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Stand by Me—Experiments on Help and Commitment in Coordination Games

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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. 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.

Data, as supplemental material, are available at http://dx.doi.org/10.1287/mnsc.2015.2269.

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 does not get finished until the last person completes his section, and a meeting cannot 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 might have an incentive to help their less able colleagues.[2] Help between workers has received little attention

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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 et al. 2009) and communication (Blume and Ortmann 2007, Brandts and Cooper 2007).

[2] Hamilton et al. (2003, 2012) 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 this 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.

from researchers in economics and management.[3] To the best of our knowledge, there exist no previous experimental papers on the topic of help.

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 the interplay between the effects of material incentives, beliefs, and nonpecuniary motivations. Laboratory experiments are well suited for studying settings where such factors interact.[4] The advantages of laboratory experiments for studying help include 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 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. Although 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 "overoptimism" 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 to explain 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. It is critical to note that 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 et al. [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 coworkers 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

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[3] See Drago and Garvey (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.

[4] For examples, see Zwick and Chen (1999), Brandts and Charness (2003), Weber and Camerer (2003), and Harbring and Irlenbusch (2011).

[5] The corporate turnaround game was introduced by Brandts and Cooper (2006). See also Hamman et al. (2007). More broadly, there exists an extensive literature on coordination in weak-link games. Camerer (2003) surveys the early literature. Prominent recent papers include Chaudhuri et al. (2006), Weber (2006), Blume and Ortmann (2007), and Kogan et al. (2011).

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 downward 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 provides an explanation for why high-ability types reduce help too rapidly in the Endogenous Help treatment, and, by extension, captures the main treatment effects observed in Experiment 1. This is a simplified version of the sophisticated experience-weighted attraction (EWA) model of Camerer et al. (2002), combining the spirit of level-k reasoning with a learning model. Learning models are inherently dynamic and hence well suited to studying the dynamic phenomena observed in our data.[6] Including sophisticated learners in the model allows for individuals who anticipate learning and optimization by others. Without this, it becomes difficult to explain why help is used by high-ability types, let alone why it is switched frequently.

Subjects are assumed to be one of two types, unsophisticated or sophisticated learners. Note that a subject being of high (low) ability does not imply that he or she is a sophisticated (unsophisticated) learner, as the former is randomly and exogenously assigned by the experimenters, whereas the latter is a behavioral characteristic of the individual. As will be seen, the case of greatest interest occurs when sophisticated learners are assigned to the high-ability role, as sophistication affects their use of help. Unsophisticated learners follow a simple rule closely akin to Cournot learning. Sophisticated learners noisily optimize versus unsophisticated learners and are forward looking. Sophisticated learners anticipate the effect of changing incentives on others' behavior and understand the benefits of strategic teaching.[7] 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 affects the experiences on which their learning is based. This pushes the learning dynamic toward equilibria with coordination at higher levels of effort. Two additional features were added to the model based on specific features of our data: (1) *overoptimism*, where sophisticated learners overestimate their ability to affect the beliefs of unsophisticated types, and (2) *reciprocity*, where low-ability workers reward kindness (increased help) by choosing higher effort levels and punish unkind behavior (decreased help) by moving to lower effort levels.

To generate predictions from the model, we fit its parameters using data from the three treatments we are trying to track: No Help, Endogenous Help, and Forced Commitment. The estimation is done via the simulated method of moments, minimizing the squared difference between the observed and simulated minimum effort averaging across periods and treatments. The resulting parameters give the best fit averaging across treatments, but it does not follow that the model tracks differences between treatments especially well, and it is easy to generate examples where models fit to the data make inaccurate predictions about differences between treatments. Indeed, if we fit a version of the learning model with overoptimism and reciprocity removed and then simulate data for all three treatments using the estimated parameters, the constrained model fails to predict that forced commitment increases minimum effort relative to no help and endogenous help. Performing

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[6] Crawford and Broseta (1998) provide a notable example of using a learning model to track data from coordination game experiments.

[7] Strategic teaching refers to attempts to alter others' future choices by manipulating their learning processes. For experimental evidence of strategic teaching, see Terracol and Vaksmann (2009), Hyndman et al. (2009), Fehr et al. (2012), and Hyndman et al. (2012).

the same fitting and simulation exercise with the full unconstrained model (i.e., including overoptimism and reciprocity), the simulations successfully track the differences between these three treatments. The estimated parameter for overoptimism is significant and positive, but, surprisingly, the estimated reciprocity parameter is tiny and not significant. Overoptimism helps the model track the data because it increases the use of help and, more importantly, leads to premature reductions of help as observed in the data. A high-ability type who is sophisticated and overoptimistic 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 2016), but adding a simple, natural version of reciprocity to our model harms its ability to track the data. In our model, sophisticated learners believe the other subjects are unsophisticated learners who noisily optimize subject to beliefs. If reciprocity is added to the model, the objective function of low-ability types changes. A high-ability type who is sophisticated anticipates that reciprocity affects the choices of low-ability types, expecting a more positive effect when help is increased and a more negative effect when help is reduced. Similar to overoptimism, adding reciprocity increases usage of help, but unlike overoptimism, reciprocity makes reducing help less attractive. This limits the model's ability to capture the overly rapid reductions of help that play such an important role in our data.

To recapitulate, we learn three important things from the structural model: (1) sophisticated learners must be included to generate use of help, (2) adding overoptimism allows the model to track the differences between treatments by causing high-ability types to abandon help too quickly, and (3) adding reciprocity does not help the model track the data because this feature discourages high-ability types from abandoning help too quickly.

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, whereas 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. The results of Experiment 2 reinforce our main conclusion: 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 versus 260 experimental currency units (ECUs)/round).[8] This parallels the negative effect resulting from 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 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 depending on an ex ante profit sharing decision made by the manager. In the experiments reported below, the experimenter plays the role of manager, whereas 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

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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.

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 30 consecutive rounds, broken into three 10-round blocks. Each block starts with the announcement of a common bonus rate (B) for the 10 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 10-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 ith employee. We restrict an employee's effort to be in 10-hour increments: $E_i \in \{0, 10, 20, 30, 40\}$. Intuitively, employees spend 40 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 ith employee. All payoffs are denominated in ECUs. These were converted to monetary payoffs at a rate of one euro equal to 500 ECUs:

$$\text{Employee } i: \ \pi_e^i = 200 - C_i E_i + \left(B \times \min_{j \in \{1, 2, 3, 4\}} (E_j) \right).$$

In all treatments, the average cost of effort equals 7 (i.e., $1/4(C_1 + C_2 + C_3 + C_4) = 7$). Employee 1 is a high-ability type with a low initial effort cost, $C_1 = 1$, whereas 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 §3, the final effort costs will differ from these as a function of how much help is provided.

Table 1   **Employee *i*'s Payoff Tables for $B = 8$**

Effort by employee *i*	Minimum effort by other employees				
	0	10	20	30	40
			$C_i = 1$		
0	200	200	200	200	200
10	190	270	270	270	270
20	180	260	340	340	340
30	170	250	330	410	410
40	160	240	320	400	480
			$C_i = 9$		
0	200	200	200	200	200
10	110	190	190	190	190
20	20	100	180	180	180
30	−70	10	90	170	170
40	−160	−80	0	80	160

In all treatments, the first 10 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 10 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 20 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 upward from the

Table 2   **Employee *i*'s Payoff Tables for $B = 14$**

Effort by employee *i*	Minimum effort by other employees				
	0	10	20	30	40
			$C_i = 1$		
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
			$C_i = 9$		
0	200	200	200	200	200
10	110	250	250	250	250
20	20	160	300	300	300
30	−70	70	210	350	350
40	−160	−20	120	260	400

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 trade-off 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 have natural interpretations 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 is doing occasionally to check on her colleague. Perhaps 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 unit, the effort cost of these three workers decreases from 9 to 8, whereas the effort cost of the high-ability worker increases from 1 to $1 + (3 \times 1) = 4$. To simplify the experiment, low-ability types are not allowed to help others. 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.

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 10 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.

Table 3   List of Treatments in Experiment 1

Treatment name	No Help	Endogenous Help	Symmetric Costs	Forced Commitment
Player 1 cost block 1	1	1	1	1
Player 1 cost blocks 2 and 3	1	$1 + 3H$ $H \in \{1, 2, 3, 4\}$	7	$1 + 3H$ (H fixed for block) $H \in \{1, 2, 3, 4\}$
Players 2–4 cost block 1	9	9	9	9
Players 2–4 cost blocks 2 and 3	9	$9 - H$ $H \in \{1, 2, 3, 4\}$	7	$9 - H$ (H fixed for block)
Number of firms (number of sessions)	20 (2)	39 (5)	20 (2)	20 (2)

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 coworker's effort cost by 1 and increasing own effort cost by 3, leading to a cost distribution of 4, 8, 8, 8; or

c. ($H = 2$) reducing each of the three coworker'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 10-round blocks, a fact that was common knowledge among employees. In this treatment there is effectively a commitment to $H = 2$ for the 10-round block.

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 the differences between the No Help and Endogenous Help treatments was 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 the 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 with $H = 0$, 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 stressed 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

Table 4   Employee Payoff Tables with $B = 14$ and $C_i = 7$ for All Employees

Effort by employee i	Minimum effort by other employees				
	0	10	20	30	40
0	200	200	200	200	200
10	130	270	270	270	270
20	60	200	340	340	340
30	−10	130	270	410	410
40	−80	60	200	360	480

quiz about the payoffs and the rules of the experiment. The instructions for the Endogenous Help treatment are shown in Online Appendix A (available as supplemental material at http://dx.doi.org/10.1287/mnsc.2015.2269).

At the beginning of each 10-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 to Tables 1 and 2, 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.[9]

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 €5 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 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 Table B.1 of Online Appendix B provides formal statistical backing for the preceding observations. The ordered probit regressions reported in Online Appendix B correct for clustering at the group level and include controls for behavior in the initial phase, rounds 1–10. The regression 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 the Symmetric Costs treatment somewhat improves matters, the difference between this treatment and the No Help treatment 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 reject 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 they are 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

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[9] Given the symmetry of help, the absence of identifying information seemed to us to be the simplest choice.

[10] Running ordinary least squares regressions with high-ability-type profits as the dependent variable and using equivalent specifications to those described in Online Appendix B, the difference in

