



## **Douglass C. North: Transaction Costs, Property Rights, and Economic Outcomes**

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Douglass North asked why some societies historically and contemporarily have rising per-capita incomes and individual welfare, whereas others do not. He argued that successful economies had property rights that encouraged markets, trade, and investment in new production and organizational methods. In other economies, transaction costs, especially those due to the political process, blocked more efficient property rights. Property rights grant decision making over valuable resources and are the basis for investment, and market exchange. They mold the economy and the distribution of wealth and political power. Politicians and coalitions of privileged elites with stakes in the *status quo* join to preserve it. Inefficiencies create their own constituencies. There is no clear remedy for general citizens in North's cases. Despite the power of this argument, transaction costs are not clear in the aggregate studies. They are more apparent in US common-pool resource problems with large, continuing losses in resource rents. This evidence runs counter to the facile arguments for addressing externalities in the welfare and environmental economics literatures in a manner similar to the growth and economic history literatures that North challenged. If the observed costly political response to open access losses is characteristic of regulation in general, then welfare losses permeate developed economies as well and are more pervasive than the dramatic examples of development failure examined by North and others.

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## Introduction.

The impediments to economic growth and welfare highlighted by Douglass North, his coauthors, and others are explored. North provides general, cohesive arguments about why economic growth and advances in welfare empirically are so uneven historically and contemporarily, despite often enormous lost opportunities. The details, however, are missing about the transaction costs that limit the definition, enforcement, and exchange of more effective property rights to make such growth possible. What actually impedes adoption of institutions that support wealth creation and advances in general welfare?

Micro-level studies of persistent, economically-important losses with common-pool resources provide insight. The problems of open-access have long been understood, as has their solution—the definition of property rights. Yet, empirically-observed responses often are late, incomplete, with unanticipated results. These findings are counter to facile recommendations in the welfare economics literature (Pigou 1922, Meade 1973) or environmental economics (see policy review in Goulder and Parry 2008 where transaction costs and interest groups play no role; Weitzman 1974) for the mitigation of externalities. As Coase argued (1960, 15-16) the regulatory remedies may be more costly than the problem. Why are these losses addressed not privately as suggested by Ostrom (1990)? As in North's examples, there are heterogeneous interests with differential incentives to assign property rights that limit rent dissipation and create value. Some interests have a stake in the *status quo* and agreement on compensation to build consensus for change is not forthcoming. Inefficiencies create their own constituencies. Transaction costs constrain private arrangements and mold the political response to private bargaining failure.

Politicians and bureaucrats are not resource owners as private parties can be, and hence, do not have the same motivation for maximizing resource net rents. Politicians, elected or not, and bureaucrats depend on the support of critical constituencies. As a result, the political reaction is to provide particularistic benefits to influential interests, not necessarily to increase resource rents. Politicians and bureaucrats may have no particular incentive to provide generalized benefits to citizens as public goods, unless doing so coincides with gains to their constituents. If this is a common phenomenon, the economy will underperform in a manner described broadly by North. Moreover, it calls for a rethinking of the role of government in responding to externality losses. Only if there are more general, organized interests who would profit from a more effective property rights regime will competitive interest groups form and encourage a more complete political response to the losses of the common pool.

The cases, competitive oil and gas extraction, excessive harvest of fisheries, and the misallocation of fresh water and corresponding rapid draw down of groundwater basins are from the US. The country has a generally supportive legal and political structure for property rights and markets to encourage more optimal resource use and economic growth. Nevertheless, surprisingly large and on-going rent losses occur due to the failure to adopt more effective property rights. In a large economy, such as that in the US, these costs are spread broadly across the citizenry. With limited information and high organization costs, there may be little political pressure for more welfare-enhancing policies, and costs per capita may be small. In total, however, they add up and result in damaging underperformance of the economy. In smaller, more resource-dependent economies the losses from the failure to adopt more effective property rights are far more harmful.

## **North on Transaction Costs and Impediments to Economic Growth and Welfare.**

North defined institutions as “humanly devised constraints that structure political, economic and social interactions” (1981, 36), that range from formal rules--constitutions, laws, judicial rulings, property rights—to informal restraints and rewards--sanctions, customs, traditions, codes of conduct. Unless impeded by transaction costs, which are the costs of defining, enforcing, and trading property rights (Coase 1960, Allen 2011), those institutions that are out of step with potential economic gains are adjusted through bargaining among relevant agents. As North (1987, 422) described: “Modern economic growth results from the development of institutions that permit an economy to realize the gains from specialization and division of labor associated with the sophisticated technology that has developed in the Western world in the last several centuries.”

Indeed, Davis and North (1971, 59) optimistically employed a transaction-cost free contractual framework in describing the process of institutional change: “It is the possibility of profits that cannot be captured within the existing arrangemental structure that leads to the formation of new (or mutation of old) institutional arrangements.” In their framework, bargaining does not break down and when politicians are involved, they respond to interest groups that are motivated to maximize returns because they, and society, are better off by doing so.

Why this would be the case, given empirical evidence to the contrary, remained unresolved. Although North did not delve into the details of transaction costs, he became far more appreciative of how they could derail economic growth: “the absence of such institutions [effective property rights] when compared to their presence in successful developing countries provide essential clues for exploring production failures as a result of the high cost of transacting” (North 1987, 427).

North was pessimistic about when the political process would actually respond in a manner that was welfare enhancing: “In fact, one of the most evident lessons from history is that political systems have an inherent tendency to produce inefficient property rights which result in stagnation or decline” (1987, 422). These insights led him to conclude that “...economic history is overwhelmingly a story of economies that failed to produce a set of economic rules of the game (with enforcement) that induce sustained economic growth. The central issue of economic history (and of economic development) is to account for the evolution of political and economic institutions that create an economic environment that induces increased productivity” (North 1990, 2). But the details of transaction costs and conditions when bargaining conflicts over property rights would be resolved successfully remained unaddressed.

