions. We do this in a couple of ways. First, standard errors in both regressions are corrected for clustering (Moulton, 1986; Liang and Zeger, 1986) at the firm level. Second, even though effort level zero is the unique equilibrium choice in Rounds 1 – 10, the majority of employees (60%) choose positive effort at least once in this first phase. We therefore controls for behavior in Rounds 1 – 10 with the idea that this will pick up an individual and/or group tendency to choose higher effort levels. Specifically we include the firm’s average minimum effort in Rounds 1 – 10 and, in the regressions on employee-level data, the employee’s average effort over Rounds 1 – 10.

We start by looking at the statistical support for Conclusion 1. Looking at Models 1 and 1a, few significant differences are observed at the firm-level between the treatments in Experiment 1. The only significant difference is between the Endogenous and Symmetric Costs treatments in Rounds 21 – 30, and this is only significant at the 10% level. Looking at employee-level data, in Models 2 and 2a, even this difference fails to achieve statistical significance. The regression results therefore support Conclusion 1 – Endogenous Help is doing nothing to improve firm productivity (as measured by minimum effort) and even the positive effect of Symmetric costs is modest.

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31 The cutoffs are not reported on Table B.1 since they are of little economic interest. Copies of all regression output are available from the authors upon request.

32 In Models 2 and 2a, observations from individuals in the same firm are obviously not independent. We therefore cluster at the firm level rather than the employee level.
Turning to Conclusion 3, the regression analysis reported in Table B.1 also supports this conclusion. Compared with either the No Help or Endogenous Help treatments, the Forced Commitment treatment leads to significantly higher minimum effort and effort levels in Rounds 21 – 30. This effect is significant at the 5% level for all four models. If the regressions are altered so the base is the Symmetric Costs treatments, no significant differences are found between this treatment and Forced Commitment.

The regressions provide strong support for Conclusion 4. Compared with the No Help treatment, Direct Help without Commitment leads to significantly lower minimum effort and effort throughout Rounds 11 – 30. This effect is always significant at the 1% level. In contrast the effect of Direct Help with Commitment (as compared with the No Help treatment) is always small and never approaches statistical significance at the 10% level. The difference between the two direct help treatments is always statistically significant at the 1% level.

Effects of Changing Help: Table B.2 shows the results of ordered probit regressions capturing the relation between changes in help and changes in the effort level. These provide backing for Conclusion 2. The dataset is all observations where help was available (Rounds 11 – 30) for the Endogenous Help treatment. Model 1 uses firm-level data with the dependent variable being the minimum effort chosen by the firm’s three low ability types in the current round. Model 2 uses employee-level data from low ability types only. The dependent variable is the chosen effort level for the current round. As should be clear from Figures 2 and 3, the current round and the lagged (minimum) effort both play an important role in determining how the (minimum) effort changes beyond any change in the level of help provided. To control for these effects, both regressions include dummies for the current round as well as dummies for each possible value of the lagged dependent variable. Parameter estimates for these dummies and the cutoffs are not reported in Table B.2 since they are not of direct interest. Copies of the full regression output are available from the authors upon request. With the inclusion of lagged dependent variables, the estimated parameters capture how the independent variables affect changes in the (minimum) effort. The primary independent variables are the current level of help, the increase in help from the previous round interacted with a dummy for a positive change in help, and the decrease in help from the previous round interacted with a dummy for a negative change in help. Standard errors are corrected for clustering at the firm level.

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Looking at Model 1, the two coefficients for changes in the level of help are both strongly significant, while the coefficient for the current level of help is not. The negative coefficient for negative help changes is almost three times as large – in absolute terms - as the positive one for positive help changes. The difference between the absolute values of these two parameters is statistically significant at the 1% level. The main results for Model 2 are much the same: the level of help does not have a significant effect and the negative effect of decreasing help is roughly three times as large as the positive effect of increasing help with the difference being statistically significant at the 1% level. One possible explanation for the asymmetric response of minimum effort to changes in help is strictly mechanical – three individuals need to respond positively to increased help to raise the minimum effort for low ability types, but only one needs to respond negatively to decreased help to lower the minimum effort. The results of Model 2 indicate that the disproportionate response to decreases is not caused by the minimum function emphasizing decreases.
C.1 Structural Model

Let $e \in \{1, 2, 3, 4, 5\}$ denote the effort level of a player. If a player chooses $e = 1$, then she chooses effort 0; if a player chooses $e = 2$, then she chooses effort 10; ...; if a player chooses $e = 5$, then she chooses effort 40. Let $m \in \{1, 2, 3, 4, 5\}$ denote the minimum effort level of the other 3 players in her group.

We consider three different treatments in this appendix, namely the “No Help”, “Endogenous Help”, and “Forced Commitment” treatments. These are the three treatments involved in the central finding of the paper: help only improves minimum effort with forced commitment. In the “Endogenous Help” treatment, and the “Forced Commitment” treatment, 5 help levels are possible. Because we rarely observe the high ability (low cost) subjects choosing $H = 3$ and $H = 4$, and players never choose $H = 3$ and $H = 4$ in model simulation, we only consider the first three help levels ($H = 0, 1, \text{ or } 2$).