Figure 1 (Color online) Minimum Effort
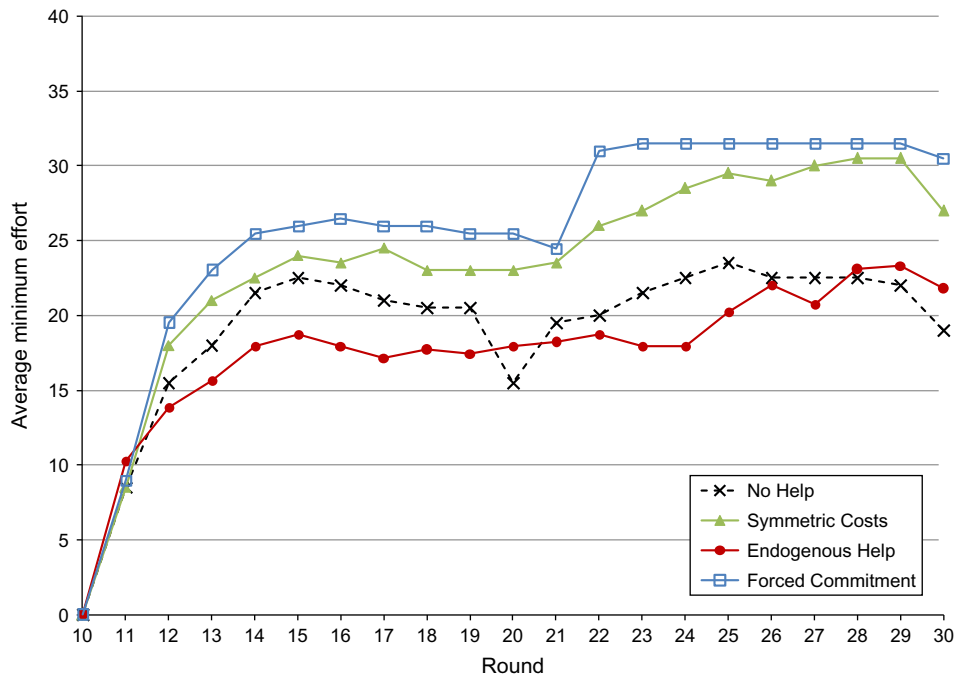
Endogenous Help and No Help treatments, averaging 278 and 264 ECUs, respectively, across rounds 11–30. Both of these figures are substantially lower than the average payoff for the Symmetric Costs treatment across this time frame, 348 ECUs.[11] It is not a shock that endogenous help makes high-ability 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 do 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 that 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 the Endogenous Help treatment. 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. 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.

Frequent changes to the level of help imply both frequent increases and frequent decreases. Figure 3 illustrates why the decreases are particularly harmful. It 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.[12] Data are taken from rounds 12–30. Round 11 is excluded

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high-ability-type payoffs between the No Help and the Endogenous Help (Symmetric Costs) treatments 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.

[12] An observation here is the minimum effort by the three low-ability types in a firm for a single round.

Figure 2 (Color online) Frequency of Changing Help, Minimum Effort, and High-Ability-Type Profits
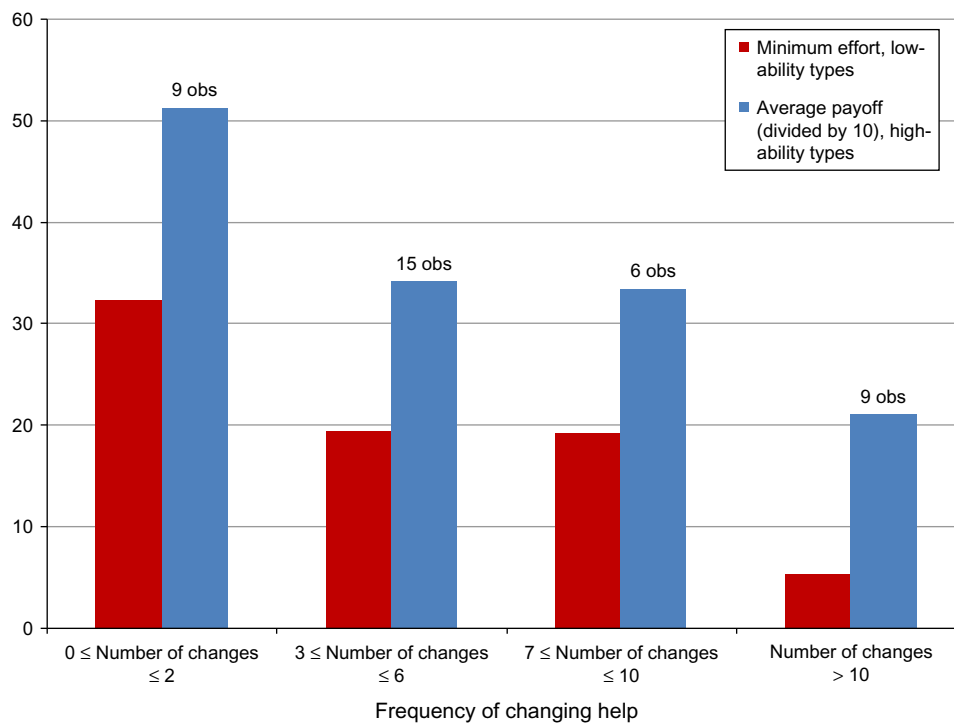
since the effect of help is confounded with the bonus rate increase. Changes in the amount of help unambiguously affect the minimum effort of the three low-ability types. When the lagged minimum effort of the low-ability types is 0, an increase is the only possible change. Such improvement mainly occurs 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 that successfully coordinate do so gradually, these cases are critical in determining a firm's success. Increasing help or holding it constant only has a moderately positive effect on minimum effort levels for low-ability types, but decreasing help has a strong negative effect on their minimum effort levels.[13]

Ordered probit regressions (see Table B.2 in Online Appendix B) provide formal evidence that the response of low-ability types' minimum effort to changes in help is asymmetric. These regressions include controls for the lagged minimum effort of low-ability types, time effects, and individual effects. Summarizing the results, either increasing or decreasing help leads to statistically significant changes in the

minimum effort of 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.

Given the large negative consequences of decreasing help, it is puzzling that high-ability types frequently change the level of help. Two features of the data suggest an explanation for this behavior. First, decreases in help primarily occur when lagged minimum effort is high.[14] Just as things start going well, high-ability types tend to throw a wrench in the works by decreasing help. This is consistent with premature attempts at profit taking by high-ability types. We conjecture that high-ability types are too optimistic about having gotten the firm out of its performance trap and reduce the help they provide, failing to anticipate a drop in the effort of others. A second feature of our data supports 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). When 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.[15] This tendency by high-ability types to couple

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[13] The response of individual effort levels to changes in help are also asymmetric but less so than minimum effort of the low-ability types. The minimum function accentuates the asymmetry.

