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Group rewards and individual sanctions in environmental policy[☆]

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ABSTRACT

We examine an incentive scheme for a group of agents, where all agents are rewarded if the group meets its target. If the group does not meet its target, only the agents that meet their individual target are rewarded. This incentive scheme is applied in the UK Climate Change Agreements. There is only a difference in outcome between group and individual rewards if performance is stochastic. Group rewards lead to lower abatement than individual rewards if targets are realistic, i.e. if they have a high probability of being reached. Given the strictness of the targets, the agents prefer group rewards. The principal might want to use group rewards because they require less information, out of fairness concerns, or to combine strict targets with weak enforcement.

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1. Introduction

Consider the following incentive scheme: A group of agents takes on a group target, which is broken down into individual targets. If the group meets its target, everyone is rewarded, whether they met

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their individual targets or not. If the group does not meet its target, only the agents who met their individual targets are rewarded. This group rewards/individual sanctions (or group subsidies/individual taxes) scheme is applied in the UK Climate Change Agreements (CCAs).

The UK government imposed a Climate Change Levy on industrial energy consumers in 2001. Energy-intensive firms could get an 80% discount on the levy if they signed a CCA, promising to improve their energy efficiency. The government signed agreements with the sectoral organisations, and the sectoral targets were translated into targets per firm. Every other year the agreement is evaluated. If the sector meets the target laid down in the agreement, all firms in the sector (even those who did not meet their target) continue to receive the discount for the next two years. If the sector does not meet the target, the individual firms' emission-reduction performance is assessed. The firms that met their target continue to receive the discount. The firms that did not meet the target do not receive the discount for the next two years.

The main purpose of our paper is to compare the equilibrium abatement efforts under group and individual rewards (both combined with individual sanctions). This subject has not been addressed in the literature before. Equilibrium abatement levels are different only if there is the possibility of individual overachievement under group rewards. Then one agent can benefit from another agent's overachievement. If each agent can set her emission level deterministically, all agents will just meet their individual targets with individual as well as with group rewards.

However, it seems quite plausible to assume that an element of chance enters the translation from abatement effort to emission reduction. Firms cannot precisely predict the effect of their measures on their emissions. It depends on factors like market and economic conditions, the weather and the functioning of abatement equipment. There is some empirical evidence from BOD discharges in the US that emissions are stochastic, and that firms take this into account in their abatement decisions. [Bandyopadhyay and Horowitz \(2006\)](#) show that plants with a higher discharge variability have lower median discharges. [Shimshack and Ward \(2008\)](#) show that plants which statistically overcomply increase their overcompliance in response to an increased probability of sanctions, and the response is increasing in the randomness of the discharges. In the UK CCAs themselves there was also significant overcompliance.² This could be seen as evidence in favour of the stochastic nature of emissions.³

As we will show, group rewards lead to lower abatement efforts if targets are realistic. Thus, one might wonder why a principal would want to use group rewards. One reason may be that group achievement is easier to observe than individual emission reduction, but this does not apply to the UK CCAs, as the sectoral organisations have the data on individual firms' emission reductions and only collate these to calculate the sector's emission reduction.

There might be, however, two other possible advantages of group rewards which also apply to the UK CCAs. The first advantage is fairness. When emissions are stochastic, individual rewards can be regarded as unfair. The second advantage of group rewards is that the principal can point to a set of targets that look quite ambitious.

The paper is organized as follows. Section 2 reviews the literature. The CCAs are discussed in Section 3. Section 4 introduces the model and shows that with deterministic emission reduction, there is no difference between group and individual rewards. In Section 5 we address the difference between group and individual rewards for stochastic emissions. The concluding Section 6 discusses our results in the context of the CCAs.

2. Review of the literature

The problem of how to get each member of a team to provide his optimal (but potentially unobservable) contribution has been widely studied, starting with [Alchian and Demsetz \(1972\)](#) and [Holmstrom \(1982\)](#). [Prendergast \(1999\)](#) reviews the literature.

² This is shown as "excess emission reduction" in [Table 1](#). We discuss this issue further in Section 3.

³ We thank one of the referees for making this point.

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