THE CONDITIONS FOR SUCCESSFUL COLLECTIVE ACTION REGARDING COMMON POOL RESOURCES: EXAMPLES AND IMPLICATIONS FOR GLOBAL COOPERATION

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I

I. Introduction.

In some cases, the losses associated with the common pool lead to successful private cooperation or to agreements between private parties and government officials for beneficial institutional change. In other cases, common-pool problems are not successfully resolved, either privately or with state intervention. Empirical research has identified a number of factors that characterize collective action regarding common-pool resources and that critically affect the outcome. Although, institutional change affecting the common pool typically involves local issues and a comparatively small number of parties, the patterns of behavior and the conditions for successful resolution of conflicts seem likely to have implications for more global issues of international relations. Indeed, some commons problems, such as the management of fisheries, explicitly involve parties across countries and cultures. The purpose of this paper is to summarize some of the bargaining issues involved in collective action to address local common-pool problems and to illustrate them in three empirical cases. The importance of riming or the sequence of coalition building and the heterogeneity of the participant's preferences, information, and stakes in the problem are emphasized. Two of the empirical cases involve traditional common-pool problems and efforts to resolve them in fisheries and oil fields, and the third involves collective action with government assistance to control orange shipments to fix prices. As described below, collective action to resolve rent dissipation from technological externalities in common-pool resources is similar to that required for reducing the losses from pecuniary externalities.

II. The Common-Pool Problem.

There is confusion in the literature on the terms, common property and open access. Technically, open access occurs when there are no controls on the access to and use of a valuable resource. It is the most extreme case. A common-property condition can mean open access; that is, the resource is common to all parties, or it can describe a case where a group has access to a resource, and non-group members are denied. Hence, a common-property condition can involve less extreme cases where there are at least some restrictions on entry and use. Even so, within common-property regimes, rules must be devised to control the access and use by

group members, as well as to limit entry by non members.

The classic articles on the potential losses or rent dissipation from an open-access resource are those by Gordon (1954) and Cheung (1970).[1] Capturing a portion of rents saved by mitigating open-access conditions provides the individual motivation for collective action. Complete open access occurs when property rights to a valuable resource are absent. If property rights are poorly defined, open-access losses will occur along unregulated or unconstrained margins. Under these circumstances, net private and social costs diverge, since individuals who use the resource do not have to consider the full social costs of their activities. Except in unusual circumstances, their production lowers the productivity of others who also are using the resource. Because private costs are less than the social costs for each party, total output by all exceeds the social wealth-maximizing level, where social marginal costs equal social marginal returns. By equating only their relevant private marginal benefits and costs, individuals exploit the resource too rapidly, relative to what interest rate and price projections would suggest. Further, competitive pressures under conditions of poorly-defined property rights encourage short-time horizons in production, leading user costs and other long-term investment possibilities to be ignored. The incentive to invest is reduced because investors are uncertain as to their ability to capture the resulting returns. Resource values also fall because exchange and the reallocation of the resource to higher-valued uses is difficult when property rights are absent. Demsetz (1967), for example, argues that an assignment of property rights is a prerequisite before decentralized, price making can occur. Prices that reflect underlying demand and supply conditions are necessary to facilitate socially-valuable exchange among economic agents. Without the more complete market signals possible when property rights are well defined, resources may not flow smoothly or routinely to higher-valued uses as economic conditions change. This can be a particular problem in the allocation of resources over time, because one of the important roles of market prices is to reflect the present value of the intertemporal stream of resource rents. Where those values are higher from future, rather ***than*** from current use, competitive market pressures will bring desirable delay in the exploitation of the resource. If property rights and associated market prices are absent, there will be little incentive for economic agents to postpone resource use to the future. Hence, where common-pool conditions are prevalent, the value of the resource will be reduced and the economy will be less responsive to current and future

opportunities. Finally, resource values will be reduced as productive inputs are diverted from socially-valued production to predatory and defensive activities. These open-access or common-pool losses define the potential gains that can be possible from collective action to assign more exclusive property rights within groups or to individuals for controlling resource access, use, and exchange.

Capturing a portion of the aggregate gains (saved resource rents) from mitigating common pool loses motivates individuals to bargain to install or to modify property rights arrangements. The bargaining stands taken by the various interested parties depend upon their private expected gains from institutional change as compared to the status quo. Hence, allocation rules are critical. Each party will attempt to mold the resulting agreement in ways that maximize its share of the aggregate returns. This maneuvering affects both the nature of the property rights that ultimately are adopted and the aggregate benefits that can be obtained. In considering whether or not to support proposed changes in property rights at any time, the **bargaining** parties implicitly compare their expected income stream under the status quo with that offered by the new arrangement. The benefits of the status quo are determined by the current property rights allocation and any adjustments in future shares achieved by delaying institutional change. Interest groups may chose to delay agreement on a proposed adjustment in property rights if they anticipate that new information will be forthcoming to bolster their claims for a larger share of rents in the new arrangement or if they expect favorable changes in political conditions to strengthen their bargaining power. Delay, however, has costs since it means the continuation of common pool conditions. Hence the bargaining parties must consider the expected private losses from the maintaining the common pool.

III. Heterogeneities and Collective Action.

In the absence of serious disputes over the aggregate gains or benefits of assigning or modifying property rights, the problem of collective action is one of distribution, achieving agreement on the individual shares of resource rents that are implicit in the assignment of property rights. Generally, the magnitude of the losses associated with common-pool or open-access conditions will not be controversial. The losses are observable by most parties and can be documented with publicly-available information. As a result, there will

be agreement on the need for institutional change regarding the creation or refinement of controls on resource use. Disputes, however, will arise over the allocation rule—how the resulting benefits and costs are to be distributed.

The intensity of debate over distribution and the likelihood of collective action are influenced by a), the size of the aggregate expected gains, b). the number and heterogeneity of the bargaining parties, and c). information problems. The role of the size of the aggregate expected gains is discussed below because of its impact on the sequence of agreements. In general, the larger the expected aggregate gains, the more likely an acceptable share arrangement can be devised. With large expected gains, enough influential parties will see themselves made better off that collective action for institutional change can proceed. The number of bargaining parties involved can make it more difficult to reach agreement for the usual bargaining reasons (Olson, 1965). The greater the number of competing interests with a stake in the new definition of property rights, the more claims that must be addressed in building a consensus on institutional change. A more important problem, however, is heterogeneity across the parties in information regarding resource values, in production costs, in output history, and in organizational size, wealth, and political experience. These differences affect share negotiations and the ability to engage in collective action.