[14] A decrease of help is 70% more likely than an increase when the lagged minimum effort of low-ability types is strictly positive.

[15] There are 23 increases and 5 decreases out of 69 total observations. If we limit the sample to cases where the lagged effort was

Figure 3   (Color online) Effect of Changing Help on Low-Ability-Type Minimum Effort (Rounds 12–30)
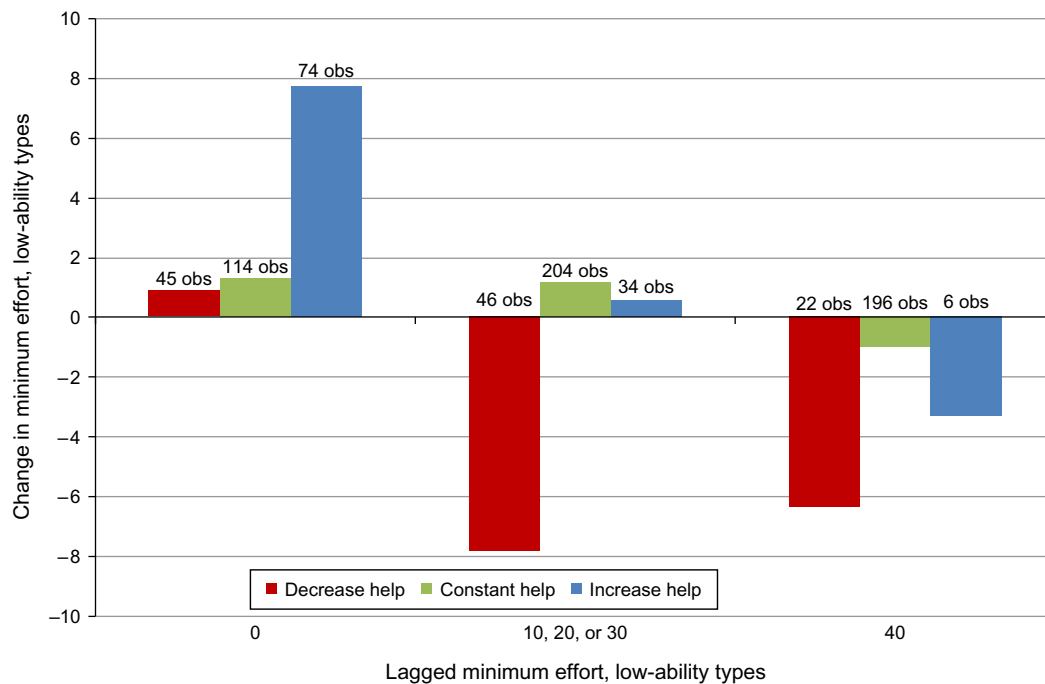
decreases in help with increases in their own effort only makes sense if the low-ability workers are not expected to react to the decrease in help by cutting their effort.

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.[16] In this

treatment, the high-ability (low-cost) type 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 10-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.[17]

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neither 0 nor 40, so that changes in both directions are possible, these figures become 14 increases and 3 decreases out of 27 total observations.

[16] 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 10 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 as a result of 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.

[17] When looking at the data from the first three treatments of Experiment 1, we noticed that groups that 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

HYPOTHESIS 2. *Minimum effort will be higher for the Forced Commitment treatment than for either the No Help or Endogenous Help treatment.*

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 treatment, 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 versus 350 ECUs for high-ability types and 348 versus 278 ECUs for low-ability types. Over the final 10 rounds, average payoffs for both types are (roughly) as high in the Forced Commitment treatment as in the best of the other three treatments.[18]

The regression analysis described in Table B.1 of Online Appendix B 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 Forced 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, the Forced Commitment treatment makes low-ability types better off without harming the high-ability types. The data support 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 versus 1.21) but not dramatically so.[19] As in the Endogenous Help treatment, high-ability types in the Forced Commitment treatment often cut help for successfully coordinated firms—of 12 firms coordinated at 40 in round 20, 4 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 versus 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 (from 5.2 to 25.6). With forced commitment, changes in help push effort up 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 cutting help, a conjecture formally examined by the model contained in §6.

6. A Structural Model of Behavior in Experiment 1

We now introduce a structural model designed to explore the causes of the two key observations from Experiment 1: (1) forced commitment leads to an increase in minimum effort relative to no help and endogenous help, and (2) high-ability types in the Endogenous Help treatment cut help prematurely, undermining the positive effects of having provided help. We develop a model that reproduces these features. In §5 we conjectured that overoptimism by

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effective than the symmetric help allowed in the Endogenous Help treatment. 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. Details are available from the authors.

[18] 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, respectively. Analogous figures for low-ability types are 288 ECUs, 383 ECUs, 302 ECUs, and 377 ECUs.

[19] Running a t-test on the average help provided low-ability types, the difference is not statistically significant at even the 10% level (59 observations; $t = 0.98$, $p = 0.33$).

high-ability types plays an important role in generating these regularities by encouraging high-ability types to abandon help prematurely. Going beyond intuition, the fitting exercise directly tests whether allowing for overoptimism significantly improves the model's fit to the data and improves its ability to track differences between the treatments. Reciprocity could also play a role in driving the dynamics, a proposition tested through the fitting exercise.

6.1. Model Specification

Our basic model is a simplified version of the sophisticated EWA model of Camerer et al. (2002). The technical details are given in Online Appendix C. 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 α. 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, whereas the individual's 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 such as 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.[20] Modeling Cournot learning by others does not require this information, but models such as 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 do not possess.