General insights were provided by North and Thomas (1973). They broadly compare the differential success of England and the Netherlands in economic growth in the 17<sup>th</sup> and 18<sup>th</sup> centuries relative to wealthier and more populous France and Spain. North and Thomas argue that the political position of the monarch and important constituents who would gain or be harmed by changes in the *status quo* property rights regime were quite different across the four countries. In England there were constraints on the arbitrary power of the crown, who faced political pressure from those who would benefit from institutional change--new land owners, commercial interests. As a result, new property rights, taxes, commercial law, and land and capital markets were supported, allowing for more fluid

resource movement and access to expanded domestic and international markets. This process did not play out the same way in France or Spain. There, absolutist monarchies faced few political restrictions or incentives to change the *status quo*. They relied heavily on granting and taxing inefficient local monopoly privileges, such as the Mesta in Spain. Monopolies not only provided revenue, but created a local, conservative elite that had a stake in supporting the crown. Elites and the crown were fearful of responding to new innovation, a more open and entrepreneurial economy that could undermine their economic, social, and political positions.

North and Weingast (1989) provide more detail on the conditions in England that limited the power of the crown to undermine economic growth. Following the Glorious Revolution of 1688, both the monarch and Parliament were constrained in their ability to arbitrarily confiscate property rights. New legal restrictions provided for more credible commitments in financial markets, for an independent judiciary that supported the sanctity of property rights and contracts, for the creation of the Bank of England and the English stock market, and for central and equal roles for Parliament and the crown in drafting laws. No similar institutional constraints were placed on the power of the crown in Spain, thus making arbitrary seizure and redistribution of property and abrogation of contracts more likely. Entrenched elites depended on the continued support of the crown, and jointly, this coalition assembled to block change, and over time, the two richest western European economies in Spain and Portugal became economic backwaters.

Almost 30 years after North and Weingast (1989), understanding the problem of coalition formation and political support for new economic opportunities remains a central challenge. Given often vast potential benefits, why is it not in the interest of politicians, bureaucrats, and critical constituents to support change? Why is it that private agents cannot solve collective-action problems to either solve local inefficiencies or to mobilize effective lobby groups for property rights that could deliver so much?

Why are North and South Korea, two basically similar societies in many ways so incredibly different in per capita income, welfare, and individual opportunity? Why has Venezuela's fabulous oil wealth been squandered, making the country one of the poorest in South America when it once had been one of the richest? Why did Zimbabwe drop from being a major food producer and exporter to being a much poorer country and food importer? In contrast, how long will the political structure in China support mostly informal or limited formal property rights that underlie its dramatic economic growth over the past 20 years?

North, Wallis, and Weingast (2009), Acemoglu and Robinson (2012), Alston, Alston, Mueller, and Nonnenmacher (2018, forthcoming) provide additional ways of thinking about these problems. They explore how the political process raises the transaction costs of adopting generally-beneficial institutional change to promote economic growth and wealth. In successful cases, coalitions form among those who would benefit and lobby for change. In other cases, incumbents associated with older economic practices and whose economic, social and political positions could be undermined, form blocking coalitions. They align with politicians who benefit from maintenance of the existing and more certain political and social order. Where these coalitions persist, economies remain more closed as natural states. Missing, however, is an understanding of when influential coalitions might form to lead

politicians and bureaucrats to provide pareto-improving collective goods, rather than costly particularistic ones.

### **Transaction Costs and Modification of Property Rights**

In a transaction cost-free world all available economic opportunities and associated rental streams would be achieved. Potential rents from adopting new property rights structures and organizational forms along with related innovative production and consumption technologies, economies of scale, and changing input mixes would be realized as soon as their prospects became known. Those tied to older property rights, technologies and production would adjust or exchange rights costlessly to those tied to new practices. There would be no free riding. If parties had heterogeneous prospects, new information would be made available for instant adjustment or for full compensation to those disadvantaged. All would benefit. Where property rights required new legal refinement, politicians and bureaucrats would be supportive. Measurement and monitoring compliance with new rights structures would be complete (Barzel 1982). No opportunity with positive net gains would be foregone. Economic welfare would be maximized.

Transaction costs, however, are positive because information about economic opportunities is incomplete. Measurement and monitoring are imperfect. Parties are heterogeneous in production cost and expectations and verifying differences credibly for uniform positions in support of institutional change is difficult. Compensating payments to offset differential assessments are not forthcoming. While private parties might be paid for disproportionate costs they might bear in property rights change, politicians and bureaucrats cannot be. They value political power and esteem, attributes not easily monetized or in some cases, prohibited. When transaction costs are positive then economic outcomes stray importantly from their optimum.

To understand how positive transaction costs can impede needed definition, enforcement, and exchange of property rights, it is useful to examine more micro-level, common-pool resource problems. At this disaggregate level, it is possible to identify what impedes private agreement and to see how such bargaining problems hinder effective interest group mobilization in the political process for institutional change. Examination also reveals how politicians and bureaucrats respond to narrow interests, rather than to coalitions that have an interest in widespread welfare gains.

The lessons learned are generalizable for the broader economy and economic performance. Many common-pool resource problems are surprisingly costly and persistent. Addressing them involves private parties, politicians, and bureaucrats. There are private negotiations and bargaining between politicians and political coalitions in the presence of often formidable transaction costs. The outcomes determine what resource rents are saved and what welfare gains are possible. Resolving common-pool resource problems likely are microcosms of the broader challenges of property rights change to promote economic growth.

### **Adjustments in Property Rights and Transaction Costs.**

To understand how transaction costs can affect both private and political negotiations to define, enforce, and exchange property rights to mitigate the losses of open access, it is helpful to lay out the bargaining problem abstractly to identify key parameters.