In many common-pool settings where the parties are heterogeneous, changes in property institutions involve risks for some groups. Those parties who have had informal claims or have been unusually productive under the status quo may be made worse off by institutional change unless their claims or productivity are recognized. Their particular concerns must be addressed in order to reach agreement on the assignment of property rights to reduce common-pool losses. In negotiations, prior possession or prior production can be used to document past use and be the basis for shares in the resource under the new arrangement. If these criteria can be documented with public information, they are popular because they recognize those parties with significant interests in any adjustments in property rights arrangements. Even so, conflicts still may arise over the division of rents. Prior possession and prior production as bases for more formal property rights reward those who have adapted well to open-access conditions, and this practice may be considered inequitable by those who seek to do proportionately better under the proposed institution. New entrants will particularly resist

grandfathering past production as a formula for allocating property rights. Further, there may be information problems in documenting past production or use.

One simple allocation rule that avoids these problems, but that harms those who have been successful under common property, is uniform allocation, whereby all parties with past production receive an equal share. If very productive parties expect the redistribution of wealth to be large relative to their share of the losses of continuing open-access conditions, they will oppose collective action. Side payments are a way of adjusting shares or property rights to mitigate the opposition of influential groups. The range of feasible exchanges for building an accord, however, may be quite limited when the parries are heterogeneous. Side payments require agreement on who should pay the compensation, who should receive the wealth transfers, and the form the payment should take. Equity issues can arise if those who are to receive compensation are viewed as having had an unjustifiably-large share under common property. Information problems also can complicate an accord on the amount of the side payments, even when there is agreement that they are necessary. Compensating payments require agreement on the value of current holdings and of any losses that some parties expect as a result of the new definition of property rights. The valuation of individual wealth under current and proposed property rights can be a serious problem in negotiations for collective action if there are information asymmetries among the parties regarding individual holdings. These disputes will occur quite aside from any strategic bargaining efforts, if private estimates of the value of current property rights and of potential losses from the new system cannot be conveyed easily or credibly among the bargaining parties. In addition to honest disagreements on the value of individual claims, the information problems encountered in devising side payments will be intensified if the parties engage in deception to increase their compensation. Deception occurs through willful distortions of the information released to the various parties to inflate the value of current claims and the losses institutional change might impose. Widespread deception by competing interests can make agreements more difficult by reducing any trust that might otherwise promote the more rapid evaluation and consideration of claims in side payment negotiations.

IV. The Sequence of Agreements and Collective Action.

Because of the difficulties of reaching a consensus on mitigating the losses of the common pool when the parties are heterogeneous, collective action (both private and involving the state) frequently will occur late, after the losses have become so large that distributional issues can be settled. Under these circumstances, the expected gains of reaching agreement are so large that they tend to dwarf individual distribution concerns. Additionally as common-pool losses continue, the value of individual shares under the status quo declines so that more and more, all of the parties see themselves as made better off by collective action. A factor that contributes to successful collective action is that the continuation of common-losses so reduces resource values and incomes from its use that some parties exit. Hence, over time the number of bargaining parties may fall. Unfortunately, by the time agreements can be reached to resolve open-access problems, many of the resource rents have been dissipated permanentiy. This result is revealed repeatedly in the empirical cases described below and in other settings, and it is an unfortunate result of the difficulties of reaching agreement when the bargaining parties are heterogeneous. Hence, the sequence of bargaining over common property begins with discussion of the aggregate gains of new institutional arrangements. These generally are not controversial and are recognized for some time before collective action is taken. The problem is reaching agreement on the distribution of the benefits and costs of the new property arrangement. Resolving distributional conflicts becomes the next round of negotiations. This round takes the most time and is the most contentious, and many resource rents are lost. Finally, after conditions have become so severe regarding the state of the resource and the ability of the parties to obtain income from its use, agreement on closing some of the margins for rent dissipation becomes possible through collective action.

An exception to this pattern of late agreement occurs when newly-discovered resources are to be divided among the competing parties. If no production has occurred, the parties will be reasonably homogeneous, all with an equal stake in saving resource rents through collective action. Moreover, the information asymmetries that plague the valuation of individual shares under current and proposed arrangements are absent because none of the parties have established production histories. None have a vested interest in the

common pool. Hence, under conditions of mutual ignorance, agreement on closing potential common-pool losses is possible. The circumstances for such early agreements, unfortunately, are quite limited. Nevertheless, they have been encountered in bargaining over mineral rights in the nineteenth-century American west and in bargaining over the allocation of exploration and production rights to very new oil fields and new fisheries, as described below.[2]

V. An Empirical Case: Oil Field Unitization.

A. The Common Pool Problem.

Since the first discovery of petroleum in the United States in 1859, oil production has been plagued by serious common-pool losses.[3] These losses arise as numerous firms compete for migratory oil lodged in subsurface reservoirs. Under the common law rale of capture, private property rights to oil are assigned only upon extraction. Oil reservoirs are commonly found below numerous independently-owned surface tracts. The surface landowners initially hold the mineral rights, but transfer them to firms through mineral leases. By this process, multiple firms gain access to the pool, and the lease, rather than the field, becomes the unit of production. In the United States with fragmented surface land ownership and tiny leases, many firms are very small, with only a few leases on a single reservoir. Typically, oil reservoirs are compressed between an upper layer of natural gas and a lower layer of water. The two layers, as well as gas dissolved in the oil, drive the oil to the surface, when the surrounding formation is punctured by a well. Oil migrates to the well, draining neighboring areas. The extent of migration depends upon subsurface pressures, oil viscosity, and the porosity of the surrounding rock. Reservoirs are not uniform. These characteristics differ across the field, generating inherent variation in well productivity. As a firm drills additional wells, oil migrates more rapidly into the created low pressure zone, raising the firm's share of field output. For each of the firms on a reservoir, a strategy of dense well drilling and rapid production allows it to drain oil from its neighbors and to take advantage of the low extraction costs that exist early in field development. In new, flush oil fields, subsurface pressures are sufficient to expel the oil without costly pumping or injection of water or natural gas into the reservoir to drive oil to the surface. Under these conditions, when there are multiple firms on a reservoir, each

firm has incentive to drill competitively and drain to increase its share of oil field rents, even though these individual actions lead to aggregate common-pool losses.