The model includes two types of individuals, unsophisticated and sophisticated learners. We denote unsophisticated learners by superscript $u$, and denote sophisticated learners by $s$. Furthermore, there are two types of unsophisticated learners which vary only in their initial beliefs about others’ behavior. Denote the optimistic type player by $u = h$. Denote the pessimistic type player by $u = l$.

C.1.1 Unsophisticated Players

Let $q_{it}^u(m)$ denote the probability belief associated with minimum effort level $m$ of a type $u \in \{h, l\}$ player $i$ in period $t$. Then, the vector of belief probabilities of a type $h$ player is $q_t^h = [q_t^h(1), q_t^h(2), q_t^h(3), q_t^h(4), q_t^h(5)] = [0, 0, 0, 0, 1]$. Similarly, for a type $l$ player, $q_t^l = [1, 0, 0, 0, 0]$. In period 1, all players of the same type share the exact same belief $q_1^u$, so player subscript $i$ is suppressed.

A unsophisticated player updates her belief based on her observation of other players’ efforts in the current period. Let $N_{-it}(e)$ be the number of players other than player $i$ choosing effort level $e$. Given that three other players are in the group, the fraction of other players choosing effort level $e$ is $N_{-it}(e)/3$. A unsophisticated player believes that the probability of any other player in her group choosing effort
level $e$ in the next period $t + 1$ is $p_{it+1}(e) = N_{it}(e)/3$. Given the belief $p_{it+1}(e)$, we have:

- prob. of all three others choosing efforts $e = 5$: $pr_{it+1}(5) = (p_{it+1}(5))^3$
- prob. of all three others choosing efforts $e \geq 4$: $pr_{it+1}(4) = (p_{it+1}(4) + p_{it+1}(5))^3$
- prob. of all three others choosing efforts $e \geq 3$: $pr_{it+1}(3) = (p_{it+1}(3) + p_{it+1}(4) + p_{it+1}(5))^3$
- prob. of all three others choosing efforts $e \geq 2$: $pr_{it+1}(2) = (p_{it+1}(2) + p_{it+1}(3) + p_{it+1}(4) + p_{it+1}(5))^3$
- prob. of all three others choosing efforts $e \geq 1$: $pr_{it+1}(1) = 1$

A unsophisticated player can infer the probability of minimum effort being $m$ in period $t + 1$ is $\eta_{it+1}(m)$, where

\[
\eta_{it+1}(5) = pr_{it+1}(5) \\
\eta_{it+1}(4) = pr_{it+1}(4) - pr_{it+1}(5) \\
\eta_{it+1}(3) = pr_{it+1}(3) - pr_{it+1}(4) \\
\eta_{it+1}(2) = pr_{it+1}(2) - pr_{it+1}(3) \\
\eta_{it+1}(1) = pr_{it+1}(1) - pr_{it+1}(2)
\]

At the beginning of period $t$, a type $u \in \{h, l\}$ player $i$ has a probability $\omega(t)$ of believing the probability distribution of others’ minimum effort is $\eta_{it}(m)$, and has a probability $1 - \omega(t)$ of believing the probability distribution of others’ minimum effort is her initial belief $q_{it}^u(m)$. In particular, for period 2 and beyond

\[
q_{it}^u(m) = \omega(t)\eta_{it}(m) + (1 - \omega(t))q_{it}^u(m) \quad \text{for } u = h, l \text{ and } \forall m
\]

where $\omega(1) = 0$, $\omega(2) = \tilde{\omega}$, and $\omega(t)$ changes over time according to

\[
\omega(t) = \omega(t - 1) + \gamma \quad \forall t \in [2, 10] \text{ and } \forall t \in [12, 30]
\]

Parameter $\tilde{\omega}$ is the initial weight that unsophisticated players place on the current belief of minimum effort $\eta_{it}$, and parameter $\gamma$ is the per period deviation of $\omega(t)$ from the initial weight $\tilde{\omega}$. A reset of belief $\rho$ happens at the beginning of period 11, so

\[
\omega(11) = \omega(10) - \rho
\]
We restrict $\omega(t) \in [0, 1]$. Given the estimated parameters, $\omega(t)$ is always strictly within these bounds. Given belief $q^u_{it}(m)$, the expected payoff of a type $u$ player choosing effort $e$ is

$$E\pi^u_{it}(e) = \sum_{m=1}^{5} q^u_{it}(m) \cdot \pi_{it}(e, m) \quad \text{for } u = h, l \text{ and } \forall e$$

Two transformations are made to the expected payoffs to generate “attractions” for each effort level. First, extra weight is put on the effort level that was chosen in the previous period. We capture this by introducing a hysteresis parameter $\delta$. Second, reciprocity by low ability (high cost) types is incorporated into the model, which is explicitly captured by the reciprocity parameter $\kappa$. The attraction weight of player $i$ towards effort level $e$ in period $t$ is

$$A^u_{it}(e) = ((1 - \delta R_{it}) + \delta R_{it}(e) I_{it}) E\pi^u_{it}(e) + \kappa \cdot hc_{it} \cdot E\pi^{u,\text{high.ability}}_{it}(e) \quad \text{for } u = h, l \text{ and } \forall e \quad (C1)$$

In Equation (C1), $R_{it}$ is the number of times past effort choices have been consecutively repeated. If a player fails to choose the effort level of the last period, then $R_{it}$ is reset to zero. More specifically, for player $i$, $R_{i1} = 0$, $R_{i2} = 0$ and

$$R_{it+1} = \begin{cases} R_{it} + 1 & \text{if } e_{it} = e_{it-1} \\ 0 & \text{otherwise} \end{cases}$$

Indicator function $I_{it}$ is such that $I_{it}(e) = 1$ if $e$ is the repeated action, and $I_{it}(e) = 0$ otherwise. In practice, $\delta R_{it}$ is restricted to never exceed one. The setup in Equation (C1) implies that for any player, the more times an effort choice is repeated, the more attractive it becomes relative to the other effort choices.

To model reciprocity in the model, we let $H_{it}$ be the help level a player $i$ faces at period $t$. Let the change in help level in $t \geq 2$ be $hc_{it} = H_{it} - H_{it-1}$. In addition, $E\pi^{u,\text{high.ability}}_{it}(e)$ is the expected payoff of the group’s high ability type based on player $i$’s belief given player $i$ chooses effort level $e$. Each low ability (high cost) player forms her belief of the group’s high ability type’s effort choice based on her type $x \in \{s, h, l\}$. Let this belief be $p^x_{i,\text{high.ability}}(e)$. Also, each player can form belief of other players’ minimum effort $q^x_{it}(m)$. For given player $i$’s own choice of effort $e$, the probability of minimum effort in

---

1For example, for a unsophisticated player, this belief is simply $N_{-it}(e)/3$. 

the group is

\[
\begin{align*}
\text{if } e = 5 & \quad q_{it}^{x, \text{min}}(e, m) = q_{it}^{x}(m) \quad \text{for } m = 1, 2, 3, 4, 5 \\
\text{if } e = 4 & \quad q_{it}^{x, \text{min}}(e, m) = q_{it}^{x}(m) \quad \text{for } m = 1, 2, 3 \\
& \quad q_{it}^{x, \text{min}}(e, 4) = q_{it}^{x}(4) + q_{it}^{x}(5) \\
& \quad q_{it}^{x, \text{min}}(e, 5) = 0 \\
\text{if } e = 3 & \quad q_{it}^{x, \text{min}}(e, m) = q_{it}^{x}(m) \quad \text{for } m = 1, 2 \\
& \quad q_{it}^{x, \text{min}}(e, 3) = q_{it}^{x}(3) + q_{it}^{x}(4) + q_{it}^{x}(5) \\
& \quad q_{it}^{x, \text{min}}(e, m) = 0 \quad \text{for } m = 4, 5 \\
\text{if } e = 2 & \quad q_{it}^{x, \text{min}}(e, 1) = q_{it}^{x}(1) \\
& \quad q_{it}^{x, \text{min}}(e, 2) = q_{it}^{x}(2) + q_{it}^{x}(3) + q_{it}^{x}(4) + q_{it}^{x}(5) \\
& \quad q_{it}^{x, \text{min}}(e, m) = 0 \quad \text{for } m = 3, 4, 5 \\
\text{if } e = 1 & \quad q_{it}^{x, \text{min}}(e, 1) = 1 \\
& \quad q_{it}^{x, \text{min}}(e, m) = 0 \quad \text{for } m = 2, 3, 4, 5
\end{align*}
\]

Therefore, the total expected payoff of a high ability type is

\[
E\pi_{it}^{x, \text{high.ability}}(e) = \sum_{k=1}^{5} p_t^{x, \text{high.ability}}(k) \sum_{m=1}^{5} q_{it}^{x, \text{min}}(e, m) \pi_t^{x, \text{high.ability}}(k, m)
\]

We assume the probability of a type \( u \) player choosing effort level \( e \) follows a logit specification, where

\[
\Phi_{it}^{u}(e) = \frac{\exp(\lambda \cdot A_{it}^{u}(e))}{\sum_{k=1}^{5} \exp(\lambda \cdot A_{it}^{u}(k))} \quad \text{for } u = h, l \text{ and } \forall e
\]

Each unsophisticated player takes an i.i.d. random draw to determine her actual effort choice based on this probability \( \Phi_{it}^{u} \) each period \( t \).