### **A. The Bargaining Problem.**

Rent dissipation from competitive extraction of a common-pool resource arise because property rights to control access and use are not fully defined. The problem is outlined by Gordon (1954) and Cheung (1970). Too many users exploit the resource too rapidly and it is locked into current production. Additional labor, capital, and technology are marshaled to win the race for rents, and in the limit, the full rental value of the resource is dissipated. There are no residual net benefits to enhance social and economic welfare. Open access fails to provide incentives for users to invest in or conserve the resource and absent property rights, it cannot be traded for reallocation to higher-valued uses. Addressing the problem is costly because excess labor and capital must be denied resource access. Which parties have to go? If the parties are homogeneous in cost, values, and expectations, the answer does not matter. Those that leave can be fully compensated so that all parties share in the net gains. If the parties are heterogeneous, however, deciding who must be denied and what their offsetting compensation must be becomes the bargaining problem. Hold out is possible and those that believe they are made worse off will resist welfare-enhancing solutions.

Implementing a remedial, new property rights regime requires both agreement on property rights to the net gains as well as enforcement and reallocation via exchange. Because negotiations are fraught with disagreement, they are costly, and whether they are worthwhile depends upon the value of the resource. The difference between aggregate benefits and costs determines the overall net gains or rents available from moderating the losses of the common pool. These net gains define what the parties could achieve through the assignment or refinement of property rights.

### **B. The Nature of the Resource.**

If the resource is small, boundable, low-valued, and homogeneous in quality, and the impact of over exploitation is observable and not subject to dispute, then parties can agree upon a property rights regime of some type that reduces the losses of open access. These characteristics describe the small-scale common-pool resources often successfully managed locally (Ostrom, 1990). By contrast larger, less boundable and observable, more heterogeneous, and more valuable resources are associated with more disputes over the net gains from a new property rights regime and the division of the rents associated with it (Libecap 2014).

### **C. The Number and Nature of the Bargaining Parties.**

More valuable resources attract more claimants, and the larger the number of parties that must agree on property rights, the higher the transaction costs of agreement (Olson 1965). When the parties are homogeneous in production cost and information, they will form similar expectations of the net gains of new property rights. The distribution of associated rents can occur through use of property

rights that define uniform shares. The process is not controversial because the parties are generally identical. These similarities generate trust and shared objectives (Ostrom 1990).

Problems arise when these conditions are not associated with the common-pool resource, as is common. All parties must be made no worse off or they will oppose change. Some who have adjusted well to open access will anticipate little gain from property rights change, unless they receive offsetting compensation. Demonstrating and credibly verifying their requirements for private agreement to the other negotiating parties is contentious when information is asymmetrically held or incomplete. Parties may hold out to secure a greater share if they believe that new information will be revealed to bolster their claims. In the meantime, they continue to inflict losses on other parties.

As open-access exploitation continues and rents are dissipated, agreement on new property rights becomes more likely. There are fewer parties because some have departed as rents decline. Further, the remaining users become more similar in cost and expectations. High-cost parties have exited and more is revealed to all remaining users on the true resource state.

#### **D. Politicians and Bureaucrats.**

In the presence of private bargaining failure, advocates may turn to the political process. They negotiate with politicians and bureaucrats to use the coercive power of the state to implement their favored action that was not possible voluntarily. There is no guarantee, however, that the political response will be one that maximizes rents or welfare. The reaction depends on the nature of the interest groups that mobilize and their relative political influence (Peltzman 1976; Becker 1983). If groups that benefit from a more efficient property rights regime are larger, wealthier, and better organized than those that resist it, then politicians have an incentive to provide particularistic benefits that coincide with greater rents and social welfare. If the groups that mobilize most effectively have instead, a stake in the *status quo*, then politicians will provide particularistic benefits that result in lost overall rents and reduced welfare. If advocates for new property rights or opponents are similarly balanced as competitive interest groups, then politicians and bureaucrats are motivated to use discretion in responding and more limited property rights adjustments will take place.

Clearly defined property rights assign resource access and value, as well as wealth, political influence and social standing. Politicians and bureaucrats have a stake in the outcome. There is an inherent tension between private property rights and markets and political actors. Property rights shift authority from politicians to individuals and hence, reduce political authority over the resource and its uses. The market becomes more important than the state in resource use and allocation. This weakens the ability of politicians and bureaucrats to reward favored constituents. If responding to critical constituent demands is costly to general welfare, politicians may distort information, linking their particularistic actions to broadly-valued public goods and downplaying costs (Buchanan and Tullock 1962; Johnson and Libecap 2001). In the political arena no clear, tradable ownership is established when politicians and bureaucrats reward favored constituencies. Adjustments in light of new political demands or economic conditions is contentious. The process is inherently unstable, possibly leading to political upheaval. The associated uncertainty dampens incentives for beneficial, long-term investment.

Private rights and markets, by contrast, are quite different. Rights owners are residual claimants to new values and the gains from trade. They have incentive to search for and respond to new market entrants and to participate willingly and smoothly to reallocation via market transactions. Further, small adjustments can be made routinely, generating new rent flows and more information.

North and others have targeted the political process as a major culprit in observed poor economic performance across countries and time. But it is not just absolute rulers or limited access orders that undercut economic growth and dissipate rents. In the cases at hand, there are many ways in which the political process can undermine effective responses to the common pool in the definition and assignment of property rights. The issue, then, is when will private parties reach voluntary agreement to mitigate the losses of the common pool and limit political intervention? When they do not, under what circumstances will the political response be one that coincides with advances in economic welfare or hinders it? Table 1 summarizes key variables in the bargaining process.

