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journal homepage: [www.elsevier.com/locate/ree](http://www.elsevier.com/locate/ree)On the dual nature of weak property rights<sup>☆</sup>Louis Hotte<sup>a,\*</sup>, Randy McFerrin<sup>b</sup>, Douglas Wills<sup>c</sup><sup>a</sup> University of Ottawa, Canada<sup>b</sup> New Mexico State University, United States<sup>c</sup> University of Washington Tacoma, United States

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## ABSTRACT

In the natural-resource literature, conventional wisdom holds that weak property rights will cause a resource to be over-exploited. This is because weak property rights are typically perceived as a problem of input exclusion – or theft of un-extracted resources. We present evidence to the effect that weak property rights often take the form of contestable outputs – or output theft – and that this has an impact on resource use. We propose a model of resource use under generally weak property rights – or weak state presence – when resource users face the dual problem of input exclusion and output appropriation. We show that introducing the possibility that outputs be contested acts as an output tax, with the added twist that resource users effectively determine the tax level. This tax has a depressive effect on input use. Whether the resource is under- or over-exploited depends on the relative severity of output appropriation and input exclusion problems. Increasing enforcement measures against theft may lead to severe resource overuse. Efficiency considerations require to account not only for direct resource input use, but also for thieves' efforts and gains as well as the costs of enforcement against theft and trespass.

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## 1. Introduction

In the natural-resource economics literature, weak property rights are typically presented as the fundamental cause of resource overexploitation. The basic argument can be traced back to the pioneering work of [Gordon \(1954\)](#), who explained that in the absence of ownership rights to a fishery, all fishers enjoy a free access and this yields an equilibrium with excessive input use and low rents. This standard story has led to the general view that weak property rights cause a resource to be overexploited.

Now as [Gaudet et al. \(2002\)](#) justly point out, the convention in natural resource models has been to “assume that everything extracted under the rule of capture is marketed immediately”. Implicit with this assumption is the fact that there are no property right issues regarding the extracted resource, that is, output appropriation is not being contested. In other words, the “Gordon setting” posits a situation of *weak* property rights over unextracted resources that co-exist with the presence of *strong* property rights over extracted resources. This may have been a fair representation of the situation faced by cod fishers in Newfoundland in the 1950s. But if weak property rights are due to a weak state presence – as is often the case – this co-existence of weak and strong property rights is not realistic. Indeed, resource users are then faced with a *dual enforcement problem*: not only is input access to the resource imperfectly controlled, but some of the output produced may also be appropriated, or stolen, by others. The objective of this paper is to analyze the implications for resource use through explicit modeling of the strategic interactions of the various actors.

We begin by presenting evidence of the widespread presence of dual enforcement problems taken from existing case studies, both historical and contemporary. This evidence is used to set-up a simple two-dimensional analytical framework helpful in comparing the cases in terms of the relative importance of each enforcement problem. A theoretical model is then proposed which accounts for the strategic behavior of three types of agents: a resource manager as a leading resource user and output appropriator; trespassers as illegitimate resource users; and thieves as illegitimate output appropriators. The trespass modeling strategy is based on [Hotte \(2005\)](#). The theft part is novel and constitutes, to the best of our knowledge, a first attempt at modeling the strategic interactions between resource users and output thieves with consequent impact on input decisions.

We obtain that in the presence of “generally” weak property rights, theoretical predictions regarding resource use can be drastically different from the tragedy of the commons story. Indeed, the presence of output theft causes the resource to be under-exploited since output appropriation by others acts as a tax on resource users which discourages input efforts. An added twist is that the effective tax level is endogenously set by resource users through the anticipated reaction of thieves. As a result, when enforcement is partial for both input exclusion and output appropriation, whether the resource ends up being under- or over-exploited will depend on the relative severity of each enforcement problems.

For the particular case of a free-access resource, the presence of theft actually induces resource conservation. The flip side is that the introduction of stricter enforcement measures against theft that neglect the problem of free access to inputs may cause the resource to be overused. Comparative static experiments are performed by varying the degree of property right enforcement over both input access and output appropriation which are used to provide insight into various case studies. Finally, in line with [Coase \(1960\)](#), the model helps us understand why an equilibrium input use that corresponds to the efficient level in a world without transaction cost may not be efficient once we consider the opportunity costs of thieves’ efforts as well as those of enforcement over access exclusion and output theft.

From a theoretical perspective, our analysis builds on two major strands of the economics literature on property rights. One considers the problem of exclusive access to a resource with consequent overuse, as exemplified by the works of [Cheung \(1970\)](#), [Libecap and Wiggins \(1984\)](#), [de Meza and Gould \(1992\)](#) and [Hotte \(2005\)](#). The other considers the problem of output appropriation with consequent underuse and is inspired by both the literature on crime, such as [Becker \(1968\)](#), [Clotfelter \(1977\)](#) and [Usher \(1987\)](#), and the literature on conflict and appropriative activities, such as [Skogh and Stuart](#)

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