**C.1.2 Sophisticated Players**

Sophisticated players assume all other players in the group are unsophisticated. A sophisticated player knows how unsophisticated players' beliefs evolve and is forward looking. It is also possible for sophisticated players to be overly optimistic. In particular, sophisticated players can have biased update weights
\( \omega^s(t) \), where \( \omega^s(1) = 0, \omega^s(2) = \bar{\omega} + \mu \) and for \( t \in [3, 30] \)

\[
\omega^s(t) = \omega(t) + \mu
\]

\( \mu \geq 0 \) is over-optimism parameter.

Sophisticated player \( i \) know \( q_{11}^{b}, q_1^l \) and can infer \( \eta_{jt} \) for all other players \( j \neq i \) in her group in the same way of unsophisticated players. With the biased weight \( \omega^s(t) \), sophisticated players can construct biased beliefs \( q_{jt}^{u,s} \) for each of the other players \( j \neq i \),

\[
q_{jt}^{u,s}(m) = \omega^s(t)\eta_{it}(m) + (1 - \omega^s(t))q_{1}^{u}(m)
\]

Then in the same exact way as the unsophisticated players do, sophisticated player \( i \) can construct biased expected payoffs \( \bar{E}_{jt}^{u,s} \), and biased choice probability \( \Phi_{jt}^{u,s} \) for each of the other players \( j \neq i \) in her group.

Sophisticated players do not know the types of the other players. They believe the probability of another player being type \( l \) is \( \theta \), and the probability of another player being type \( h \) is \( 1 - \theta \), which is consistent with the true distribution of unsophisticated player types in the population. So sophisticated players belief of distribution of choice efforts by another player \( j \neq i \) is

\[
p_{jt}^{s}(e) = \theta\Phi_{jt}^{l,s}(e) + (1 - \theta)\Phi_{jt}^{h,s}(e) \quad \forall e
\]

Based the belief \( p_{jt}^{s}(e) \), a sophisticated player can infer the probability of minimum effort being \( m \) in period \( t \), which is \( \eta_{it}^s(m) \). For exposition convenience, for a sophisticated player \( i \), denote the other three players she faces \( i_a, i_b \) and \( i_c \). Then

- prob. of all three others choosing efforts \( e = 5 \): \( pr_{it}^s(5) = \prod_{j=i_a, i_b, i_c} p_{jt}^{s}(5) \)
- prob. of all three others choosing efforts \( e \geq 4 \): \( pr_{it}^s(4) = \prod_{j=i_a, i_b, i_c} (p_{jt}^{s}(4) + p_{jt}^{s}(5)) \)
- prob. of all three others choosing efforts \( e \geq 3 \): \( pr_{it}^s(3) = \prod_{j=i_a, i_b, i_c} (p_{jt}^{s}(3) + p_{jt}^{s}(4) + p_{jt}^{s}(5)) \)
- prob. of all three others choosing efforts \( e \geq 2 \): \( pr_{it}^s(2) = \prod_{j=i_a, i_b, i_c} (p_{jt}^{s}(2) + p_{jt}^{s}(3) + p_{jt}^{s}(4) + p_{jt}^{s}(5)) \)
- prob. of all three others choosing efforts \( e \geq 1 \): \( pr_{it}^s(1) = 1 \)
So the probability of observing minimum effort being \( m \) is \( \eta^s_{it}(m) \), where

\[
\begin{align*}
\eta^s_{it}(5) &= pr^s_{it}(5) \\
\eta^s_{it}(4) &= pr^s_{it}(4) - pr^s_{it}(5) \\
\eta^s_{it}(3) &= pr^s_{it}(3) - pr^s_{it}(4) \\
\eta^s_{it}(2) &= pr^s_{it}(2) - pr^s_{it}(3) \\
\eta^s_{it}(1) &= pr^s_{it}(1) - pr^s_{it}(2)
\end{align*}
\]

Therefore, the expected payoff of sophisticated player \( i \) choosing a effort level \( e \) next round is

\[
E\pi^s_{it}(e) = \sum_{m=1}^{5} \eta^s_{it}(e) \pi_{it}(e, m) \quad \forall e
\]

In addition, sophisticated player \( i \) has the ability of forward looking, and understands how her own action can potentially affect the beliefs of unsophisticated players one period ahead. More specifically, if sophisticated played \( i \) chooses to play effort level \( e \), it would increase the number of observations \( N_{-jt}(e) \) of choice \( e \) for other players \( j \neq i \). A sophisticated player understands that by changing \( N_{-jt}(e) \), she can affect each unsophisticated player’s belief of minimum effort next period. In other words, a sophisticated player would be aware of her own action’s effect on \( q^{u,s}_{jt+1}(m) \). In a sense, if a sophisticated player chooses higher effort choice \( e \), she would expect all other players in her group to believe higher minimum effort is more likely in period \( t + 1 \). Notice that this forward looking is also biased by sophisticated player \( i \)’s own over-optimism. So given \( q^{u,s}_{jt+1}(m) \), a sophisticated player can also form expectation on her own expected payoff level in period \( t + 1 \). This expected payoff depends on her current choice of effort level \( e \), denoted by \( E\pi^s_{it+1}(e) \). We assume that the sophisticated players weigh current expected payoff and future expected payoff equally. We also assume sophisticated players do not forward look in the end of each block (period 10, 20 and 30).