There are two types of unsophisticated learners that vary only in their initial beliefs about others' behavior. Optimists initially believe that all other players will choose 40, the highest possible effort level, whereas pessimists initially believe that all other players will choose 0.[21] The initial beliefs of an unsophisticated

type are randomly drawn, with parameter θ 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

$$q_{it}(m) = \omega(t)\eta_{it}(m) + (1 - \omega(t))q_{u1}(m)$$

$$\text{for } u \in \{\text{optimist, pessimist}\} \text{ and } \forall m. \quad (1)$$

Specifically, an unsophisticated player's beliefs $q_{it}(m)$ 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 γ is a parameter fit from the data, $\omega(1) = 0$, and $\omega(2) = \bar{\omega}$ ($\bar{\omega}$ is also a parameter fit from the data). The function $\eta_{it}(m)$ 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 $q_{u1}(m)$ 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 ρ from $\omega(10)$, which puts less weight on experience from round 10 and more weight on initial beliefs:

$$\omega(t) = \omega(t-1) + \gamma \quad \text{if } t \geq 3. \quad (2)$$

Based on these beliefs, expected payoffs can be generated for each of the five available effort levels. These are transformed into "attractions" by adding extra weight to the effort level that was chosen in the previous period, where the extra weight is given by a parameter δ multiplied by the number of times the same choice has been repeated. Putting extra weight on repeated choices allows the model to capture the fairly obvious hysteresis in the data. Earlier papers have found that incorporating hysteresis into a learning model significantly improved the fit (i.e., Cooper and Stockman 2002, Camerer et al. 2002, Wilcox 2006).

The choice of an unsophisticated type is generated from beliefs using a logit decision rule, with the parameter λ determining the level of noise. In the

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

[21] Adding these types helps the model capture the bimodal distribution of behavior 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.

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, λ^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 quantal response equilibrium 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 our model does a good job of tracking the data and gives useful insights into the underlying processes, we opt for the simpler model.

Sophisticated types have all the information necessary to calculate beliefs and attractions for the other three members of their group (assuming that 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 to 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.

Based on their beliefs about current and future actions by the other three players, sophisticated types calculate expected current and future payoffs as a function of their current actions (effort and, if a high-ability type, help). Choices are reached via a logit decision rule where attractions are given by the sum of expected payoffs for the current and upcoming periods.[23]

Based on specific features of our data described above, we added two features to the basic model.

1. *Overoptimism:* The basic model assumes sophisticated types have a correctly specified model of how unsophisticated types form beliefs and then make choices. We depart from this assumption by allowing for overoptimism by sophisticated 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 for the possibility that sophisticated types overestimate the weight that unsophisticated players give to observed past behavior versus their initial beliefs. Specifically, sophisticated types calculating the beliefs of unsophisticated types replace $\omega(t)$ with $\omega(t) + \mu$, where μ is an overoptimism parameter fit from the data.

2. *Reciprocity:* Reciprocity is an important feature of many environments, and it seems plausible that it could play a role here as well. When a high-ability type increases the level of help, she (weakly) helps the low-ability types and harms herself. Likewise, decreasing help (weakly) harms the low-ability types and helps the high-ability type. The preceding implies that increasing help can be seen as a kind action by the high-ability type, whereas decreasing help can be seen as unkind. If the preferences of low-ability types incorporate reciprocity, they should want to reward the high-ability types following an increase in help and punish them after a decrease. This can be done within a weak-link game via changes in their effort levels since, in a weak-link game with stochastic choice, the expected payoffs of the other players are a strictly increasing function of my own effort. From a dynamic point of view, reciprocity can affect the model's predictions because it accentuates responses to changing levels of help. We therefore wanted to test for the presence of reciprocity and determine whether the addition of reciprocity to the model would improve its ability to capture the main features of Experiment 1.

To incorporate reciprocity into our model, we allow the attractions for a low-ability type, as a function of the low-ability type's effort, to include weights on the expected payoff of the high-ability type. Positive weight is put on the high-ability type's expected payoff if he has been kind by increasing the amount of help provided. The amount of weight put on the high-ability type's expected payoff in these circumstances is given by the parameter κ, which is fit from the data.[24] This is a simple and intuitive way of adding reciprocity to the model, similar to the way reciprocity

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[23] To simplify the model, equal weight is put on current and future expected payoffs, and the noise parameter is assumed to be the same for sophisticated and unsophisticated types.

[24] 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.

is added to the Charness and Rabin (2002) model, and it 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. Reciprocity is applied to attractions for both unsophisticated and sophisticated low-ability types.

6.2. Model Results

The full 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 Online Appendix C for details on how the model was fit to the data, but fitting the model roughly involves the following. Starting with a given set of parameters, we simulate the model for 1,000 groups in all three treatments. For each period in each treatment, we calculate the difference between the observed average minimum effort and the simulated average minimum effort. Squaring these differences and then taking the sum across periods and treatments gives us our measure of fit. The parameters are adjusted to minimize the sum of squared differences. In other words, we are picking the parameters that most closely track the observed minimum effort averaging across periods and treatments. The estimated parameters and standard errors (in parentheses) are presented in Table 5. All of the parameters are significantly different from zero, except for γ, the time trend for the weight unsophisticated types' beliefs put on their most recent experience, and, surprisingly, the reciprocity parameter κ. 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 overoptimism 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.

Using the parameters that best fit the data, we look at simulated data for each of the three treatments. Figure 4 compares the average minimum efforts in the experimental (top left panel) and simulated (top right panel) data. The simulated data reproduces the two main regularities of the experimental data: forced commitment leads to an increase in minimum effort relative to no help, but endogenous help does not.