Oil field rents are dissipated in a number of ways. First, increases in the rate of production by any one firm reduces ultimate aggregate oil recovery. With high withdrawal rates associated with competitive, common-pool production, the ratio of natural gas to water to oil production increases, leading to a greater loss of subsurface reservoir pressure. With the loss of pressure and dissolved gas, oil becomes more viscous, closing pore spaces in the reservoir and requiring more pressure to move it. Pockets of oil become trapped and are retrievable only with high extraction costs, including the premature need for artificial pumping or reinjection of water or gas to drive the oil to the surface. Second, capital costs are driven up with the drilling of excessive numbers of wells (more than geologic conditions require or price and interest rate projections warrant) and with the construction of surface storage, where the oil can be held safe from drainage by other firms. These storage practices are costly. Third, rapid extraction also increases production costs as subsurface pressures are vented prematurely, forcing the early adoption of pumps and injection wells. Finally, rents are dissipated as production patterns diverge from those that maximize the value of output over time.

B. Problems of Collective Action: Information Asymmetries and the Sequence of Agreements.

There never has been much disagreement over either the nature of the common-pool problem or the general solution to it. Early discussions of unrestrained oil production in the United States emphasized extraordinary wastes. In 1910, oil losses from fire and evaporation from surface storage in California (wooden tanks or behind earthen dams) ranged from 5 to 11 percent of state production. In 1914, the Director of the Bureau of Mines estimated losses from excessive drilling at $50 million, when the value of U.S. production was $214 million. In 1926, the Federal Oil Conservation Board estimated oil recovery rates of only 20 to 25 percent with competitive extraction, whereas recovery rates of 85 to 90 percent were thought possible with controlled withdrawal. In 1937, the American Petroleum Institute estimated that unnecessary wells on the East Texas field cost over $200 million. In 1980, intensive drilling under prevailing ownership and regulatory practices in the United States left the United States with 88 percent of the world's oil wells and only 14 percent

of the world's production.[4]

Although the common-pool problem and its costs have been long recognized in the industry, so has been the most complete solution to it—field-wide unitization. Both the Federal Oil Conservation Board and the American Institute of Mining and Metallurgical Engineers issued various reports in the 1920s and early 1930s on the merits of unitization. Under unitization, production rights are delegated through negotiation to a single firm, the unit operator, with net revenues apportioned among all parties on the field (including those that would otherwise be producing). Shares are based on estimates of each firm's leases contribution to the unit. As the only producer on the field and a residual profit claimant, the unit operator has incentive to maximize field rents. Accordingly, unitization results in important economic gains: a time stream of output that more closely approximates the rent-maximizing pattern, increased oil recovery, and reduced wells and other capital costs. For instance the Oil Weekly (April 13, 1942; May 3, 1943) estimated that early unitization of oil fields would increase recovery from two to five times that of unconstrained production. Similarly, on the Fairway field in Texas estimates were that unitization would increase oil recovery by 130 million barrels.[3]

Despite these attractions for mitigating the substantial losses involved in common-pool crude oil production, complete field-wide unitization has not been widespread. In his study of the oil industry in the 1940s, Joe Bain (1947, p. 29) noted that "It is difficult to understand why in the United States even admitting all obstacles of law and tradition, not more than a dozen pools are 100 percent unitized (out of some 3,000) and only 185 have even partial unitization." Similarly, Libecap and Wiggins (1985) reported that as late as 1975 only 38 percent of Oklahoma and 20 percent of Texas production came from field-wide units.

The key issue in blocking agreement on the voluntary unitization of oil fields is conflict over a share formula to divide the net proceeds of unit production among the various parties. In share negotiations two serious problems arise. First, unitization contracts must assign once-and-for-all shares at the time the contract is completed. This is because changes in reservoir dynamics after unitization make it impossible to link unit production to particular leases, which would be necessary for adjusting shares. A second problem is general uncertainty and asymmetrical information regarding relative preunitization lease values, which determine unit shares. These problems block agreement on lease value estimates and proposed unit shares in unit rents.

The level of information available to the contracting parties depends upon the stage of production in which contracting occurs. In exploration, little is known regarding the location of oil and its commercial extraction possibilities. At that time, all leases are relatively homogeneous, and unitization agreements are comparatively easy to reach, using simple allocation formulas, often based on surface acreage. Since no party knows whether the formula is to its advantage or disadvantage, negotiations can focus on the aggregate gains from unitization. Information problems and distributional concerns, however, arise with development, as oil reserves are proved and expanded. With the initial discovery well and the drilling of subsequent wells, lease heterogeneities emerge. Because reservoirs are not uniform, the information released from a well is descriptive of only the immediate vicinity. Hence, through drilling their individual leases, firms gain knowledge of their portion of the reservoir, and the full extent of the deposit and the productive potential of other areas of the reservoir will be revealed only through the drilling activities of other firms.

The production potential and commercial value of a lease are functions of both public and private data. Public data include objectively-measured and noncontroversial variables, such as the number of wells on the lease, its surface acreage, the record of current and past production. These data are available to all of the contacting parties. Private data on lease parameters involve more subjective geological variables, which tend to be assessed and valued by individual company engineers. These assessments and their implications for lease values and unit shares are controversial and subject to dispute. Procedures and estimates vary across firms, even when examining the same data. For instance, in unit negotiations on the Prentice field in West Texas, there were differences in rock porosity estimates of 60 to 100 percent.[6] The estimation of dynamic reservoir characteristics, such as remaining oil reserves and future lease output, involves even greater complications. Companies often have differing opinions about the correct estimation procedure, when choices can reallocate millions of dollars.

As a result of these different interpretations of private information and differences in estimation procedures, the negotiating parties cannot reach agreement on lease values or unit shares. To avoid conflict over subsurface parameters, unit negotiations often focus on a small set of objectively-measurable variables, such as cumulative output or wells per acre. These objective measures, however, may be poor indicators of

lease value. The resulting asymmetry in lease value calculations, based on differential information and interpretation among firms is the primary cause of breakdown in unit share negotiations. These conflicts over lease values and unit shares will continue until late in the life of a reservoir. With the accumulation of information released through development and production, public and private lease value estimates converge and primary production (production based on natural subsurface pressure) approaches zero. At that point, a consensus on shares and the formation of the unit is possible. Without artificial injection of natural gas or other substances to supplement underground pressure and other secondary recovery techniques, lease values will approach zero. Secondary recovery, however, generally requires coordinated actions across multiple leases and hence, is most effective with a unit. Unfortunately, by the time secondary recovery is required, most of the common-pool losses already have occurred.