Similar to unsophisticated players, reciprocity can potentially affect a low ability (high cost) sophisticated player’s attraction weight towards certain effort choices. When help can be offered, and when \( i \) is not a high ability type herself, the attraction weight of player \( i \) towards effort level \( e \) in period \( t \) is

\[
A^s_{it}(e) = E\pi^s_{it}(e) + E\pi^s_{it+1}(e) + \kappa \cdot hc_{it} \cdot E\pi^{s, high, ability}_{it}(e) \quad \forall e
\]

where \( E\pi^{s, high, ability}_{it}(e) \) is the expected payoff of the group’s high ability type based on player \( i \)’s belief
given player $i$ chooses effort level $e$, similarly defined as in the above subsection.

We assume the probability of a type $s$ player choosing effort level $e$ follows a logit specification, where

$$\Phi^s_{it}(e) = \frac{\exp(\lambda A^s_{it}(e))}{\sum_{k=1}^{5} \exp(\lambda A^s_{it}(k))} \quad \forall e$$

Each sophisticated player takes an i.i.d. random draw to determine her actual effort choice based on this probability $\Phi^s_{it}$ each period $t$.

### C.1.3 Help Decisions

Given the previous help level $H(t-1)$, a high ability type can decide on $H(t)$ each period in the “Endogenous Help” treatment, and in period 11 and period 21 in the “Forced Commitment” treatment. A high ability type can calculate the her expected attraction weights under each potential help level.

A high ability type $x$ offering help level $H$ expects her own probability of choosing effort level $e$ is $\Phi^x_{it}(e|H,H_{t-1})$, and her current expected payoff is $E\pi^x_{it}(e|H,H_{t-1})$. So the expected attraction weight of type $x$ high ability type offering help level $H$ in period $t$ given previous period’s help level $H_{t-1}$ is

$$EA^x_{it}(H|H_{t-1}) = \sum_{e=1}^{5} \Phi^x_{it}(e|H,H_{t-1}) \cdot A^x_{it}(e|H,H_{t-1}) \quad \forall H \quad \forall x \in \{s,h,l\}$$

A high ability type’s help decision probability is based on a logit decision rule,

$$\Phi^{H,x}_{it}(H|H_{t-1}) = \frac{\exp(\lambda H EA^x_{it}(H|H_{t-1}))}{\sum_{k=1}^{3} \exp(\lambda H EA^x_{it}(k|H_{t-1}))} \quad \forall H$$

where $\lambda^H$ is the logit parameter for help decisions. A high ability type takes an i.i.d. random draw to determine her actual help choice based on this probability $\Phi^{H,x}_{it}$ each period $t$.

### C.2 Estimation Procedure

We use Simulated Method of Moments to estimate parameters. The moments we use are the average minimum efforts of every period in all three treatments “No Help,” “Endogenous Help” and “Forced Commitment.” More specifically, the set of moments is $\Gamma = \{\Gamma^{NoHelp}_{1}, \ldots, \Gamma^{NoHelp}_{30}, \Gamma^{Endo}_{1}, \ldots, \Gamma^{Endo}_{30}, \Gamma^{Commit}_{1}, \ldots, \Gamma^{Commit}_{30}\}$, where $\Gamma^{tr}_t$ is the $t$th period average minimum effort in treatment $tr$.

For any particular set of parameters $\Theta$, we can simulate the behaviors of $N = 1,000$ groups of 4 players

---

3Without the loss of generality, let the high ability type be player 1 in a group.
for each treatment. Without loss of generality, we let the first player of the group to be the group’s high ability type with a lower effort cost. Each player receives a random draw in the beginning of time to determine her own type (whether she is a sophisticated player, a type \( l \) player or a type \( h \) player), this type will remain with her for all 30 periods. In addition, each player draws an i.i.d. logit error each period to determine her choice of effort in that period. Each high ability type draws an i.i.d. logit error to determine the level of help in the period when she need to make a help decision. This set of errors are fixed for each iteration of the estimation routine. For each group \( n \), we can determine the simulated minimum effort \( \hat{\Gamma}_{t,n}^{tr}(\Theta) \) for that group in period \( t \) and treatment \( tr \). So correspondingly, we can construct the set of simulated moments \( \hat{\Gamma}_n \) for each group \( n \). Then the optimal estimator is defined as

\[
\Theta^* = \arg\min_{\Theta} \left[ \Gamma - \frac{1}{N} \sum_{n=1}^{N} \hat{\Gamma} \right]^\prime W \left[ \Gamma - \frac{1}{N} \sum_{n=1}^{N} \hat{\Gamma} \right]
\]

where \( W \) is the optimal weighting matrix\(^3\).