**Table 1: Variables Affecting the Transaction Costs to Resolve Open-Access Losses.**

<b>Aggregate Benefits</b>	<b>Aggregate Costs</b>
More valuable resources are more vulnerable to new entry and competitive extraction and hence, offer greater benefits from more precise property rights definition and enforcement (Demsetz, 1967).	Higher-valued resources attract more claimants, raising transaction costs in resolving allocation disputes, in monitoring and enforcing compliance.
<b>Nature of the resource</b>	<b>Nature of the Resource</b>
Spatially small, low-value, observable, homogenous resources can be bounded and measured to control extraction. The political process likely not needed. Low value and few users makes the resource less attractive to political intervention.	Spatially large, valuable, non-observable, migratory resources are costly to measure, bound, and agree upon allocation in the definition of property rights. Absent private agreement, the political process becomes involved. Responses depend on characteristics of the lobby groups and may not maximize rents or advance broad economic welfare.
<b>Nature of the Parties</b>	<b>Nature of the Parties</b>
The smaller the number of parties, the more homogeneous are their costs and values of resource use, expectations and preferences, the more likely are agreements on property rights definition and enforcement.	The larger the number, the more heterogeneous in cost and values of resource use, expectations and preferences, the more likely there will be breakdowns in voluntary negotiations over property rights and resort to the political process.
<b>Politicians and Bureaucrats</b>	<b>Politicians and Bureaucrats</b>
Politicians and bureaucrats are not direct residual rent claimants arising from more efficient property rights. They depend upon favored constituents whose demands may not coincide with broader welfare gains. They seek discretion and information control over the costs of their actions to general citizens. There are limits as to how they might be	More precise property rights shift assign resource use authority and net rents to individual owners. The market is more important than the state. Politicians and bureaucrats may constrain property rights so as to maintain discretion to reward key constituents and keep the political equilibria. Realized rent gains depend upon the relative political influence of beneficiaries of more effective property rights.



compensated for property rights that generate greater rents.	
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**Micro-Level Cases of Transaction Costs: Addressing the Losses of Open Access.**

What do we learn from these case studies about the transaction costs of defining, enforcing, and trading property rights that are consistent maximizing the rental value of the key natural resources? The cases oil field unitization, wild ocean fisheries, fresh water allocation and management in the US. All are small portions of overall US GDP (For example, fisheries generated .01% of US GDP in 2015, as compared to 8% -20% in Iceland). Hence, their value can be wasted in isolation without widespread losses to overall welfare. If, however, they are indicative of broader problems in granting, enforcing and exchanging property rights in the economy, then the general negative effects are more significant.

Examination of the cases reveals the factors that are behind success or failure of voluntary private bargaining and how those factors spill over to the political arena. Any political response, whether the granting of more complete property rights or more commonly, regulation, or less commonly, Pigouvian taxes assigns a claim to long-term benefits and costs. Parties with a stake in the outcome organize to lobby politicians and government agencies for favorable rights arrangements that may or may not maximize general rents. Politicians and their clients have an incentive to couch the response in terms of provision of broad public goods, but general citizens will have little cost-effective information to evaluate those claims. This indicates is why competitive interest groups, rather than interest-group capture, are critical for information generation for citizens (Johnson and Libecap 2001).

The evidence in these cases indicates that the political response to open-access losses may be costlier than the problem as warned by Coase (1960, 15-16). As North observed commented (1981, 20): “the existence of a state is essential for economic growth; the state, however, is the source of man-made economic decline.”

**Oil Field Unitization.**

**The Transaction Cost Lesson.**

Oil and gas reservoirs in the U.S. are common-pool resources, subject to potential competitive extraction under the rule of capture, unless property rights are defined to the resource. Oil and natural gas are fugitive and in the US, accessible via leases to production firms from surface property owners. When the ownership is fragmented, relative to the size of the reservoir, producers access the same resource competitively, inflicting costs on one another and dissipating overall rents. The problem has long been known, as have the solutions. Consolidation of leases through purchase reduces the number of competitors and unitization contracts that designate one producer to extract from the reservoir with assignment of shares in unit net profits to other lease owners. Both involve reallocation of property rights and reduce the losses of open access. Even so, neither occurs early when most rents could be saved.

Reservoirs are not uniform deposits, but vary in size and thickness, so that leases differ in longevity and value. Other reservoirs have distinct pockets of natural gas and oil, and lease owners must decide whether to use the gas as an input to drive out oil that may be owned by others or extract it to be sold separately. Finally, on all reservoirs, some leases are well situated to intercept subsurface hydrocarbon flows. These differences affect the incentives of lease owners to agree at any point in time to new property rights. They will agree if the proposed arrangement makes them at least as well off as they would be under open access. Negotiating parties, however, generally do not settle on how to value the distinct characteristics of leases, especially early in the productive life of the field. Lease owners with deep, long-lasting deposits; those with natural gas; and those that rely upon drainage seek to grandfather their advantages in share assignment. Private bargaining breaks down, even in the face of observable field-wide losses. Over time, as reservoir production declines, leases become more homogenous and lease owners exit so that sales or unit agreements become more likely, but after vast rents have been lost.

Producers with large leases that internalize most of common-pool losses turn to the state to regulate extraction. These are classic externalities described by Pigou (1920) and Meade (1973), but the government response is not as hypothesized by those authors. Rather, politicians react to the demands of numerous, politically-influential, high-cost producers, that frequently are local, and not to the often smaller number of low-cost producers (even wealthier) with headquarters in different political jurisdictions. The problem has been most egregious in Texas, the largest oil and gas producing state and with the greatest distribution of high-cost, small, local firms. Politicians and bureaucrats in Texas are not direct residual claimants to rents saved or generated, but benefit from providing regulatory-defined particularistic property rights to these well-organized interests (Volden and Wiseman 2007).

### **Open-Access Losses in Oil and Gas Production and Property Rights Solutions.**

The problem of competitive extraction has been known since first discoveries in Pennsylvania in 1859. Rents are lost due to too-rapid production, compared to what would maximize rents, excessive capital investment in surface storage and wells and labor input, and lower overall recovery as subsurface pressures are vented too rapidly, trapping oil beneath the surface. In 1910, 10% of California's production was lost annually from fires on surface storage reservoirs—unnecessary if oil could be safely left below ground (Libecap and Smith, 2002, S592). In 1914 the Director of the US Bureau of Mines asserted that 25% of the value of US production (\$214,000,000 in 1914), was lost due to the drilling of excessive wells. This translates to losses of \$1,344,000,000 in 2018 prices). The Federal Oil Conservation Board in 1926 concluded that oil recovery rates were 20-25% at current prices due to competitive extraction, whereas recovery of 85-90% of initial oil was thought feasible with more restrained production (Libecap and Wiggins 1984, 88). The Prudhoe Bay field in Alaska, discovered in 1966, went into decline in 1988 due to the added costs of competitive extraction, not from declining endowments (Libecap and Smith 1999, 543-545).

