The Effect of Institutional Setting on Behavior in Public Enterprises: Irrigation Districts in the Western States

by

John M. McDowell and Keith R. Ugone

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John M. McDowell*
Keith R. Ugone**

I. Introduction

A broad spectrum of institutional settings surrounds enterprises that supply water and electric power. For example, such enterprises may be privately or publicly owned. Private enterprises may be regulated (e.g., natural monopolies) or non-regulated. Public enterprises such as governmental units or districts may have management teams that are either appointed or elected.[1] Finally, elected management teams in public enterprises may be placed in office via popular voting schemes (e.g., one-person, one-vote) or land-based voting schemes (e.g., one vote per acre owned).[2] Figures 1 and 2 summarize these institutional settings.

The literature concerning the economic consequences of various institutional arrangements suggests a growing recognition of, and empirical support for, the proposition that alternative institutions, by establishing different cost-reward structures, lead to systematically affected economic outcomes.[3] The economic theory encompassing the various institutional

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* Assistant Professor, Department of Economics, Arizona State University. B.A. 1968, M.A. 1970, Ph.D. 1979, University of California at Los Angeles.

** Ph.D. candidate in Department of Economics, Arizona State University. B.A. 1977, University of Notre Dame; M.A. 1979, University of Southern California.

1. For the pattern in irrigation districts in particular, see, e.g., M. Goodall, J. Sullivan & T. De Young, California Water: A New Political Economy, 9-25 (1978); W. Hutchins, Summary of Irrigation—District Statutes of Western States 13-18 (U.S. Dep't of Agric. Misc. Publ. No. 103, 1931). For examples of appointed governing boards, see, e.g., Utah Code Ann. § 73-9-9 (1980) (water conservancy district directors appointed by state district court; those eligible are residents of the counties where the water district is situated who own real property in the district); *cf.* Colo. Rev. Stat. § 37-45-114 (1974) (generally follows Utah scheme but also provides for election in lieu of appointment for districts organized after 1945 upon request by at least 15% of qualified taxpaying electors of the district).

2. *See, e.g.*, M. Goodall, J. Sullivan & T. De Young, *supra* note 1.

3. *See generally* De Alessi, *An Economic Analysis of Government Ownership and Regulation: Theory and Evidence from the Electric Power Industry*, 19 Pub. Choice 1 (1974).

settings under which enterprises operate is of differing levels of sophistication and refinement. The theory of the unregulated private firm is well developed.[4] Not quite as well developed is our understanding of the operations of the regulated firm.[5] Finally, least well developed is the theory of public enterprises whose management teams are elected under different institutional (voting) arrangements. A primary purpose of this paper is, in the context of water districts, to fill this gap and provide a theoretical foundation for empirical analysis of the policies of government enterprises whose management teams are elected under different voting arrangements.

Figure 1

Institutional Setting of the Firm

- enterprise
  - private
    - regulated
    - non-regulated
  - public
    - appointed management
    - elected management
      - popular vote
      - land-based vote

Figure 2

Voting Schemes

Acreage Voting Schemes	Popular Voting Schemes
1. one vote per acre	1. one person - one vote
2. one vote per dollar valuation	2. one vote per landowner

After establishing a theoretical foundation for analyzing the behavior of water districts according to institutional setting, this paper addresses a variety of questions. For example, do water districts whose boards of directors are elected on an acreage voting basis have pricing policies different from water districts whose boards are elected on a popular voting

4. *See generally* R. MILLER, INTERMEDIATE MICROECONOMICS: THEORY, ISSUES, AND APPLICATIONS (1978).

5. *See generally* Aranson & Ordeshook, *Regulation, Redistribution, and Public Choice*, 37 PUB. CHOICE 69 (1981); Posner, *Theories of Economic Regulation*, 5 BELL J. ECON. AND MGMT. SCI. 335 (1974); Stigler, *Theory of Economic Regulation*, 2 BELL J. ECON. AND MGMT. SCI. 3 (1971); Stigler & Friedland, *What Can Regulators Regulate? The Case of Electricity*, 5 J. L. & ECON. 1 (1962).

scheme? Do irrigation districts that provide electric power undertake pricing policies different from those that do not and, if so, is this difference the result of their institutional setting?

Section II establishes a model by which these issues can be theoretically analyzed while Section III provides descriptive support for the model. Section IV develops empirical models to help determine the factors—in addition to institutional setting—that bear on the finances and expenses of water districts. Finally, Section V presents a summary and concluding comments.

II. A Voting Model of Pricing Behavior in Public Enterprises

Peltzman's theory of pricing in public and private enterprises provides a theoretical analysis of the effect of voting schemes on policy behavior in irrigation districts.[6] Peltzman developed an "empirically verified theory of the effect of ownership on the behavior of enterprises."[7] Specifically, he found that pricing policies in public enterprises were very different from pricing policies in private enterprises. The underlying theory is that in public enterprises prices can be used to benefit a group of voters who will in return provide political support for the regulator, government manager, or government agency.[8] If Peltzman has indeed developed a viable general theory of pricing behavior in public enterprises, his theory should be amenable to extension from public enterprises whose managers are appointed to public enterprises whose managers are elected under different institutional settings.