\(^3\)For initial estimation, we use the identity matrix. Standard errors are obtained by computing the variance-covariance matrix of the simulated moments, and the partial derivatives of \( \Gamma - \frac{1}{N} \sum_{n=1}^{N} \hat{\Gamma} \) with respect to each parameter of interest.
Table 1: Employee i’s Payoff Tables for B=8

\[ C_i = 1 \]

<table>
<thead>
<tr>
<th>Effort by Employee i</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
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<tbody>
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<td>0</td>
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<td>200</td>
<td>200</td>
<td>200</td>
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<tr>
<td>10</td>
<td>190</td>
<td>270</td>
<td>270</td>
<td>270</td>
<td>270</td>
</tr>
<tr>
<td>20</td>
<td>180</td>
<td>260</td>
<td>340</td>
<td>340</td>
<td>340</td>
</tr>
<tr>
<td>30</td>
<td>170</td>
<td>250</td>
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<td>40</td>
<td>160</td>
<td>240</td>
<td>320</td>
<td>400</td>
<td>480</td>
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</table>

\[ C_i = 9 \]

<table>
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<th>Effort by Employee i</th>
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<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
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<td>200</td>
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<td>10</td>
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<tr>
<td>20</td>
<td>20</td>
<td>100</td>
<td>180</td>
<td>180</td>
<td>180</td>
</tr>
<tr>
<td>30</td>
<td>-70</td>
<td>10</td>
<td>90</td>
<td>170</td>
<td>170</td>
</tr>
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<td>40</td>
<td>-160</td>
<td>-80</td>
<td>0</td>
<td>80</td>
<td>160</td>
</tr>
</tbody>
</table>
Table 2: Employee i’s Payoff Tables for B=14

<table>
<thead>
<tr>
<th>Effort by Employee i</th>
<th>Minimum Effort by Other Employees</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>190</td>
<td>330</td>
<td>330</td>
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<td>20</td>
<td>180</td>
<td>320</td>
<td>460</td>
<td>460</td>
<td>460</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>170</td>
<td>310</td>
<td>450</td>
<td>590</td>
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</tr>
<tr>
<td>40</td>
<td>160</td>
<td>300</td>
<td>440</td>
<td>580</td>
<td>720</td>
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</table>

<table>
<thead>
<tr>
<th>Effort by Employee i</th>
<th>Minimum Effort by Other Employees</th>
<th>0</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td>200</td>
<td>200</td>
<td>200</td>
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</tr>
<tr>
<td>10</td>
<td>110</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td>250</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>160</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>-70</td>
<td>70</td>
<td>210</td>
<td>350</td>
<td>350</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>-160</td>
<td>-20</td>
<td>120</td>
<td>260</td>
<td>400</td>
<td></td>
</tr>
</tbody>
</table>
Table 3: List of Treatments of Experiment 1

<table>
<thead>
<tr>
<th>TREATMENT NAME</th>
<th>NO HELP</th>
<th>ENDOGENOUS HELP</th>
<th>SYMMETRIC COSTS</th>
<th>FORCED COMMITMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Player 1 Cost Block 1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Player 1 Cost Blocks 2 and 3</td>
<td>1</td>
<td>1 + 3H ( H \in {1,2,3,4} )</td>
<td>7</td>
<td>1 + 3H ( H \text{ fixed for block} ) ( H \in {1,2,3,4} )</td>
</tr>
<tr>
<td>Players 2, 3 &amp; 4 Cost Block 1</td>
<td>9</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Players 2, 3 &amp; 4 Cost Blocks 2 and 3</td>
<td>9</td>
<td>9 – H ( H \in {1,2,3,4} )</td>
<td>7</td>
<td>9 – H ( H \text{ fixed for block} )</td>
</tr>
<tr>
<td>Number of Firms (Number of Sessions)</td>
<td>20</td>
<td>39</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

(2 Sessions) (5 Sessions) (2 Sessions) (2 sessions)
Table 4: Employee Payoff Tables with $B = 14$ and $C_i = 7$ for all Employees

<table>
<thead>
<tr>
<th>Effort by Employee $i$</th>
<th>Minimum Effort by Other Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
</tr>
<tr>
<td>0</td>
<td>200</td>
</tr>
<tr>
<td>10</td>
<td>130</td>
</tr>
<tr>
<td>20</td>
<td>60</td>
</tr>
<tr>
<td>30</td>
<td>-10</td>
</tr>
<tr>
<td>40</td>
<td>-80</td>
</tr>
</tbody>
</table>
Table 5: Parameter Estimates of the Structural Model