The information in Table 1 indicates just how long unit negotiations can take. The data were compiled by Libecap and Wiggins (1985) and Wiggins and Libecap (1985), and they involve seven oil fields in Texas and New Mexico where unit negotiations took place: North Cowden, Goldsmith /Landreth, Prentice Northeast, Western R K M, Slaughter Estate, Empire Abo, and Goldsmith/San Andres.

The Table reveals that negotiations to address common-pool problems through unitization took a long time, ranging from four to nine years. Moreover, in five of the seven cases, the acreage in the final unit was less than that involved in the early negotiations. As unitization negotiations were drawn out over share conflicts, some firms decided to create subunits, which are less effective. On small subunits, secondary recovery methods work less well, and overall recovery declines. Further, partial unitization leads to increased capital costs. For instance, after the unsuccessful efforts to completely unitize the 71,000 acre Slaughter field in West Texas, 28 separate subunits were established, ranging in size from 80 to 4,918 acres. To prevent migration of oil across subunit boundaries, some 427 off-setting, water injection wells were sunk along each subunit boundary at a per well cost of $360,000 for a total of $156 million. These wells and related expenses were not needed for production and could have been avoided with a field-wide unit. Such practices have been routine, particularly in Texas where multiple units are common.

VI. An Empirical Case: Fisheries.

A. The Common-Pool Problem.

Fisheries are the classic common-pool resources. In most cases in the U.S. and in many throughout the world, there are no restrictions on entry. In part, this is due to the migratory nature of many species. The area necessary to effectively manage the stock is large, and policing property rights to it is costly. This is a particular problem for off-shore fisheries, where the areas involved are extensive and government jurisdictions overlap. Another constraint, particularly in the U.S., is the legal prohibition of private property rights or even communal rights to natural fish stocks. For in-shore fisheries where migratory distances are less, exclusive rights institutions would be an option for collective action if they were allowable by law. But they are not. Foi off-shore fisheries where 200-mile territorial limits are in place, exclusion applies to foreign fishermen, while access is available to native fishermen. In these fisheries, arrangements must be devised to limit access and harvest by local fishermen, and these arrangements typically have not been very successful.

Hence, many (if not most) of the world's fisheries are characterized by limited or no effective restrictions on entry and harvest. With more or less open access, fishery rents are dissipated. Lacking ownership in the stock, individual fishermen do not consider the total costs of their private harvests. Aggregate catch is too great because fishing occurs until the average private cost of harvest equals the market price, rather than where marginal social costs and benefits are equated. Each fisherman imposes costs on others by dispersing fish and lowering the stock. Further, competitive pressures lead to excessive amounts of labor and capital inputs in the fishery. As entry continues and the stock declines over time, average catch and income falls. The losses of the common pool in fisheries have a long history and unfortunately, little record of success in collective action. Historical examples of fisheries that have disappeared or have very diminished commercial viability include the California sardine fishery and the Pacific Northwest salmon fishery. Currently, few of the world's fisheries escape problems of overfishing, falling yields, and rising costs.[7]

B. Collective Action Problems: Heterogeneities and the Sequence of Agreements.

The losses of the common pool provide important incentives for fishermen to engage in collective

action to devise restrictions on entry and harvest, both among themselves and with politicians for regulatory policy (given the absence of private or communal property rights in the U.S.). Nevertheless as noted above, the record of collective action is not one of much success until the fishery is severely overfished. At that time, both fishermen and regulatory agencies are more able to agree to and implement transferable quota schemes. The limited exception to this conclusion occurs in a few very new fisheries where quotas have been adopted early to limit catch. Differences among fishermen according to skill, capital, and size create conflicting interests and incentives for regulating fishing. These differences limit the informal agreements that might be reached among fishermen to reduce fishing and diminish the effectiveness of fishermen as cohesive lobbyists for influencing more formal regulatory controls on access and harvest in open-access fisheries. As fish stocks, yields, and incomes have fallen, regulatory policies have been adopted, but these generally have been costly and relatively ineffective.

Differential abilities among fishermen exist according to fishing skills, which include ability to correctlj set nets and regulate their spread, ability to determine effective trawling speed, and ability to quickly locate fish before they are dispersed by the trawling of other fishermen. The effects of variation in skills are observable in persistent catch differences per unit of effort across fisherman. Because those skills are unlikely to be readily transferable assets, economic rents will be earned by better fisherman, even under open-access conditions. With the differential rents that exist among heterogeneous fishermen, some fishermen may have a stake in maintaining current conditions in the fishery and in opposing collective action if proposed changes seriously upset status quo rankings and redistribute income. Further, because of the costs of designing regulations that respect skill and catch differences, skilled fishermen have reason to be wary of regulatory change.

Accordingly, the nature of individual benefits or rental shares under the status quo, relative to that under a new arrangement achieved through collective action is a critical issue. Understandably, existing fishermen are concerned about how they will fare with restrictions on entry and catch. Those fishermen who have adapted well to existing conditions are under risk that their shares of fishery rents with any new program to control fishing will be less than they currently receive. This hazard can exist at least until the fishery is depleted. At that point, when individual catch and incomes are very low and many fishermen have left the

fishery, those that remain are more likely to see themselves as being made better off with more restrictive controls on harvest, and agreement on new regulatory initiatives is more probable. As with the case of oil fields, by that time common pool conditions will already have inflicted serious and perhaps, permanent damage.

Redistribution concerns not only affect the stands taken by fishermen in bargaining over proposed regulations, but they also affect the positions of regulatory officials who will have a stake in how the proposals affect their authority and jurisdiction. Politicians who must enact legislation regarding fishery regulation will seek policies that maximize their political support. The political influence of fishermen in this process will depend upon their numbers and cohesion as lobbyists. Differences among fishermen, as well as their traditional independence, limit their effectiveness as a political force for enacting restrictions on their own fishing practices. The likelihood of successful collective activity is greater when fishermen are seeking restrictions on their rivals or when they are attempting to obtain programs that will raise total catch or wealth without placing tight controls on individual fishing effort. In political negotiations among fishermen, politicians, and bureaucrats for regulatory policies, those programs that recognize existing share allocations or rankings of fisherman, while increasing total catch or yields, generally will have broad support. If yields can be increased through the adoption of season closures or through the construction of fish hatcheries, existing fishermen can be made better off and no divisive redistribution of catch or fishing effort need be involved.