It is not true that *any* learning model fit to the data would reproduce the main features of the data. A model's goodness of fit is being measured by the squared sum of differences between simulated and observed minimum efforts *averaging across periods and treatments*. A model that fits well on average can still

**Table 5**   **Parameter Estimates of the Structural Model**

Parameter	Explanation	Estimate
μ	Overoptimism	0.046
		(0.004)
κ	Reciprocity	0.012
		(0.045)
α	Fraction of sophisticated players	0.657
		(0.057)
θ	Fraction of optimists	0.089
		(0.005)
$\bar{\omega}$	Initial belief weight	0.202
		(0.008)
δ	Hysteresis	0.303
		(0.023)
γ	Belief weight slope term	$0.178 \times 10-4$
		$(1.175 \times 10-4)$
ρ	Reset of belief weight	0.086
		(0.006)
λ	Logit function parameter	0.072
		(0.002)
λ^H	Logit parameter for help decisions	0.410
		(0.137)
—	Sum of squared errors	523.861

fail to track the data from any one treatment or differences across treatments. This point is illustrated by three alternative models to the data. The first only includes unsophisticated learners. Mathematically, we impose a constraint that $\alpha = 0$, where α is the fraction of sophisticated types. The second is the basic model with unsophisticated and sophisticated learners but no overoptimism or reciprocity. Here, the constraints on the full model are $\mu = 0$ and $\kappa = 0$, where μ and κ are the parameters governing the strength of overoptimism and reciprocity, respectively. The third adds reciprocity but not overoptimism to the main model. The sole constraint imposed in this case is $\mu = 0$. The middle left panel of Figure 4 shows simulation results for the model with only unsophisticated learners, and the middle right panel shows simulations for the basic model. In both cases, even though the models' parameters are chosen to best fit the data, there is no discernable difference between the three treatments.[25] The model with reciprocity but no overoptimism (lower left panel) does only slightly better, with only tiny differences between the treatments.

Not only does reciprocity receive little weight in the fitted version of the full model, but artificially adding reciprocity to the model harms its ability to track differences between treatments. To show this, we fit a model constrained to have a higher level of reciprocity ($\kappa \geq 1$) than the low fitted value ($\kappa = 0.012$). Simulated data for this model are shown in the

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[25] It may not appear that there are three lines in these two panels, but this is because they are on top of each other.

Figure 4   **(Color online) Comparison of Experimental and Simulated Data**
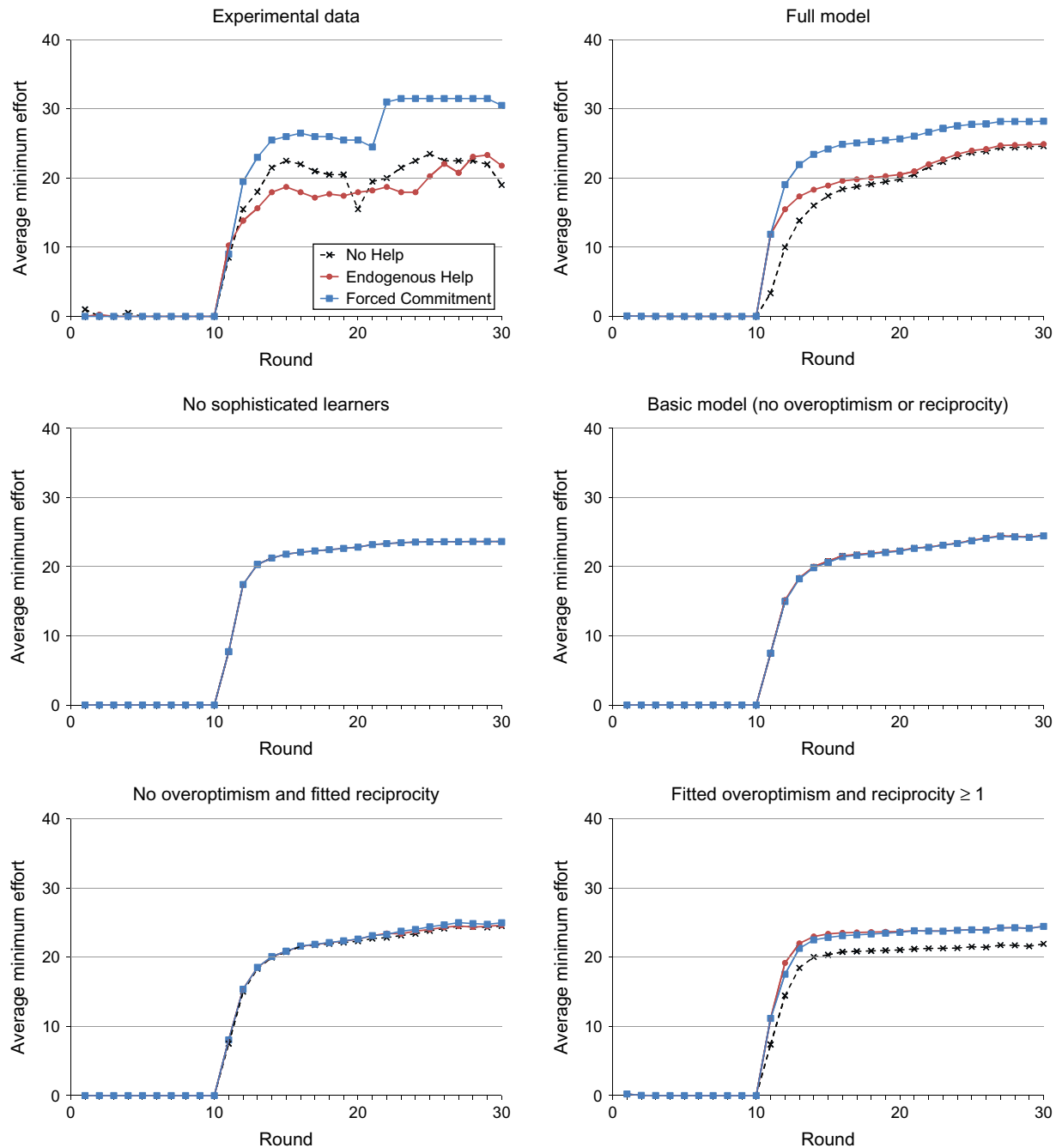
lower right panel of Figure 4. It correctly has average minimum effort higher in forced commitment than no help, but it has equally high average minimum effort for endogenous commitment. In the experimental data, the average minimum effort for endogenous commitment is significantly lower than in forced commitment.