Private solutions have not been forthcoming preemptively. In 1947 energy economist Joe Bain pointed out that of some over 3,000 active fields in the US, only 12 were fully unitized and only 285 had partial unitization (Libecap and Wiggins 1984, 90; Libecap 2008, 380). 30 years later as of 1975, Libecap and Wiggins (1985, 702) report that only 38 % of Oklahoma and 20 % of Texas, production came from

fully-unitized fields. Based on examination of oil company records, Wiggins and Libecap (1985) and Libecap and Wiggins (1985) report that lease owners favorably-positioned above the thickest hydrocarbon deposits with the longest-lived and most uncertain productive potentials, hold out for better shares and there is resistance from high-cost producers to relaxed unanimity requirements for unit implementation to get around holdouts. The time to reach agreement in 7 major Texas fields ranged from 4 to 9 years and final units were incomplete, with one covering only 30% of the field area Wiggins and Libecap (1985, 384). When firms seeking remedies appealed to the state to address the externalities, politicians and regulatory agency officials responded with prorationing controls as a different type of property right.

Prorationing caps annual state production and distributes it via a politically-devised formula on a field-by-field basis, even though reservoirs differ dramatically in physical characteristics, production cost, and potential. While high-cost fields could be closed down and state production directed to low-cost reservoirs to maximize rents, this does not occur. Instead, fields are assigned shares of the state allowable and those field shares are distributed among leases based on political formulas. In the regulatory process, numerous, well-organized and politically-influential small lease owners who benefitted from competitive production by draining others, organized to mold prorationing rules. In Texas, they organized as the Texas Independent Producers Association, and politicians and elected agency officials in the Texas Railroad Commission, were responsive. In 1948, for example, there were more than 3,400 small independent producers in Texas who profited from dense well drilling and drainage (Libecap and Wiggins 1985, 701-711). Small producers achieved field production allowances and prorationing rules that weighted well depth, encouraging the digging of deeper, costlier wells. Further, the rules exempted high-cost stripper wells altogether from production controls (Libecap and Smith 2002, S593-S594). Finally, unanimity rules for field-wide unitization were retained (Libecap and Wiggins 1985, 693). In Oklahoma, where small producers were less politically powerful, the unanimity requirement was relaxed to allow smaller majorities to force unit agreements after lobbying from representatives of larger firms.

This costly political response not only preserved high-cost output, but lowered the overall contribution of hydrocarbon resource production to economic and social welfare in the US. Energy economist, Morris Adelman estimated that in the 1960s the added production costs of such prorationing rules in the US were \$2,000,000,000 (Libecap and Smith 2002, S595). To scale, the present value of that annuity for 10 years at 5% in 2018 prices is \$380,000,000,000. These are regulation-based, economically-significant losses to society.

## **Wild Ocean Fisheries.**

### **The Transaction Cost Lesson.**

Fisheries have long been subject to competitive extraction under the rule of capture and corresponding losses in wealth and contribution to social welfare. Worldwide, the World Bank estimates that \$80,000,000,000 is foregone annually due to extremely inefficient fishing practices relative to more optimal harvests (<http://www.worldbank.org/en/news/feature/2017/02/14/global-fisheries-sunken-billions>). This is larger than the 2017 GDP of small, prosperous countries, such as

Uruguay or Iceland and many of the costs are inflicted on relatively poorer populations as global fish stocks decline (Myers and Worm, 2003). With incomplete barriers to entry, more fishers and more and larger vessels compete for the same stocks, driving down catch-per-unit of effort, increasing costs, and lowering product quality. The problem potentially is solvable in many cases because the 1982 UN Convention on the Law of the Sea granted 200-mile exclusive economic zones (EEZs) to coastal states and these areas are where many valuable fish migrate. Moreover, the costs of the race to fish are no mystery. Among fishery economists, Gordon (1954) described the rent losses from open access and Scott (1955) outlined the gains from sole ownership.

The response to over harvest, however, has not been the assignment of property rights, but rather the adoption of effort controls, generalized season, vessel, and equipment controls. With diverse interests, ranging from inshore and offshore fishers, large and small boat owners, fishers from different locales, sports and commercial fishers, processors, equipment sellers, labor groups, and regulatory officials, there can be agreement only on standardized rules and not on the more difficult task of assigning and monitoring individual property rights (Libecap 2008, 387-392). Regulation, however, has been costly and not halted the fall in fish stocks or declining catch-per-unit of effort. The value of fisheries has continued to decline.

Because sole ownership to fishing regions was not adopted anywhere, Christy (1973, 388) devised an alternative of capping annual catch (TAC) and distributing shares in the cap as individual transferable quotas (ITQs) or individual vessel quotas (IVQs). These are use rights to harvest and not property rights to the stock. Nevertheless, they fundamentally change incentives as compared to the race to fish under the rule of capture. Shares only have value if the stock is vibrant and their value depends upon product quality, production cost, and tradability. Accordingly, fishers have incentive to change production practices and timing to raise product values and to lower costs. Even so, no share systems were adopted until 1984 in Iceland and 1986 in New Zealand and 1990 in the US. The Magnuson-Stevens Act in 1996 placed a 4-year moratorium on adding new ITQ systems in the US. Where ITQs have been implemented in the US, there are strict limits on tradability, often allowing exchanges only to smaller vessel owners and limiting the amount of quota held by any fisher to a small portion of the total annual allowable, .5% in some cases (Libecap 2008, 392). Although ITQs are labeled transferable quotas, they are not very transferable, undermining the objective of reducing the number of excessive vessels in a fishery and of achieving cost-effective economies of scale. High costs and large numbers of small vessels generally are locked in. Further, in the US, ITQs and other catch shares are explicitly not property rights, but use rights revocable at any time without compensation. In contrast, in New Zealand, ITQs are a perpetual property right useable for collateral (Grainger and Costello, 2014).