Where restrictions on individual catch or effort are necessary as part of setting a total allowable catch for a species, which may be necessary in more depleted fisheries, incumbent, skilled fishermen will prefer a quota scheme that maintains status quo rankings. Individual quotas assigned on the basis of historical catch will therefore be popular with those fishermen because they recognize past performance and minimize redistribution. On the other hand, new entrants and young fishermen have incentive to oppose any quota schemes that recognize historical catch patterns or place restrictions on new entry. The regulations adopted will depend in part on the relative political power of the competing fishing groups, and established fisherman may have important advantages in the political process.

Another source of concern among fishermen in collective action to mitigate rent dissipation in the fishery is limited information on what the ultimate impact of regulation will be on the fish stock and on the

returns to individual fishermen. Knowledge of many fisheries is extremely limited regarding the nature and size of the stock, its relationship to the environment, the impact of harvest, and the reaction of the stock to proposed regulatory efforts. These information problems make it more difficult for fishermen to determine whether their welfare will be improved by the adoption of new regulations relative to the status quo.

The general preferences of fisherman to favor visible, yield-enhancing policies where the costs are spread among taxpayers and where more conventional distributional restrictions are avoided, frequently coincide with the interests of politicians and bureaucrats. The latter have an incentive to respond to organized interest group pressures regarding common-pool losses in fisheries, while avoiding as much as possible the disruptive distributional conflicts that may be part of more binding restrictions on harvest and access. Accordingly at least in early regulations, politicians and bureaucrats also will favor those policies that raise total yields and that minimize interference with the activities of more influential groups of fishermen. Such policies, through may leave many margins for fishery rent dissipation uncontrolled.

Policies that are likely to be supported early in fishery regulation include hatcheries; direct government subsidies and tax relief; season closures and gear restrictions to protect adolescent, lower-valued fish; **minimum** fish size requirements; and access denials to foreigners through 200-mile coastal zones or to other less-influential fishermen. Procedures that enhance the value of total catch forestall the application of more restrictive and controversial controls on access and catch. Increases in the total value of the catch will invite greater fishing by incumbent fishermen and further entry by new fishermen, intensifying competitive pressures on incomes and the stock of fish and continuing the losses of the common pool. Eventually, when conditions have so deteriorated in the fishery, more restrictive regulations will be adopted, such as total closures or the adoption of individual transferable quotas.

To illustrate the problems of heterogeneity and sequencing in fishery regulation, consider the Gulf Coast shrimp fishery (Johnson and Libecap, 1982). As discussed above, fishermen have not been able to agree on individual quota schemes and other constraints on entry and harvest, even though average catch has fallen in the fishery from its peak in 1963. Unlimited numbers of licenses have been available for both the bay and Gulf shrimp fisheries with the payment of minimal fees. The fishery has remained virtually an open-access one.

Regulations exist to increase the value of aggregate catch by protecting immature shrimp through season closures, gear restrictions, and minimum-size limits for harvesting shrimp. Shrimpers have agreed to season closures, which are designed to expand the aggregate stock and do not discriminate in access during the open season. Conflicts, however, have developed over access to particular kinds of immature shrimp. Beginning in the 1950s, two separate shrimp fisheries developed in Texas, based on the kinds of shrimp of commercial importance to each-the bay fishery that focused on white shrimp that remained as adults in the bays and the Gulf fishery that focused on adult brown shrimp that developed in the bays in the spring, but migrated as juveniles to the Gulf. Bay shrimpers have incentive to agree to seasons that protect immature white shrimp because they have access to them as adults. But they do not have the same incentive to protect immature brown shrimp, which migrate to the deep waters of the Gulf and are harvested by Gulf shrimpers.

Since brown and white shrimp tend to be in different areas in the bays, bay shrimpers can harvest them while minimizing the catch of young white shrimp. Gulf shrimpers naturally oppose this practice because it reduces the number of shrimp that make it to the Gulf. In 1959, Gulf shrimpers lobbied the Texas legislature to close the bay fishery from March 1 to July 15 to allow brown shrimp to develop and to close the Gulf from June 1 to July 15 for the same reason. Bay shrimpers opposed the spring closing of the bays and they succeeded in amending the law to allow for a limited spring season from May 15 to July 15. Nevertheless, political conflict has continued between the two groups.

Although shrimpers generally have not agreed to internal effort controls, bay shrimpers have accepted gear restrictions on **minimum** net mesh size. These regulations reinforce the effect of season closures by allowing small shrimp to escape the pull of nets. Bay shrimpers also have supported other limits on the number and size of nets that can be used in the bays. During the fall white shrimp season, only one net, 25 feet in width can be pulled by any vessel. This restriction is not designed to limit the harvest of bay shrimpers, but to reduce the incentive of larger gulf vessels to enter the bays during the fall season. By limiting the size and number of nets the larger Gulf vessels can pull, the restrictions reduce their competitive advantage over in-shore boats. There are no restrictions on the number or size of trawl nets used in the Gulf. The conflict between Gulf and bay shrimpers over the harvest of immature shrimp also has led to the imposition of individual catch

limits on bay shrimpers during the spring brown shrimp seasonal. Daily limits of 300 pounds per vessel have been assigned in the bays in the spring, but no catch restrictions are imposed for the fall bay white shrimp season or for the fall and winter brown shrimp season in the Gulf. Various possible controls on individual fishing effort have received little support, and hence, historically, there has been no collective action to seriously limit harvests in the shrimp fishery. More recently, however, as shrimp harvests have fallen even more, interest among shrimpers in individual quotas and limits on entry has grown. This mirrors practices in other fisheries, where quotas and access controls have not been adopted until stocks have been very depleted, fishermen have left the industry, and conditions have been become desperate for those who remain.

VII. An Empirical Case: Orange Marketing Orders.

A. The Common Pool Problem.

In the case of orange marketing orders, the common pool problem is not a technological one. That is, entry into the industry and the growing and harvest of oranges does not cause serious external effects on other growers, as is the case in oil extraction or fisheries. Instead, the external effects are pecuniary. Each firm's output, made to maximize firm profits, contributes to additional market supplies and potentially, to a decline in industry prices. Agriculture has been particularly sensitive to this because of fluctuating growing conditions that contribute to market gluts and shortages, easy entry, and large numbers of producers. For products like citrus, storage of fresh fruit has been limited, making the stockpiling of commodities difficult. Hence, farmers have attempted collective action to control production and the amounts of the product placed on the market at any point in time. Although this problem of industry-wide pecuniary losses from individual production decisions does not involve efficiency issues, as are found in classic common-pool cases, the collective action to address it reveals many similarities to behavior found in collective action regarding fisheries and oil fields.

Although agriculture has always encountered price fluctuations, the problem was an especially severe one in the 1930s. Between 1919 and 1933, wholesale farm prices had fallen by 67 percent, whereas over the same period non-agricultural wholesale prices had fallen by 45 percent.[8] Moreover, the fall in agricultural prices was particularly severe after 1929.[9] For oranges, nominal prices fell by 75 percent between 1930 and

1933, and the industry, led by the California Fruit Growers Exchange (CFGE), lobbied for provisions in the Agricultural Adjustment Act (AAA) for marketing agreements to control the shipment of commodities in order to raise prices. Marketing agreements for oranges were implemented December 18, 1933, among the first marketing agreements put into place. Among agricultural products, specialty crops, such as oranges, offered the greatest potential for a successful cartelization policy. There were relatively fewer growers than existed for general commodities; production was concentrated in a few isolated regions; there was a consensus among orange growers that government cartelization was necessary (established, formal cooperatives, such as the California Fruit Growers Exchange, existed to implement the marketing agreements); and oranges were a perishable crop that limited the build up of inventories that could depress prices.

Under AAA, the Secretary of Agriculture could issue a marketing agreement if fifty percent of the shippers and two-thirds of the growers in the state agreed to the provisions. The marketing agreements authorized the Secretary to limit interstate orange shipments through weekly allotments to shippers that were enforced through revokable shipping licenses and fines of $1,000 for violation. Violators were to be prosecuted by the Justice Department, and the agreements were exempted from antitrust regulations. The weekly shipping quotas were to be determined by industry boards in California and Florida, based on estimates of supply and demand consistent with targeted prices. There were provisions in the law for national prorationing of total orange shipments by region. With national prorationing, a national control commission was to be established to assign state quotas and prorate shipments among the states throughout the growing season. Excess production was to be diverted to other uses, such as by-products (livestock feed) or foreign markets.

Despite this framework, an orange cartel was not established as envisioned by the Agricultural Adjustment Act. National prorationing among the producing regions was never adopted. Further, there were sharp differences in the industry response to the marketing agreements proposed by the Secretary of Agriculture for California and Florida. California growers and shippers accepted their 1933 marketing agreement with weekly prorationing of interstate orange shipments, and although some modifications were made, the basic thrust of these regulations remained in tact through December 1992. Growers and shippers in Florida, however, rejected a 1933 marketing agreement that was virtually identical to that implemented in California. It

was terminated in 1934. Between 1934 and 1937, two other marketing agreements were executed by the Secretary of Agriculture for Florida, but terminated, before an acceptable arrangement could be devised in 1939. The final Florida marketing order did not involve prorationing of orange shipments. Instead, it relied on temporary shipping holidays and adjustable size and quality controls to limit interstate shipments. Florida never adopted weekly prorationing of orange shipments as practiced in California. Under these circumstances, orange prices did not rise to target parity levels.

B. Collective Action Problems: Heterogeneities and the Sequence of Agreements.

Throughout the summer of 1933, orange producers and shippers from California/Arizona, Florida, and Texas met with the Agricultural Adjustment Administration personnel in Washington D.C. to draft marketing agreements for their respective states and to conclude a national prorationing agreement. The representatives of the CFGE lobbied hard for national prorationing with fixed state quotas and a national price stabilization plan (national cartelization). They offered their draft marketing agreement for adoption by the Agricultural Adjustment Administration.

At the July 20, 1933 Washington meetings, California had nine delegates, Texas had nine, Arizona one, but Florida had 37 because of differences in opinion within the state as to the nature of the regulations that should be adopted.[10] Indeed, this reflected disagreement in Florida as to just what arrangement to support. The Agricultural Adjustment Administration recognized that this would be a problem for successful collective action and regulation, and to remedy it, the agency worked closely with the Florida Citrus Exchange (FCE) to adopt regulations that would force membership in the cooperative.

The Florida industry presented at least two competing draft marketing agreements, one supported by the FCE and similar to that proposed by the CFGE, and one backed by the Florida Citrus Growers Clearing House Association (FCHA). Many of the independent growers and shippers in Florida were organized under the FCHA, but they did not enter into long-term sales contracts to pool fruit as practiced by the cooperatives. The Department of Agriculture supported and ultimately adopted the draft marketing agreements proposed by the CFGE and FCE that called for the weekly prorationing of orange shipments among shippers whose quotas

would be based upon season-long contracts for fruit.[11] These long-term contracts were an integral part of the pooling agreements of the CFGE and FCE.

Importantly, independent shippers, who did not pool fruit and belong to cooperatives would not have been able to get shipping quotas under the arrangements proposed by the CFGE and the FCE. Such shippers, who were particularly prevalent in Florida, tended to engage in spot purchases of fruit and would not have had fruit under contract at the beginning of the season, when quotas were to be assigned under the marketing agreement. We analyze the effect of the prorationing rule in more detail below, but its adoption in 1933 by the Agricultural Adjustment Administration after negotiating with representatives of the California and Florida industries was an effort to require growers and shippers in Florida to join the Florida Citrus Exchange. Officials of the Department of Agriculture argued that the success of the marketing agreement depended upon broad participation in cooperative shipping pools in Florida.

Not only did the Department of Agriculture adopt a quota rule to encourage membership in the Florida Citrus Exchange, but the FCE was given a majority of the positions on the state administrative committee. Under the marketing agreement, Secretary of Agriculture Henry A. Wallace appointed the members of the Florida Control Committee that was set up to determine weekly shipping levels and to assign shipping quotas. Most of those selected were from the FCE. On the other hand, the Cahfornia/Arizona marketing agreement allowed for the election of members of the admimstrative committees for that region.

Independent shippers and growers within the FCHA, who attended the Washington meetings to draft the marketing agreements, understood the effect of the prorationing rule in requiring membership in pooling cooperatives. The department recommended that growers who were worried that their shippers would not have quotas under the prorationing rule, link up with established shippers who did. During negotiations in the fall of 1933, the FCHA demanded that the Agricultural Adjustment Administration modify its proposed marketing agreement for Florida, because it would force independents out of business.

