



Endogenous incentive contracts and efficient coordination

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ABSTRACT

We examine the effects of endogenous assignment to incentive contracts on worker productivity. Assignment to high performance pay via a market mechanism is roughly twice as effective as imposing the same contract exogenously. This positive effect is largely offset by a negative effect for workers that endogenously choose low performance pay. We decompose the positive effect of endogenous assignment to high performance pay into effects due to selection and strategic anticipation, and find that selection has a greater effect than strategic anticipation. We use a Reverse Sort treatment to show that the effect of selection is sufficiently strong to overcome the direct effect of lower performance pay, yielding coordination at high effort levels in spite of low incentives.

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1. Introduction

The performance of many work groups is constrained by a single weak link. A paper cannot be completed until all co-authors finish their assigned sections, a meeting cannot start until all critical personnel are present, and an assembly line moves no faster than its slowest worker. If pay is based on group performance, as must be the case when only output rather than individual effort is observed, the strong complementarities generated by a weak-link technology can cause *productivity traps* where pessimistic beliefs create a self-fulfilling prophecy: nobody works hard in the (correct) expectation that any effort will be wasted given that no individual can unilaterally improve productivity. Escaping such a trap is difficult since coordinated change by *all* members of the group is needed to increase productivity.

A number of mechanisms have been proposed to achieve the coordinated increase in effort needed to escape a productivity trap (defined as coordination at low effort levels). A simple option that has consistently proven effective is increasing incentives to coordinate at high rather than low effort. This has been shown to help groups escape productivity traps in lab studies of the weak-link game (Brandts and Cooper, 2006; Hamman et al., 2007; Brandts et al., 2014) as well as in field settings (Knez and Simester, 2001). The preceding lab studies feature a common element: assignment of individuals to incentive contracts is random and exogenous. This was a natural first step for the literature, but in labor markets, where

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workers frequently choose between jobs with different incentive contracts, assignment to incentive contracts is often endogenous. The primary purpose of the experiments presented below is to explore the effect of having the assignment of individuals to incentive contracts take place endogenously through a market mechanism.

All of our experiments feature an initial phase in which subjects repeatedly play a weak-link game under an incentive contract featuring high fixed pay and low incentives to coordinate at high effort levels (“low performance pay”). This reliably induces a productivity trap. In the second phase of the experiment, half of the subjects continue with the initial contract and half are assigned to a new incentive contract with lower fixed pay and larger incentives to coordinate at high effort levels (“high performance pay”). Treatments vary by whether the assignment of subjects to incentive contracts for the second phase is random or endogenous through a market mechanism. The positive effect of introducing high performance pay almost doubles with endogenous assignment. However, a matching negative effect from endogenous assignment to low performance pay largely offsets the positive effect of endogenous assignment to high performance pay. The *total* effect of endogenous assignment to incentive contracts, averaging over both contracts, is virtually zero.

Beyond identifying the effects of endogenous assignment to incentive contracts, a major goal of our study is to understand why high performance pay is more effective when assigned endogenously. In work environments with the weak-link property, strategic uncertainty makes incentive contracts “fragile.” Individuals may fail to respond to high performance pay if they fear others won’t increase effort in response. Endogenous assignment to high performance pay facilitates coordination at the highest possible effort level (“efficient coordination”) by reducing strategic uncertainty through two channels, selection and strategic anticipation. “Selection” refers to the tendency of market mechanisms to assign high performance pay to individuals (“optimists”) who have inherently optimistic prior beliefs about the chance of coordination at the efficient outcome *independent of how individuals are assigned to groups*. Because long-run outcomes in coordination games are largely driven by initial beliefs (see Van Huyck et al., 1990 and 1991), systematic assignment of optimists to high performance pay increases the chance of efficient coordination. Beyond selection, participants can infer that assignment to high performance pay is *not* random based on the information available in a market mechanism. “Strategic anticipation” is the ability of an individual to (correctly) anticipate that optimists are more likely to be assigned high performance pay by a market mechanism than with random assignment.¹ Individuals with strategic anticipation understand the effects of selection and become more optimistic under high performance pay *when contract assignment is endogenous*. This increased optimism improves the odds of efficient coordination with high performance pay.

We use an innovative “Sort” treatment to measure how much of the positive effect of endogenizing assignment to high performance pay is due to selection rather than strategic anticipation. In this treatment, subjects’ characteristics and initial choices are used to predict which incentive contract they would have been assigned by the market mechanism. We then exogenously implement the predicted contract assignments to imperfectly reproduce the market’s outcome. The Sort treatment preserves the effects of selection as it inherits the market’s tendency to assign optimists to high performance pay, but eliminates the effects of strategic anticipation by depriving subjects of any information that allows them to anticipate the selection process. We find that selection plays a larger role than strategic anticipation in increasing efficient coordination with endogenous assignment to high performance pay.

The effect of selection is so strong that it can overcome the direct effect of lower incentives to coordinate at high effort levels. We demonstrate this through a “Reverse Sort” treatment that flips the contract assignments from the Sort treatment, switching the sign of the selection effect. This results in higher effort levels with low performance pay than high performance pay!

Our work contributes to two strands of the existing literature. Both lab and field studies have examined how endogenous choice of performance pay schemes (e.g. piece-rate systems) affects performance in individual tasks. These studies generally find that such schemes improve productivity and that the majority of this positive effect is due to selection of more able individuals (i.e. Lazear, 2000; Cadsby et al., 2007; Eriksson and Villeval, 2008; Dohmen and Falk, 2011; Bandiera et al., 2015). Our work has similar findings – endogenous choice of high performance pay improves productivity with selection accounting for most of the effect – but differs from the existing literature because of the critical role played by strategic uncertainty. Selection is based on individuals’ beliefs rather than their ability to perform a task. The market mechanism assigns those who are inherently optimistic about the likelihood of efficient coordination to groups with high performance pay. Group productivity in field settings generally does not just depend on skill, but also depends on being able to work together. It makes sense that selection takes place along the latter dimension as well as the former.

Our experiments also relate to the literature on buying the right to play a coordination game, notably Van Huyck et al. (1993). Van Huyck et al. study repeated play of a two-stage game where players bid for the right to play a median game. They find that winning bids converge to the payoff from the efficient equilibrium and winning subjects’ play in the median game converges to the efficient equilibrium. Van Huyck et al. attribute the latter result to forward induction, while Crawford and Broseta (1998) argue that it reflects an interaction between learning, forward induction, and an optimistic subject effect analogous to selection. Our result that endogenous assignment to high performance pay improves the likelihood of efficient coordination is obviously related, but we reach different conclusions about the source of this effect. Using the Sort treatment, we show that the effect of endogenizing contract assignment is primarily due to selection rather than strategic anticipation

¹ This is related to forward induction, as both rely on individuals understanding that past choices reveal information about others’ beliefs, but is not based on iterated removal of dominated strategies (Ben-Porath and Dekel, 1992).

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