To understand why sophistication and overoptimism receive significant weight in the fitted version of the full model but reciprocity does not, consider how changing the learning model affects use of help.

Unsophisticated learners treat their group members as a fixed statistical distribution, failing to recognize that changes in incentives will change their behavior. Since high-ability types only benefit from help if it affects the behavior of low-ability types, unsophisticated learners do not anticipate any benefits from help. Virtually no help is provided in the fitted model with only unsophisticated types—only 0.2% of the high-ability types ever use help in simulations of the Endogenous Help treatment. Given that help does not get used, it follows that changing how help can be

used will not matter. This leads to the lack of differences between treatments shown in the middle left panel of Figure 4.

In the basic model (i.e., no reciprocity or overoptimism), help still gets almost no use. In the simulations, only 0.5% of the high-ability types ever use help in the Endogenous Help treatment. Once again, it follows that changing how help can be used will be irrelevant. Adding overoptimism gets two important features. High-ability types think low-ability types will respond more to the provision of help than they actually do, making them more willing to use help. The percentage of high-ability types who use help at least once in simulations of the Endogenous Help treatment rises to 65% in the full model. But because they overestimate how much they have affected low-ability types' beliefs after providing help, overoptimistic high-ability types are too willing to abandon help. Switches in help are almost evenly split between increases and decreases (high-ability types average 0.81 increases and 0.75 decreases) as high-ability types who adopt help tend to rapidly abandon it, undercutting its positive effect. With forced commitment, the high-ability types can no longer abandon help, allowing minimum effort to converge to higher levels in simulation of the full model. The mechanism underlying the differences between treatments in simulations of the full model is similar to the mechanism in the experimental data.

Use of help also explains the little role reciprocity plays in the ability of the model to track the experimental data. Like overoptimism, reciprocity makes help more attractive since the positive response to increasing help is larger. In the model with artificially high reciprocity ($\kappa \geq 1$), the percentage of high-ability types who use help at least once in simulations of the Endogenous Help treatment is still relatively high at 37.5%. However, reciprocity also accentuates the negative response of low-ability types to a decrease in help. Since sophisticated learners model the decision process of other players and therefore anticipate this effect, reciprocity makes decreasing help less attractive. In the model with artificially high reciprocity, there are far fewer decreases than increases (an average of 1.34 increases versus 0.52 decreases). Reciprocity gets little weight in the full model because it undermines a critical feature, premature decreases of help. It is worth noting that other modifications to the model that accentuate the negative response to decreased help, such as adding inequality aversion to the utility function, would likewise fail to improve the model's performance.

A pair of observations, one about the data and one about the simulations, makes it less surprising that the full model puts little weight on reciprocity. The strong negative reaction to reductions in help

in the Endogenous Help treatment was an important piece of evidence for reciprocity, but this reaction is not present in the Forced Commitment treatment. In groups where help is reduced prior to round 21, the mean (and median) change in effort by low-ability types between rounds 20 and 21 is 0. Given that reducing help for the final 10 periods is an irreversible action that harms the low-ability types, reciprocity should be highly relevant in this particular case. The data from the Forced Commitment treatment are more consistent with groups having converged to equilibrium and hence not being destabilized by reduced help than reciprocity.

In the experimental data from the Endogenous Help treatment, we documented an asymmetric response of minimum effort by the low-ability types to changes in the level of help (see Figure 3 and accompanying text). Generating asymmetric responses to changes of help does not require reciprocity. In simulations of the full model, where reciprocity is largely absent in the fitted parameters, the minimum effort of the three low-ability types increases by an average of 4.54 in response to an increase in the help level and falls by an average of 10.00 in response to a decrease in the help level.

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.[26] Indeed, in future work we plan to explore ways the model can be improved as well as experimental tests of the learning model.

To summarize, we learn three important things from fitting the learning model. (1) A relatively simple structural model is able to track the most important features of the data from Experiment 1: adding help does not increase minimum effort when high-ability types are free to adjust help in the Endogenous Help treatment but does yield an increase when they are forced to commit in the Forced Commitment treatment. (2) It is not true that any learning model fit to the data would track these features. Models without sophisticated learners or with sophisticated learners but lacking overoptimism cannot reproduce the relative effects of Endogenous Help and Forced Commitment treatments.[27] (3) Adding reciprocity to the model, either alone or coupled with overoptimism, does not help the model's ability to explain the main

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[26] Alternatives we are exploring include making sophisticated types better at predicting the future, using more data from past periods, and changing the specification to capture hysteresis.

[27] The importance of sophisticated learners adds to existing evidence (notably Camerer et al. 2002) of the importance of sophisticated learners in tracking experimental data.

treatment effects. This stems from the interaction between reciprocity and sophistication; reciprocity makes high-ability types who are sophisticated learners less willing to help since they correctly anticipate a strong negative response.

CONCLUSION 4. *A model containing unsophisticated learners and sophisticated learners with overoptimism captures key regularities of the experimental data. Overoptimism is necessary to capture the main features of the data, but adding reciprocity to the model is not necessary.*

7. Experiment 2: Direct Help

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. The new treatments parallel the Endogenous Help and Endogenous Help with Forced Commitment treatments. A low bonus rate ($B = 8$) is used in rounds 1–10 to trap groups at low effort levels and then raised to $B = 14$ for rounds 11–30. High-ability types can help low-ability types in rounds 11–30 by choosing 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 ECUs/hour) 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 can work more hours than low-ability types.[28] 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.