Small, high-cost fishers, local community representatives, and regulatory agency officials have resisted the assignment of more complete fishery property rights. Bureaucrats have not trusted private property rights or the likelihood that fishers would adhere to total annual catches. Neither bureaucrats nor fishers have the same stock assessments, with the former believing stocks are in direr straights, whereas the latter believe stocks are more plentiful. Politicians have preferred to maintain a strong regulatory presence not only for biological reasons, but also to be responsive to the many constituencies that have some stake in the fishery and the ecosystem and whose representatives could influence agency funding. Their regulatory mandate is to manage fisheries and they are reluctant to transfer

much authority to private fishers, whose livelihoods depend upon it. Regulators do not directly bear the costs of their actions and can focus on ecological and equity concerns. There is no inherent reason for them to balance costs and benefits.

Heterogeneity hinders the ability of fishers to agree privately on methods of controlling entry or harvest as hypothesized by Ostrom (1990) and their ability to form effective lobby groups. Fishers differ in productive ability and harvest success based on skill. Many adapt well to open access through specialized knowledge of fish migration patterns, how to set nets, and timing. Their differential success allows them to acquire larger and better equipped vessels. Successful commercial vessels often are from major fishing centers where marketing of fish products and fleet supports are available. In contrast, smaller, high-cost fleets tend to be linked with more remote, smaller communities. ITQs based on documented historical catch are attractive to better fishers, who support ITQs and other catch shares based on grandfathering, which is by far the most common allocation mechanism (Lynham 2014; Anderson, Arnason, and Libecap, 2011). Smaller, high-cost fishers resist such ITQs, unless they are modified significantly through the political and regulatory process. ITQs tend to be implemented only when fish stocks are near collapse when fisher differences and numbers have diminished.

#### **Open-Access Losses in Fisheries and Property Rights Solutions.**

Johnson and Libecap (1982) outline the impact of heterogeneity based on fishing skill on bargaining for controls on access and harvest within a fishery. In their examination of the Gulf of Mexico shrimp fishery, they find that differences among in-shore and off-shore fishers and among those from across states impede private actions and formation of lobby groups for property rights definition to reduce externalities. When shrimp fishers formed local fisherman unions in coastal bays with rules to control total harvests, limit entry by nonmembers, and channel catch toward higher-valued larger shrimp in the 1950s, excluded fishers appealed to the FTC and Justice Department to dismantle the unions as violations of antitrust laws. Local union efforts in Monterrey Bay on the Pacific Coast were similarly challenged and rejected. The result was open access by law, resolvable only by regulation (Johnson and Libecap 1982, 1007-8).

Deacon, Parker and Costello's (2013) study of the formation and collapse of the Chignik salmon fishery cooperative in Alaska also reveals transaction costs due skill-based heterogeneity among fishers. The cooperative, which operated between 2002 and 2004, was comprised primarily of less-skilled fishers, who cooperated in channeling salmon toward nets and in retiring excess vessels. All cooperative fishers shared in group net returns uniformly and rents in the fishery rose by 33%. Better fishers, however, did not join, preferring to their own practices and maintaining their greater harvests and returns. State regulators administering the cooperative, however, gradually reduced the share of the total allowable harvest available to the independents in order to force them into the cooperative. The number of cooperative members rose from 77 to 87 (of a total of 100 fishers) by 2004, but the 13 that remained outside successfully sued in court in 2005 to dismantle the cooperative that was denying them the right to fish. The study again reveals differential skills, rents, and incentives among fishers and shows why there is no clear political constituency for effective property rights.

The failure of common effort-regulation in fisheries and the benefits of more complete private property rights to replace it is underscored by Grafton, Squires, and Fox (2000) who study the British Columbia halibut fishery. Limited entry restrictions were put into place by regulators in 1980 with more vessels allowed than were in the fishery at the time in order to reduce fisher opposition. Outside fishers (nonvoters) were denied access. The number of vessels rose by 31% to the regulatory limit in 9 years and the stock fell as fishing effort rose. Regulators gradually reduced the fishing season from 65 days to 6 days by 1990, and a tournament fishery emerged with intense congestion as part of the race to fish. All fish had to be caught during that period, and hence, only low-valued frozen halibut were available for consumers. In light of this failure, total allowable catch and individual catch shares (IVQs) were introduced in 1991 and consolidation of shares or quotas resulted in removal of vessels. By 1993 the stock had recovered and the season was expanded to 245 days (Grafton, Squires, and Fox 2000, 685). More valuable fresh halibut became available for consumers because fishers could harvest as market conditions implied for much of the year. The authors do not describe the political process that allowed for this far-better assignment of property rights, but it may be consistent with the general phenomena that more effective arrangements are not adopted until late in resource use.

Costello, Gaines and Lynham (2008) reveal that the benefits of more secure property rights generalize across fisheries. They examined 11,135 fisheries between 1950 and 2003 worldwide, where 121 had total allowable catches and catch shares. They simulated the results of the share-based fisheries and applied them to the other fisheries and found that more complete property rights halted or reversed declines in fish stocks.