Despite their efforts, the FCHA could not block the marketing order negotiated by the Agricultural Adjustment Administration and the FCE. Since the agency basically used the Cahfornia model for regulation, the marketing agreements imposed in the two states were virtually the same. Whereas there was substantial

consensus in California for the marketing agreements, opposition in Florida to the prorationing rule and to the Florida Control Committee appointed by the Secretary of Agriculture, meant that additional negotiations would have to take place between the agency and the industry. These negotiations subsequently led to important modification of regulation in Florida in ways that diverged from the original aims of the Agricultural Adjustment Act and of the administrative agency. Further, negotiations between the Agricultural Adjustment Administration and the Florida industry continued for the rest of the decade before a satisfactory arrangement could be devised.

Table 2 summarizes the pattern of regulation of oranges shipments under the A A A and subsequent federal legislation through 1941. Although the California marketing agreement remained in operation through 1947, in Florida the first marketing agreement was terminated in August 1934; a second was adopted in December 1934 and terminated in July 1935; a third was implemented in May 1936 and terminated in July 1937; and a fourth that remained in effect was adopted in February 1939. Negotiations over six years led ultimately to a marketing agreement without the prorationing of shipments because of disagreement over quotas. In the final agreement, shipping controls were limited to shipping holidays and adjustable grade and size restrictions. Neither of these regulations required individual quotas or membership in agricultural cooperatives.

The original marketing agreements in both California and Florida called for weekly prorationing of interstate orange shipments as set by the industry administrative committee. In Florida, there was one committee, appointed by the Secretary of Agriculture, while in California there were two committees, both elected. Quotas to individual shippers within the weekly prorate were to be set by the administrative committee. The allocation was determined by a 'prorate base' assigned to each shipper on the basis of the amount of fruit held under contract with growers at the beginning of the season. The prorate base was the shipper's fraction of total seasonal orange shipments from the state, and multiplying it times the authorized weekly total, determined each shipper's weekly quota.

This prorationing rule emphasized long-term, seasonal contracts between growers and shippers as to when fruit would be picked and shipped and the division of returns. It posed an immediate threat to independent Florida growers and shippers who relied upon short-term, spot, cash exchanges for fruit whenever

market conditions warranted. As designed by the marketing agreement, however, these transactions did not qualify for determining the shipper's prorate base. A shipper with no seasonal contracts would have a zero prorate base, and hence, receive no weekly quota. Typically, only growers and shippers who were part of seasonal pools engaged in such contracts, since pooling cooperatives like the Florida Citrus Exchange relied on long-term arrangements to manage the flow of shipments throughout the season.

Florida independent shippers and growers strongly objected to this prorationing rule that was designed to force them into pooling arrangements. They also objected to the assignment of quotas by the Florida Control Committee, appointed by the Secretary of Agriculture and dominated by the Florida Citrus Exchange. Additionally, independent growers were concerned that the prorationing rules would not sufficiently recognize differences in maturity dates, which were so important in Florida.[12] Instead of prorationing rules, the independents favored the use of shipping holidays and quality restrictions to more loosely regulate shipments to smooth prices. Shipping holidays could block all deliveries from the state for a specified period of time to alleviate temporary market gluts. Size and quality standards could be set to deny shipment of fruit that fell below the standard, and the standard could be adjusted from time to time to provide flexible restraints. Quality standards also provided some industry-wide public goods in maintaining product reputation.[13] Enforcement for both policies would involve inspection and monitoring of all deliveries across state lines, rather than insuring individual quota compliance, as was necessary under prorationing.

Because shipping holidays and quality standards generally applied across the board, the distributional consequences were less severe than those associated with the proposed allocation of quotas under the marketing order proposed by the Agricultural Adjustment Administration. Quality constraints did harm marginal growers with low-quality fruit, but those growers appeared not to be sufficiently influential to block their use. Shipping holidays typically were short enough so as not to cause serious losses. Moreover, these alternatives did not require membership in cooperatives. An example of broad-based support for shipping holidays in Florida is the February 6, 1933 call by the FCE, the FCHA, and other shippers for a six-day shipping holiday in order to raise prices.[14]

The 1933 marketing agreement was challenged in Federal District Court almost immediately in Yarnell

v Hillsborough Packing Co., 70 F.(2nd) 435. An injunction was issued against prorationing on January 18, 1934, and prorationing controls by the Florida Control Committee were temporarily halted. Although the injunction was removed in February 10, 1934 by an appellate court and the ruling was reversed by the Fifth U.S. Circuit Court of Appeals April 14, 1934, the injunction was applied at the height of the Florida orange season, and it raised uncertainty about the future of prorationing.[13] Throughout the summer and fall of 1934, members of the FCE and the FCHA corresponded with officials of the Agricultural Adjustment Administration regarding the redrafting of the marketing agreement. Each side wanted its position considered and to be assured of adequate representation on the drafting committee. A second marketing agreement was initiated December 1934. There were two minor modifications in the order, but the Department of Agriculture continued to maintain the basic prorationing framework.

Throughout 1934 and 1935 there were conflicts over the membership of the Control Committee and demands for access to its records in prorationing allocations. In the face of continued opposition, the second marketing agreement for Florida oranges was terminated July 15, 1935. A third marketing agreement was not put into place until May 1936, ten months after the termination of the second agreement and after the 1935-36 shipping season had passed. As before, the Department of Agriculture maintained prorationing of orange shipments as the primary method of regulation, and conflicts continued over the assignment of quotas and Department efforts to force membership in cooperative pools. Court challenges of the prorationing quotas continued. The third marketing agreement for Florida oranges was terminated July 31, 1937.

Over a year of negotiations between the Agricultural Adjustment Administration and the Florida industry was necessary before a final and successful marketing agreement was implemented February 22, 1939. Pooling remained relatively limited in Florida, and the new marketing order contained no quota rules or prorationing provisions. Regulation, instead, focused upon uniform grade and size restrictions and shipping holidays, the framework originally demanded by independents.