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>EXPLANATION</th>
<th>ESTIMATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\mu$</td>
<td>Over-optimism</td>
<td>0.046 (0.004)</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>Reciprocity</td>
<td>0.012 (0.045)</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>Fraction of sophisticated players</td>
<td>0.657 (0.057)</td>
</tr>
<tr>
<td>$\theta$</td>
<td>Fraction of type I players</td>
<td>0.089 (0.005)</td>
</tr>
<tr>
<td>$\bar{w}$</td>
<td>Initial belief weight</td>
<td>0.202 (0.008)</td>
</tr>
<tr>
<td>$\delta$</td>
<td>Hysteresis</td>
<td>0.303 (0.023)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>Belief weight slope term</td>
<td>$0.178 \times 10^{-4}$ ($1.175 \times 10^{-4}$)</td>
</tr>
<tr>
<td>$\rho$</td>
<td>Reset of belief weight</td>
<td>0.086 (0.006)</td>
</tr>
<tr>
<td>$\lambda$</td>
<td>Logit function parameter</td>
<td>0.072 (0.002)</td>
</tr>
<tr>
<td>$\lambda^H$</td>
<td>Logit parameter for help decisions</td>
<td>0.410 (0.137)</td>
</tr>
<tr>
<td>-</td>
<td>Sum of squared errors</td>
<td>523.861</td>
</tr>
</tbody>
</table>
Table 6: Payoff Tables, High Ability Type Provides One Unit (10 Hours) of Help

<table>
<thead>
<tr>
<th>Effort by Employee I at Own Job</th>
<th>Minimum Effective Effort by Other Employees</th>
<th>$C_i = 1$</th>
<th>$C_i = 9$</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>0 -70</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>20</td>
<td>10 60</td>
<td>20</td>
<td>110</td>
</tr>
<tr>
<td>30</td>
<td>20 50</td>
<td>30</td>
<td>20 160</td>
</tr>
<tr>
<td>40</td>
<td>30 40</td>
<td>40</td>
<td>40 -70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Effort by Employee I at Own Job</th>
<th>Minimum Effective Effort by Other Employees on Own Job</th>
<th>$C_i = 1$</th>
<th>$C_i = 9$</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10 200</td>
<td>10</td>
<td>10 200</td>
</tr>
<tr>
<td>20</td>
<td>20 110</td>
<td>20</td>
<td>20 110</td>
</tr>
<tr>
<td>30</td>
<td>30 20</td>
<td>30</td>
<td>30 20</td>
</tr>
<tr>
<td>40</td>
<td>40 -70</td>
<td>40</td>
<td>40 -70</td>
</tr>
<tr>
<td>50</td>
<td>50 -160</td>
<td>50</td>
<td>50 -160</td>
</tr>
</tbody>
</table>
### Table B.1: Ordered Probit Regressions on Treatment Effects

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Model 1</th>
<th>Model 1a</th>
<th>Model 2</th>
<th>Model 2a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum Effort</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Firm</td>
<td>No Help</td>
<td>Endogenous Help</td>
<td>No Help</td>
<td>Endogenous Help</td>
</tr>
<tr>
<td>Rounds 21 – 30</td>
<td>.197</td>
<td>.265**</td>
<td>-.030</td>
<td>.053</td>
</tr>
<tr>
<td></td>
<td>(.129)</td>
<td>(.106)</td>
<td>(.138)</td>
<td>(.105)</td>
</tr>
<tr>
<td>No Help</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Rounds 11 – 20</td>
<td>.103</td>
<td>.262</td>
<td>-.035</td>
<td>.048</td>
</tr>
<tr>
<td></td>
<td>(.262)</td>
<td>(.236)</td>
<td>(.292)</td>
<td></td>
</tr>
<tr>
<td>No Help</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Rounds 21 – 30</td>
<td>-.103</td>
<td>.035</td>
<td>-.035</td>
<td>-.048</td>
</tr>
<tr>
<td></td>
<td>(.262)</td>
<td>(.315)</td>
<td>(.236)</td>
<td>(.292)</td>
</tr>
<tr>
<td>Endogenous Help</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Rounds 11 – 20</td>
<td>-.035</td>
<td>.048</td>
<td>-.035</td>
<td>-.048</td>
</tr>
<tr>
<td></td>
<td>(.315)</td>
<td>(.292)</td>
<td>(.236)</td>
<td></td>
</tr>
<tr>
<td>Symmetric Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Rounds 11 – 20</td>
<td>.185</td>
<td>.288</td>
<td>.102</td>
<td>.137</td>
</tr>
<tr>
<td></td>
<td>(.288)</td>
<td>(.258)</td>
<td>(.287)</td>
<td>(.255)</td>
</tr>
<tr>
<td>* Rounds 21 – 30</td>
<td>.496</td>
<td>.532</td>
<td>.486</td>
<td>.438</td>
</tr>
<tr>
<td></td>
<td>(.365)</td>
<td>(.315)</td>
<td>(.351)</td>
<td>(.304)</td>
</tr>
<tr>
<td>Forced Commitment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(.329)</td>
<td>(.297)</td>
<td>(.313)</td>
<td>(.278)</td>
</tr>
<tr>
<td>* Rounds 21 – 30</td>
<td>.781**</td>
<td>.816**</td>
<td>.799**</td>
<td>.751**</td>
</tr>
<tr>
<td></td>
<td>(.396)</td>
<td>(.343)</td>
<td>(.371)</td>
<td>(.322)</td>
</tr>
<tr>
<td>Direct Help</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Rounds 11 – 20</td>
<td>-1.032***</td>
<td>-.929***</td>
<td>-1.380**</td>
<td>-1.428***</td>
</tr>
<tr>
<td></td>
<td>(.377)</td>
<td>(.261)</td>
<td>(.310)</td>
<td>(.244)</td>
</tr>
<tr>
<td>* Rounds 21 – 30</td>
<td>-1.556***</td>
<td>-1.521***</td>
<td>-1.380**</td>
<td>-1.428***</td>
</tr>
<tr>
<td></td>
<td>(.377)</td>
<td>(.261)</td>
<td>(.310)</td>
<td>(.244)</td>
</tr>
<tr>
<td>Direct Help with Commitment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Rounds 11 – 20</td>
<td>-.003</td>
<td>.100</td>
<td>.010</td>
<td>.045</td>
</tr>
<tr>
<td></td>
<td>(.253)</td>
<td>(.220)</td>
<td>(.232)</td>
<td>(.192)</td>
</tr>
<tr>
<td>* Rounds 21 – 30</td>
<td>-.070</td>
<td>-.034</td>
<td>.094</td>
<td>.046</td>
</tr>
<tr>
<td></td>
<td>(.328)</td>
<td>(.273)</td>
<td>(.298)</td>
<td>(.244)</td>
</tr>
<tr>
<td>Ave. Min. Effort Rounds 1 – 10</td>
<td>.170</td>
<td>.170</td>
<td>.176*</td>
<td>.176*</td>
</tr>
<tr>
<td></td>
<td>(.109)</td>
<td>(.109)</td>
<td>(.105)</td>
<td>(.105)</td>
</tr>
<tr>
<td>Average Effort, Rounds 1 – 10</td>
<td></td>
<td></td>
<td>.008</td>
<td>.008</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>(.006)</td>
<td>(.006)</td>
</tr>
<tr>
<td>Log-Likelihood</td>
<td>-3686.89</td>
<td>-3686.89</td>
<td>-14584.60</td>
<td>-14584.60</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>2660</td>
<td>2660</td>
<td>10640</td>
<td>10640</td>
</tr>
</tbody>
</table>

