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An auction mechanism for allocation of unobserved use of a common resource

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ABSTRACT:

Regulating pollution, fishing, and other uses of common resources is an important economic problem. In some cases this regulation problem is complicated by the regulators inability to observe how much each user utilizes the commons. It may for example be too costly to measure non-point pollution emissions such as pesticides and nutrients leaching from the individual farmers land. Another example is the widespread enforcement problems encountered by fisheries regulators where harvest quotas are often exceeded because of illegal landings and discard.

Regulations bases on observable behavior, such as input or capital use, is common in practice but may often be inefficient (Xepapadeas, 2011) because correlation with resource use is imperfect. To address this economist have suggested incentives based on *aggregate* common resource use that often is observable (Segerson 1988, Cabe & Herriges, 1992, Xepapadeas, 1992, Hansen, 1998, Horan et al. ,1998, Hansen, 2002, Hansen and Romstad, 2007, Hansen and Jensen ,2008,2014). The idea is that each firm pays a tax on the measured aggregate of all firms resource use. This can give efficient incentives to change behavior because the tax paid by any one resource user increases when he increase his utilization. However, all the proposed mechanisms imply a strategic interaction problem. Since firm's profits from resource use are private information the regulator does not know a priori what is the optimal aggregate resource use. Nor can firms a priori predict what aggregate

resource use will result from a given tax. This means that the optimal equilibrium cannot be implemented in the first round but requires that tax incentives and firm behavior are adjusted until equilibrium is reached^[1]. However, if firms are strategic and realize that incentives are adjusted in response to their own behavior the resulting equilibrium may not be efficient (Karp (2005), Vossler et al 2013). The problem for all the aggregate use mechanisms is that they do not give incentives for truthfully revelation of private information in a one shot game but rely on myopic behavior during a dynamic adjustment process.

A parallel strand of literature has considered truthful revelation of private information in order to achieve optimal allocation of rights to use common resources when such use *can* be observed by the regulator. Recently Montero (2008) has proposed an auction mechanism that implements truthful revelation of demand schedules for such rights in dominant strategies. This auction scheme essentially implements the tax mechanism proposed by Dasgupta, Hammond, and Maskin (1980) for such problems through policy instruments (auction and payback) that are commonly used in practice. Montero's auction mechanism relies on observability of each firm's common resource use in order for the regulator to enforce compliance with the allocated licenses. The implicit assumption is that the combination of fines and detection probability for non-compliance that is in place is sufficient to ensure that all firms comply.

This is my point of departure. In the following I suggest combining a Montero like auction mechanism for *self-reported* use of the commons with a tax on *unreported* aggregate commons use. The idea is that the tax on unreported aggregate commons use will induce compliance with the licenses allocated through the Montero auction. Compared to prior suggestions for regulating unobserved resource use this mechanism solves the strategic interaction problem. Compliance with allocated licenses by all firm is the only focal equilibrium and conditional on this truthful revelation of private information is the dominant strategy. It also solves a number of other problems plaguing prior suggestions i.e. it is coalition proof and it results in a fair allocation tax payments and it gives correct entry-exit incentives. Thus the proposed tax would seem to be a potentially attractive alternative for practical regulation of common resource use when measurement costs make enforcement difficult.

JEL Classifications:

^[1] For example a linear tax on aggregate resource use with constant marginal incentives (segerson 1988) will have to be adjusted until marginal damage at the resulting aggregate use is equal to the tax incentive. A tax equal to damage (Hansen 1998 , Horan et al. (1998)) where marginal incentives depend on aggregate resource use will require firms to adjust their behavior until their marginal costs are equal to the based tax.

Key words: