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How transaction costs obstruct collective action: The case of California's groundwater

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ABSTRACT

Collective action to remedy the losses of open access to common-pool resources often is late and incomplete, extending rent dissipation. Examples include persistent over-exploitation of oil fields and ocean fisheries, despite general agreement that production constraints are needed. Contracting costs encountered in assigning property rights are an explanation, but analysis of their role is limited by a lack of systematic data. We examine governance institutions in California's 445 groundwater basins using a new dataset to identify factors that influence the adoption of extraction controls. In 309 basins, institutions allow unconstrained pumping, while an additional 105 basins have weak management plans. Twenty of these basins are severely overdrafted. Meanwhile, users in 31 basins have defined groundwater property rights, the most complete solution. We document the critical role of the transaction costs associated with contracting in explaining this variation in responses. This research adds to the literatures on open access, transaction costs, bargaining, and property rights.

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1. Introduction

Common-pool resources are subject to excessive exploitation and rent dissipation due to the absence of well-defined economic property rights (Gordon, 1954; Coase, 1960; Hardin, 1968; Cheung, 1970; Ostrom, 1990). Remedies often are implemented late and are incomplete. Distributional conflicts among actors over property rights and the corresponding allocation of benefits and costs raise transaction costs, impeding more timely and complete collective action. In this paper, we examine whether transaction costs, defined as the costs of defining and enforcing property rights (Allen, 1991, 2000), explain delayed and incomplete collective management action to address common-pool losses. Specifically, we are interested in the transaction costs that occur during an initial phase that Libecap (1993) terms “contracting for property rights.” We refer

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broadly to *contracting costs* as those that arise during private bargaining to redefine ownership arrangements as well as efforts to define the resource's extent and characteristics.

Prior work suggests that contracting costs can prevent agreement. Wild-ocean Atlantic Bluefin Tuna, perhaps the world's most valuable fish, has long been overharvested, depleting stocks, but relevant fishing countries have been unable to agree upon a sustainable total annual allowable harvest and the distribution of catch shares within it (Bjørndal and Brasão, 2006, 193–7; Ellis, 2008; Webster, 2010, 328; Korman, 2011, 701–3, 740). Libecap and Smith (1999, 545) argue that output on the giant Prudhoe Bay field in Alaska went into premature decline in 1988, not because of waning deposits, but because of a failure of the parties to implement complete unitization. Wiggins and Libecap (1985) find that agreement on oil field unitization to avoid competitive drilling and extraction is constrained by the number and heterogeneity of firms. While these studies suggest key factors that affect contracting costs, there have been few opportunities to empirically test the extent to which these factors impede collective action because it is difficult to define a statistically meaningful set of collective action negotiations over separate resources with varying levels of contracting costs.

This paper uses a novel, newly assembled dataset to examine factors that influence the outcome of contracting over groundwater governance regimes in California groundwater basins. The paper contributes to the literature on transaction costs by empirically examining a setting with many groundwater basins facing similar collective action problems. This approach is novel to the analysis of groundwater management, which has emerged as a crucial challenge. Water is critical for life and also as an input into production, but groundwater commonly is exploited under open access with excessive pumping and depletion worldwide, despite evidence of serious losses (Konikow and Kendy, 2005; Zekri, 2008; Giordano, 2009; Barlow and Reichard, 2010; Aeschbach-Hertig and Gleeson, 2012). While groundwater management districts have emerged in several states, for instance in Texas (Nachbaur, 2014) and Kansas (Edwards, 2016), and collective action is observed in groundwater management elsewhere, for instance in Kansas (Drysdales and Hendricks, 2018) and Colorado (Smith et al., 2017), California offers two advantages in examining groundwater management: (1) governance relies on a bottom-up, collective approach versus more uniform control at the state level, and (2) a relatively large number of hydrologically and economically distinct basins.

Governance institutions across California's 445 groundwater basins vary in the extent they control resource degradation. The default institutional regime, retained in 309 basins, allows unconstrained pumping by surface property owners, and in 105 basins users have adopted weak groundwater management plans. Twenty of these basins with limited or no controls are severely overdrafted. Meanwhile, users in 31 basins have defined groundwater property rights through costly court adjudication, which is the most complete solution. We exploit this variation in analyzing the factors affecting when any controls will be implemented and when property rights will be assigned. We find that agents are more likely to agree on pumping limits where these controls are likely to result in larger gains in aggregate. Basin-wide benefits rise as the resource becomes more common, as cross-well impacts become more severe, and as groundwater values rise. However, basins with high predicted contracting costs are less likely to adopt controls. Contracting costs rise with basin size, the number and heterogeneity of users, and variance in resource characteristics.

Because basin characteristics are not randomly assigned, we use prior literature on groundwater management to develop a model that explains which basins benefit from management and which will have high contracting costs. Analysis of California's groundwater basins using an ordered logit model demonstrates consistency between the factors predicted to explain management benefits and the observed choice of institutional regime. Controlling for these factors, we then examine the relationship between contracting costs and two indicators of incomplete or ineffective collective action: critically over-exploited basins that have failed to adopt property rights via court adjudication and the fragmentation of management regimes. In both cases, the presence of incomplete collective action is explained, in part, by factors that increase contracting costs.

The paper proceeds by providing background on common pool resources generally and groundwater specifically in section 2. In section 3 we develop a stylized model to demonstrate where gains from groundwater management are likely to be high. Section 4 describes our dataset, and Section 5 tests whether basins with higher expected benefits of management are more likely to have adopted stricter pumping controls. Section 6 then examines the role of contracting costs in limiting the adoption of controls. Discussion of the importance of our results for implementing California's new Sustainable Groundwater Management Act (enacted 2014) and concluding remarks follow.

2. Background

2.1. Bargaining over property rights to a common pool

Institutional remedies, if employed, can mitigate common-pool losses. In Kansas, for example, groundwater management districts were implemented in the early 1970s to control well spacing and pumping in order to address growing local depletion (Edwards, 2016). In Nebraska, groundwater rights and markets were developed to reduce pumping in areas where declining groundwater levels reduced surface water flows (Kuwayama and Brozović, 2013). Collective action to adopt such arrangements requires agreement by users on resource access and extraction rules, monitoring, and enforcement. An efficient response to the losses of open access occurs when aggregate benefits exceed costs (Demsetz, 1967), but even where there appear to be positive net gains, agreement may not be forthcoming (Leonard and Libecap, 2015). Some users who do well under the *status quo* may rationally oppose the transition from unconstrained exploitation (Grainger and Costello, 2015;

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