Notes: Standard errors are corrected for clustering at the firm level. Three (***) and two (**) stars indicate statistical significance at the 1%, 5%, and 10% respectively.
Table B.2: The Effect of Changes in Help on Effort by Low Ability Types

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Firm-Level Data</td>
<td>Employee-Level Data</td>
</tr>
<tr>
<td></td>
<td>Min. Effort, Low Ability Types</td>
<td>Effort, Low Ability Types</td>
</tr>
<tr>
<td>Current Level of Help</td>
<td>.044 (.062)</td>
<td>.045 (.066)</td>
</tr>
<tr>
<td>Increase in Help * (Change in Help &gt; 0)</td>
<td>.218*** (.082)</td>
<td>.124** (.060)</td>
</tr>
<tr>
<td>Decrease in Help * (Change in Help &lt; 0)</td>
<td>-.604*** (.137)</td>
<td>-.377*** (.059)</td>
</tr>
<tr>
<td>Log Likelihood</td>
<td>-674.65</td>
<td>-2416.30</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>780</td>
<td>2340</td>
</tr>
</tbody>
</table>

Notes: Standard errors are corrected for clustering at the firm level. Three (***) and two (**) stars indicate statistical significance at the 1%, 5%, and 10% respectively.
Figure 1: Minimum Effort in Experiment 1

![Graph showing average minimum effort over periods for different conditions: No Help, Symmetric Costs, Endogenous Help, Forced Commitment.](image-url)
Figure 2: Frequency of Changing Help, Minimum Effort, and High Ability Type Profits
Figure 3: Effect of Changing Help on Low Ability Type Minimum Effort (Rounds 12 - 30)

Lagged Minimum Effort, Low Ability Types

- Decrease Help
- Constant Help
- Increase Help

Number of observations:
- 74 obs
- 45 obs, 114 obs
- 46 obs, 204 obs, 34 obs
- 22 obs, 196 obs, 6 obs
Figure 4: Goodness of Fit
Figure 5: Simulated Average Minimum Efforts: Counterfactuals

- No Reciprocity and No Over-optimism
- No Reciprocity and Over-optimism
- Reciprocity=1 and No Over-optimism
- Reciprocity=1 and Over-optimism

Legend:
- Red: Endogenous Help
- Blue: Forced Commitment
- Green: No Help
Figure 6: Minimum Effort in Experiment 2

The graph illustrates the average effective minimum effort over different periods for three scenarios:

- Direct Help
- Direct Help with Forced Commitment
- No Help

The x-axis represents the period, ranging from 10 to 30, and the y-axis represents the average effective minimum effort, ranging from 0 to 40. The graph shows how the effort changes over time for each scenario.