These gains depend upon the strength of the property right, but property rights are weak in the US. Grainger and Costello (2014) examine the dividend-price ratio (lease price/sales price) for ITQ shares in the US, Canada, and New Zealand. In New Zealand shares are a firm property right, but not so in Canada or the US. In the US fisheries are viewed by law as a common resource held in trust for all citizens. This common property notion means that restrictions on entry and harvest to increase rents must come from the political process. To facilitate regulatory intervention and discretion to reward key constituents, including biologists, the Magnuson Stevens Act emphasizes that any catch shares “shall be considered a permit” that “may be revoked, limited, or modified at any time” (Grainger and Costello, 2014, 229). Using data on lease and sales prices from 1986-2008, they show that the US lease/price ratio is about double that in New Zealand (Grainger and Costello 2014, 230-233). Based on their analysis, the market assigns a 50% probability of erosion in asset values due to political/regulatory revocation of the property right. This added political risk has an economic impact comparable to the rate of interest in determining share values.

The objectives of politicians and regulators are to maintain control of the fishery to provide particularistic benefits to favored constituents. This undermines the ability of property rights and markets to encourage long-term investment, conservation, and exchange so as to protect and generate rents. But neither politicians, nor regulators are motivated to enhance global efficiency, except under unusual circumstances. Their interests are served by responding to more narrow interests. For these reasons, fisheries continue to perform comparatively poorly relative to what they might, given the potential natural endowments of fish stocks that exist, vast experience and knowledge that has been generated among fishers, and investment in new marketing and products.

## **Fresh Water in the Western US.**

### **The Transaction Cost Lesson.**

Fresh water as groundwater is a common-pool resource almost everywhere in the world. Surface water is a common-property resource in most places because the state owns and allocates the water via the political and bureaucratic process. Only in Chile, Australia, the western US and Canada are there private property rights to water that can be used and traded among private owners (Grafton, Libecap, McGlennon, Landry, and O'Brien 2011). In the western US the system is based on prior appropriation, a first-possession water right that is separable from the land (Leonard and Libecap 2018). There are many advantages to these property rights, and a key one is that their existence allows for institutional comparison and innovation that does not exist elsewhere where state ownership is enshrined and guarded carefully by politicians and bureaucrats.

Nevertheless, the record of state regulation is not one that inspires confidence or that maximizes resource values. As with fisheries, politicians constrain water use through effort controls (none of which were effective in fisheries). They mandate uniform use reductions during drought, even though values of water use vary dramatically. They do not rely upon urban water pricing to regulate demand, and as available water supplies fall during drought, cutbacks are across-the-board. Despite being portrayed as equitable; these actions are not so. The rich not only consume more, but are better able to adjust to short falls than are the poor. But asserted equity has a strong political appeal. Further, politicians and bureaucrats allocate water to favored constituencies, but absent the value information that would be generated by market trades, there is no way for citizens to assess the costs and benefits of those distributions. Water supply and regulatory agencies rely upon value information provided by organized interests, which is unlikely to reflect broad-based demands. For all of these reasons, the problem of lost rents and welfare is increasing as water values rise with population growth, urbanization, higher per-capita incomes, new environmental and recreational uses, along with growing traditional applications in agriculture and industry.

The western US could be different because of its well-established water rights regime, but thus far it is failing to take advantage of this opportunity. In this semi-arid region, most water rights were granted by 1920 with streams being fully appropriated. Much of the water went to agricultural production, which was water intensive and offered one of the highest valued uses. Even today 60-80% of water use is in agriculture (Brewer, Glennon, Ker, and Libecap 2008). On the margin, however, values in agriculture often are much lower than urban or other uses. For example, in Nevada's Reno/Truckee Basin, the median price of 1,025 agriculture-to-urban water rights sales between 2002 and 2009 (in 2008 prices) was \$17,685/acre-foot (an acre-foot = 325,851 gallons, about enough to meet the needs of four people for a year), whereas for 13 agriculture-to-agriculture water rights sales over the same period, the median price was \$1,500/acre-foot, a difference in value of over 12 times (Libecap, 2011). Irrigators as major rights owners typically are active traders because they can earn more from some water sales than from growing crops. Water-supply organizations, such as the Metropolitan Water District of Southern California, are major buyers. Nevertheless, water trading is limited.

Only some 2-4% of annual consumption of water is traded in any western state (Libecap 2017). California is well positioned for water markets because there are private water rights in agriculture in the relatively wet north and willing demanders in the drier more populous south. Further, there is an elaborate infrastructure for moving water. Nevertheless, although the recent 5-year California drought ought to have resulted in an uptick in market activity, it did not happen. It remained flat with lost opportunities to improve value and welfare Jezdimirovic and Hanak (2016).

A major reason for limited market trading during drought is a costly, slow, and resistant regulatory process. All trades that involve changes in location (especially out-of-basin), nature and timing of use, require regulatory review to insure that other water users are not harmed by the sale. There is little evidence to support that this is a major concern, however, and much opposition to proposed sales appears to come from organized interests that seek water allocation based on the political process and not on market trades that they would have to pay for. Politicians and regulators do not rely on a market system that weakens their regulatory discretion and that limits their ability to respond to the demands of organized lobby groups.

Moreover, private water rights often are not well defined. Historically, water was plentiful and there was little return to more precise measurement and monitoring. That is no longer the case. A complicating factor is that private water rights are use rights, held so long as they are consistent with political and bureaucratic interpretations of the public interest. Unlike fishery use rights, historically water rights would be compensable if there were state adjustments in property rights. A 1982 Supreme Court ruling in California based on the public trust doctrine, however, suggested that compensation might not be required (*National Audubon Society v Superior Court* (Supreme Court of California, 1983, 33 Cal.3d 419, Libecap 2007). The Public Trust ruling has added uncertainty to private rights. As a result, irrigators are concerned that selling some water could put their imprecisely-defined rights in jeopardy.