The differences between the reactions of the Florida and California industries with regard to federal marketing agreements were due to important heterogeneities in Florida production. California and Florida were by far the dominant producers of oranges, with Cahfornia accounting for 67 percent of U.S. output in 1930-31

and Florida 32 percent.[16] Oranges from both regions competed as close substitutes in the fresh fruit market. Until the late 1940s, there was no frozen concentrate or significant use of oranges in juice. Cahfornia produced two kinds of oranges: winter navels with a season of October to June and summer Valencias with a season from May through October. Florida produced at least five varieties, all during the winter season: Parson Brown and Hamlin (October-December), Homosassa and Pineapple (January-March), and Valencia (April-June). Florida growers tended to specialize in a certain variety, which often was determined by growing conditions. Storage possibilities at this time were limited, especially for Florida fruit. Because of climate conditions, Florida oranges did not store well on the tree and had to be harvested quickly in order to avoid fruit drop. In California because of relatively cool nights, oranges could be stored on the tree for up to two or three months.

Because of important differences in growing conditions and crops, most Florida growers and shippers were independents, with only about 25 percent of the state's production pooled and marketed through the Florida Citrus Exchange. In California, with more homogeneous growing conditions and output, 90 percent of the state's output was handled through the California Fruit Growers Exchange and the Mutual Orange Distributors. These differences in pooling practices were due to much more heterogeneous fruit in Florida, which raised the costs of pooling, and sharply different subseasons and corresponding price expectations among Florida growers, which reduced the incentive to engage in seasonal pools. Nevertheless, the Department of Agriculture attempted to force membership in the cooperatives through the marketing agreements. A final agreement was not reached until 1939. By that time there were reasons for concluding an agreement. Prices had not rebounded to their targeted levels, and the future of the marketing agreement effort looked bleak for the agency. Moreover, Florida growers and shippers were concerned that federal regulation would be withdrawn altogether. Finally, the Department of Agriculture agreed to change the allocation rule within the regulation to reduce potential redistribution.

VII. Concluding Remarks.

Common-pool problems, both traditional involving technological externalities and those involving pecuniary losses, provide incentives for collective action. Yet, as the empirical cases summarized in this paper

reveal, the response is often late and quite limited. Heterogeneities among the parties, including differences in information, production, cost, and size, provide obstacles for reaching agreement. In particular, the key problem in collective action is defining an acceptable allocation rule for sharing the net benefits that result. Unless influential parties are able to see their private welfare improved by collective action, they will not support it, even though there may be important social gains that everyone agrees with. Hence, in local, and likely in global commons, collective action is not apt to take place in a smooth or timely fashion when there are important heterogeneities among the bargaining parties.

Conflicts over quotas or shares in the benefits of collective action tend to diminish as the seriousness of the common-pool problem grows. As the costs of the common pool rise, they begin to overwhelm distributional concerns. More and more, the parties see themselves made better off as a result of agreement. Moreover, as common-pool costs rise, some parties leave, so that the number of bargaining agents declines. Finally, as conditions deteriorate, information asymmetries disappear, since the value of all shares under the status quo approach zero. These empirical results suggest that sequencing is critical in collective action, and for reasons perhaps not sufficiently considered previously. Sequencing is often viewed as a means of slowly building agreement through repeat contracting. Here, sequencing reveals the problem of reaching agreement in common-pool settings when parties disagree over the distribution of the gains of collective action. And these are most serious when there are important heterogeneities. If collective action can be implemented very early to address potential common-pool losses, agreement can occur because this is a time when the parties are reasonably homogeneous. Distributional conflicts are not critical. But as common-pool production begins, differences in shares and stakes in collective action appear, making agreement for institutional change difficult. This is a pessimistic result, because it means that for many local and global commons situations, effective collective action will not occur until many of the losses already have been absorbed by society.

1. The discussion here is taken from Libecap (1989, pp. 12-28).

2. See Libecap (1978).

3. Discussion of oil field unitization is drawn from Libecap (1989, pp. 93-114), Libecap and Wiggins (1984), Libecap and Wiggins (1985), and Wiggins and Libecap (1985).

4. Referenced in Libecap (1989, pp. 94-96).

5. Libecap (1989, p. 95).

6. Libecap (1989, p. 99).

7. The discussion follows from Libecap (1989, pp. 73-92) and Johnson and Libecap (1982).

8. The discussion is drawn from Hoffman and Libecap (1994).

9. U.S. Department of Commerce (1975, 199-200).

10. Citrus Leaves, August 1933, p. 20; Citrus Industry, March 1934, p. 26.

11. Citrograph, September 1933, p. 301.

12. Citrus Leaves, October 1933, pp. 3, 4, 11-20; Citrus Industry, August 1933, p. 16; November 1933, p. 6.

13. With more heterogeneous fruit, reputation was a particular concern for Florida growers with respect to their California competitors. Because Florida oranges often had traces of green in their skins, unlike the more uniformly golden California Navels, fruit was often dyed in Florida.

14. Citrus Industry, February 1933, p. 5.

15. The constitutional issues raised by Judge Akerman and the hostility to Agricultural Adjustment Act are discussed in Irons (1982, pp. 142-149).

16. Hoffman and Libecap (1994).

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TABLE 1

Unit Negotiations

Field	Negotiation Time	Final Acreage as a Share of Initial Acreage
Goldsmith/Landreth	4 years	.84
Prentice Northeast	9 years	.80
Western RKM	4 years	.30
Slaughter Estate	5 years	1.00
Empire Abo	6 years	1.00
Goldsmith/San Andres	4 years	.85

Source: Adapted from Libecap (1989, p. 103).

TABLE 2
Federal Orange Marketing Agreements

	Florida	California
	1st Marketing Agreement	1st Marketing Agreement
Time in Operation:	12/18/33 - 8/13/34	12/18/33 - 5/17/47
Shipping Proration:	Yes	Yes
Grade & Size Regulation:	Yes	No
Shipping Holiday:	No	No
National Proration:	Yes	Yes
	2nd Marketing Agreement	
Time in Operation:	12/18/34 - 7/15/35	
Shipping Proration:	Yes	
Grade & Size Regulation:	Yes	
Shipping Holiday:	No	
National Proration:	Yes	
	3rd Marketing Agreement	
Time in Operation:	5/8/36 - 7/31/37	
Shipping Proration:	Yes	
Grade Size Regulation:	Yes	
Shipping Holiday:	No	
National Proration:	N/A	
	4th Marketing Agreement	
Time in Operation:	2/22/39 - 1955	
Shipping Proration:	No	
Grade & Size Regulation	Yes	
Shipping Holiday:	Yes	
National Proration	N/A	

Source: Adapted from Hoffman and Libecap (1994).