Table 6 shows the payoff tables for high- and low-ability types if one unit (10 hours) of help is provided.[29] In the payoff table for high-ability types (left panel), the minimum effort level by *other* employees goes from 10 to 50 (instead of 0 to 40), since the high-ability type has provided 10 hours of work to each of the low-ability types. Similarly, in the payoff table for low-ability types (right panel) the effective hours provided by a worker go from 10 to 50 reflecting the

Table 6 Payoff Tables: High-Ability Type Provides One Unit (10 Hours) of Help

	$C_i = 1$				
	Minimum effective effort by other employees				
Effort by employee 1 at own job	10	20	30	40	50
0	−70	−70	−70	−70	−70
10	60	60	60	60	60
20	50	190	190	190	190
30	40	180	320	320	320
40	30	170	310	450	450

	$C_i = 9$				
	Minimum effective effort by other employees on own job				
Effort by employee 2, 3, or 4 at own job	0	10	20	30	40
10	200	340	340	340	340
20	110	250	390	390	390
30	20	160	300	440	440
40	−70	70	210	350	490
50	−160	−20	120	260	400

10 hours of help. 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.

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 treatments, parallel 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 overoptimistic high-ability (low-effort-cost) types from decreasing help before the equilibration process has finished. Note that the No Help treatment from Experiment 1 continues to serve as the baseline.

HYPOTHESIS 3. *In the long run, average minimum effort will be higher in Direct Help than in the No Help treatment and in Direct Help with Forced Commitment than in Direct Help treatment.*

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

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[28] 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.

Figure 5   (Color online) Minimum Effort in Experiment 2
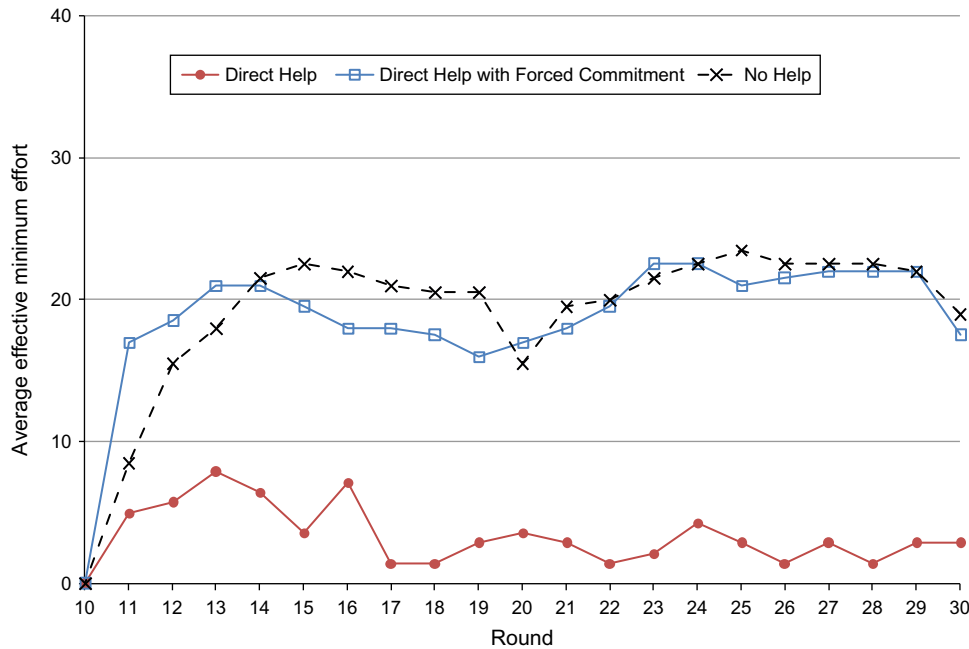

Figure 5 shows the average minimum effort for the two direct help treatments as well as the No Help treatment from Experiment 1. Note that this is *effective* minimum effort, which includes any help provided by the high-ability type as part of the effort for each low-ability type. Compared with the No 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 improves performance as average minimum effort in the Direct Help with Forced Commitment treatment rapidly stabilizes in the neighborhood of 20. Adding forced commitment to direct help overcomes the miserable performance without commitment but does not lead to an overall improvement.

Regression analysis described in Online Appendix B confirms the obvious. Compared with the No Help treatment, the Direct Help treatment leads to a statistically significant decrease in effective minimum effort. The Direct Help with Forced Commitment treatment has no significant effect relative to the No Help treatment but significantly improves effective minimum effort relative to the Direct Help treatment.

The extraordinarily low minimum effort levels in direct help 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. The problem is that the lack of commitment by high-ability types is extreme. 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. For every single case where help is decreased, the minimum effort immediately returns to 0. The inability of high-ability types in the Direct Help treatment to stick with 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 the Direct Help with Commitment treatment. 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 12 groups is 23.8 compared with 7.5 when no help is provided. Help is eliminated in 10 of the 12 groups for rounds 21–30. The response is negative but small. Minimum effort falls for 6 of the 10 groups in round 21, but only 2 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 10 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 5. *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.

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 attributed to overoptimism, the belief by sophisticated types that learning by unsophisticated types is faster 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 rematching workers may also have 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. 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 would not 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 on 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 examples where a self-defeating tendency to declare victory and cease costly attempts at leadership undercuts the benefits of leadership. If our basic insights generalize, a good strategy for individuals to follow in attempting to establish a new socially desirable norm is to pick an approach and stick with it. If effective leadership shares a common element of strategic teaching, even the best of approaches will fail if used inconsistently.

Supplemental Material

Acknowledgments

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