Most of California's drought response has been via government directives. In a series of Executive Orders by the Governor and regulatory actions by the state regulatory agency mandatory water reductions in consumption in urban areas by 25 % were called for (Libecap 2017). Additionally, 100 of California's senior agricultural water rights holders had their water uses restricted and 200 large irrigators agreed to 25% reductions in water access in order to avoid stricter state controls. Further, under the California and Federal Endangered Species Act (ESA), water flows across the Sacramento Delta have been periodically halted in order to protect endangered fish that might be harmed by the pumps used to move the water. Despite evidence of major costs in lost employment and production in the San Joaquin Valley to the south, no cost-benefit analysis is required for agencies under the ESA. Finally, state regulators are considering minimum streamflow regulations at the behest of various environmental groups to address declining stream levels during drought. Such mandates, however, do not consider costs and disproportionately impair senior water rights holders, who otherwise are the most active in water markets. Mandates do not require compensation and those interest groups who demand them achieve their desired objectives while costs are spread broadly.

Moreover, no urban water supply organization aggressively uses prices to moderate demand, again relying upon regulatory restrictions and calls upon neighbors to monitor one another's use. Politicians and bureaucrats prefer supply augmentation efforts that do not require major behavioral changes among constituents and the costs are spread across all rate payers. San Diego has a new water desalination plant, where the produced water costs twice what the city pays for alternative sources



(Libecap 2017). Water pricing can have genuine benefits. Tucson, Arizona a desert city uses steep-tier water pricing, whereas similar cities near Phoenix use low flat rate, cost-of-service pricing. Per-consumption in Tucson is about 25% less than in Phoenix (Libecap 2017) based on voluntary cutbacks. Flat rates are politically popular because they appear to be equitable and are framed by politicians in that way. But they are not equitable in the face of income elasticity of demand estimates and they do not effectively encourage water use change unless the entire rate is shifted significantly.

Existing private water rights and markets are not the politically-favored responses to growing surface water scarcity. When surface water cannot be accessed, users turn to groundwater, which is a common-pool resource. Both agriculture and urban users are impacted. But as with oil fields, important heterogeneities affect incentives to agree upon a more precise definition of water rights. Additionally, mistrust of politicians and regulatory agency officials limits resort by users to the state to address the hold out problem and related externalities.

### **Open-Access Losses in Groundwater and Property Rights Solutions**

There are 445 groundwater basins in California that supply from 40-60% of annual water use. In 309 basins, there are no constraints on pumping. 105 basins have weak management plans that prescribe well spacing, but no controls on total extraction. 20 of these basins are severely over-drafted and have been for some time. Surface levels have dropped over 100 feet in some cases, damaging roads, structures, and fields. Pumping costs are driven up, and thin parts of the aquifer have dried up. Seawater intrusion has occurred in aquifers adjacent to the coast. In contrast, Users in 31 basins have defined groundwater property rights, the most complete solution to competitive withdrawal.

What explains this variation? In the 309 basins with no property rights, there are few wells and water values are low. Ayres, Edwards, and Libecap (2018) analyze why there is such variation in property rights regimes, particularly in the basins where overdraft has inflicted major costs. As with oil and gas reservoirs groundwater basins are not uniform in the impact of over draft. Parts of large basins have more recharge from precipitation. Other parts have more permeable geology encouraging subsurface flows, while others have denser formations that hold water more in place and reduce cross-well drainage. The number of pumpers and well density differs. Users are heterogeneous, in part because of their location above the basin. Additionally, irrigators generally have lower water values and rely on intermittent rapid pumping during drought to maintain crops and orchards. Urban water supply organizations have higher water values, view aquifers as critical storage, and have lower overall pumping rates.

In their analysis of the 445 California basins, Ayres, Edwards, and Libecap (2018) find that user and resource differences significantly affect whether or not pumpers will agree to assign more definite water rights. Benefits rise as the resource becomes more common and as groundwater values increase. Transaction costs rise with basin size and the number and heterogeneity of users. Users on basins with the lowest recharge rates, most urban population growth, highest well densities, largest numbers of pumpers, and most permeable subsurface geology are more likely to agree to the definition, monitoring, and exchange of groundwater rights. Where both irrigators and urban water supply organizations pump from the same basin, agreement on water rights becomes less probable. Even so, on critically over-drafted basins where property rights would be the most effective response to open-access losses, they

often are not adopted due to disagreement on the allocation of groundwater rights. Further, even more lenient management plans that define well spacing rules, but no rights or limits on pumping rates are not adopted for entire basins. Most are fragmented with multiple management areas above a single aquifer, reducing the basin-wide benefit of pumping controls. This observation is similar to subunits above oil and gas reservoirs.

These findings reveal the role of transaction costs in impeding collective action among parties to agree to the definition of property rights to avoid rent losses. The California legislature and regulatory agencies are mandating new regulatory controls to limit over draft if private parties cannot agree. These mandates likely will assign regulatory-based property rights in a manner similar to prorationing in oil and gas. They are not apt to coincide with a more optimal definition of rights that maximizes rents. Users could turn to the state to reduce unanimity requirements as has been done in Oklahoma and other states to reduce holdouts. Given the distrust of politicians and regulators by water rights holders as well as differential agreement among the parties on the rights to be assigned, they have not adopted this strategy that might otherwise promote agreement.

## **Conclusion**

Douglass North and others castigated the political process for raising the transaction costs of defining property rights that could support economic growth and general welfare. He pointed to the actions of politicians as a major reason why countries failed to exhibit long-term economic expansion in history and contemporarily. There are spectacular failures, but the transaction costs underlying them are not articulated. Examining persistent and costly losses from three common-pool resources in the US that otherwise has an apparently supportive institutional structure for economic growth provides more detail. They begin with the breakdown in voluntary agreements to address the rent losses of the common pool, more optimistically predicted by Ostrom (1990) and described by Cox, Arnold, and Villamayor Tomás (2010). Given the potential gains, advocates for more precise property rights turn to the state. While welfare and environmental and natural resource economists prescribe regulation or taxes to address externalities, they do not examine the incentive of politicians and bureaucrats to respond in a wealth-maximizing manner.

The cases also indicate that beyond the high-profile examples pointed to by North, more common and perhaps more damaging across all economies is the political response to externalities. It can result in economic under performance, lost economic welfare, and reduced range of citizen opportunities.

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