A. *The General Model*

According to Peltzman's model, "an important object of utility to the management of government enterprises, one for which they are willing to trade owner wealth, is the maintenance of political support for the enterprise and for the continued tenure of managers."[9] Simply, a manager—subject to certain costs—wants to maximize political support and tenure of management. He can do this by employing pricing policies as a mechanism to confer benefits on "voter-consumers" through a redistribution of wealth in exchange for effective political support.

Consider a case where a public enterprise serves two distinct groups of

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6. Peltzman, *Pricing in Public and Private Enterprises: Electric Utilities in the United States*, 14 J. L. & Econ. 109 (1971).

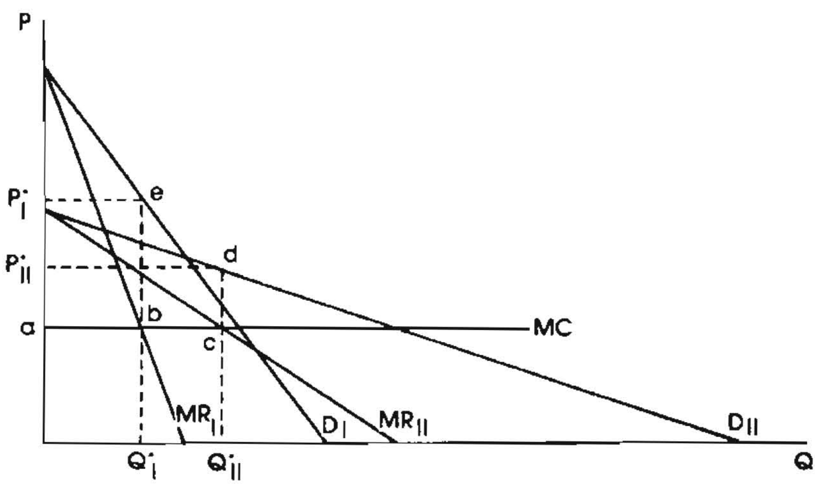
7. *Id.* at 110.

8. *Id.* at 112.

9. *Id.*

consumers, group I and group II. If this public enterprise were a discriminating monopolist facing a set of cost and demand curves, management would maximize profits by equating the marginal revenue from the last unit sold with the marginal cost of the last unit sold, charging the appropriate price to each of the different groups.[10] Figure 3 provides an example. Assume the discriminating monopolist faces a demand curve of D_I from group I and D_{II} from group II.[11] For simplicity, marginal costs are assumed to be constant (i.e., do not vary as additional units are produced) and the same for serving each of the two groups. The monopolist equates marginal revenue with marginal cost for each group individually[12] to determine the profit maximizing quantity to sell to each group—Q^*_I to group I and Q^*_{II} to group II. The appropriate demand curves then indicate to the discriminating monopolist the average price to charge for the quantities sold to each group—P^*_I to group I and P^*_{II} to group II. A lower price is charged group II compared to group I since group II's responsiveness to a change in price is relatively greater than group I's.[13] The discriminating monopolist consequently maximizes profits at a level of $\pi = P^*_I eba + P^*_{II} dca$ —the excess of total revenues over total costs.

Figure 3



10. *See generally* G. STIGLER, THE THEORY OF PRICE, 195-215 (3d ed. 1966).

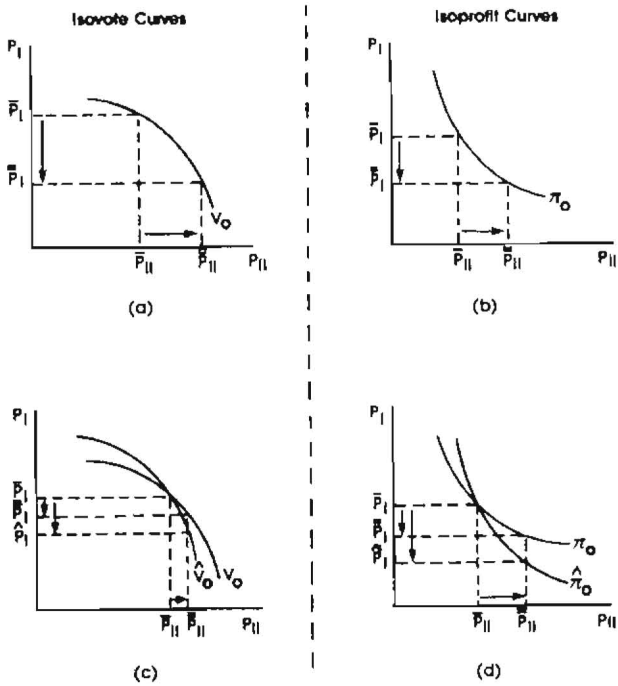
11. Demand curves provide information concerning the average price consumers are willing to pay for various quantities purchased in the market. Marginal revenue is defined as the increment added to a firm's total revenues when an additional unit is sold and is denoted by MR_I (corresponding to D_I) for group I and MR_{II} (corresponding to D_{II}) for group II. Marginal cost (MC) is defined to be the increment added to a firm's total cost from an additional unit produced. For a discussion of the concept "marginal," see J. HIRSHLEIFER, PRICE THEORY AND APPLICATIONS, 38-74 (1st ed. 1976).

12. *See* J. HENDERSON & R. QUANDT, MICROECONOMIC THEORY, 215-18 (2d ed. 1971).

13. *See* J. HIRSHLEIFER, *supra* note 11, at 113-124.

The government manager, however, realizes he can trade profits for votes in the sense that his political support will increase at a decreasing rate as the price he charges the various groups decreases.[14] The tools necessary to make predictive statements relevant to the vote/profit tradeoff are "isovote" curves and "isoprofit" curves.[15] Isovote curves (V_i) are defined by the infinite number of corresponding P_I and P_{II} price combinations that lead to a constant number of supporting votes (Figure 4a). For example, a government manager would not lose any political support by increasing P_{II} from $\bar{P}_{II}$ to $\bar{\bar{P}}_{II}$ if at the same time he decreased P_I from $\bar{P}_I$ to $\bar{\bar{P}}_I$, provided the votes gained by decreasing P_I just cancelled the votes lost by increasing P_{II} (i.e., moving along V_0).[16]

Figure 4



14. This is because, according to Peltzman, "the relevant utility increments from a price cut diminish. Therefore, the lower the initial price to one group the fewer votes gained by a given price decrease to that group." Peltzman, *supra* note 6, at 115.

15. *Id.*

16. "Isovote" curves are concave to the origin because, as prices are decreased to a particular group, political support from the group increases at a decreasing rate. Similarly, as prices are increased to the other group, political support decreases at an increasing rate. *See supra* note 14 and accompanying text.

Isoprofit curves (π_i) are defined by the infinite number of corresponding P_I and P_{II} price combinations that lead to a constant profit level for the public enterprise (Figure 4b).[17] One possible scenario for keeping profit levels constant could entail increasing P_{II} from $\bar{P}_{II}$ to $\bar{\bar{P}}_{II}$ while at the same time decreasing P_I from $\bar{P}_I$ to $\bar{\bar{P}}_I$, provided the profits gained by increasing P_{II} just cancelled the profits lost by decreasing P_I (i.e., moving along π_0). A family of isovote and isoprofit curves exists, one for each particular vote or profit level. Voter support levels increase as isovote curves move in a southwesterly direction; profit levels increase as isoprofit curves move in a northeasterly direction.

The relative steepness of the isovote and isoprofit curves depends on the size of the groups in question.[18] For example, if group II is large relative to group I, the isovote curves will be relatively steep, and would resemble $\hat{V}_0$ more than $\hat{V}_0$ (Figure 4c). The reasons for this is that if group II is very large relative to group I, for any given increase in the price charged group II, it will take a larger decrease in the price charged group I to gain the same number of votes lost by the P_{II} price increase—and remain on the same isovote curve. Hence, if group II is large relative to group I, an increase in P_{II} from $\bar{P}_{II}$ to $\bar{\bar{P}}_{II}$ will necessitate a larger decrease in P_I, from $\bar{P}_I$ to $\hat{P}_I$, just to remain on $\hat{V}_0$. Similarly for isoprofit curves, if group II is large relative to group I, a small increase in P_{II} from $\bar{P}_{II}$ to $\bar{\bar{P}}_{II}$ will generate large revenues which can only be offset with a large decrease in P_I, from $\bar{P}_I$ to $\hat{P}_I$ rather than from $\bar{P}_I$ to $\bar{\bar{P}}_I$ (Figure 4d).

Since the public enterprise manager should realize that he can trade profits for votes by charging one or both groups a price below the discriminating monopolist's profit-maximizing price, presumably he will minimize the profits sacrificed to achieve a majority of votes or, conversely, maximize the number of votes received for a given level of profits sacrificed—the solutions are identical at an optimum.[19] Once given the necessary sacrifice in profits to attain the desired political support, the government manager maximizes his political support by setting the ratio of "marginal votes gained from a price reduction to the marginal dollar loss from a price reduction" equal for both consumer groups.[20] This occurs at a tangency between the isovote and isoprofit curves. Hence in Figure 5 if political support of V_4 is desired, (π^*-π_1) profits will be sacrificed,

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17. Isoprofit curves are convex to the origin because, according to Peltzman, "profits decrease more for a given price reduction (and require a larger compensating price increase to the other group) the farther the price is from its profit maximizing level." Peltzman, *supra* note 6, at 115.

18. Peltzman, *supra* note 6, at 118.

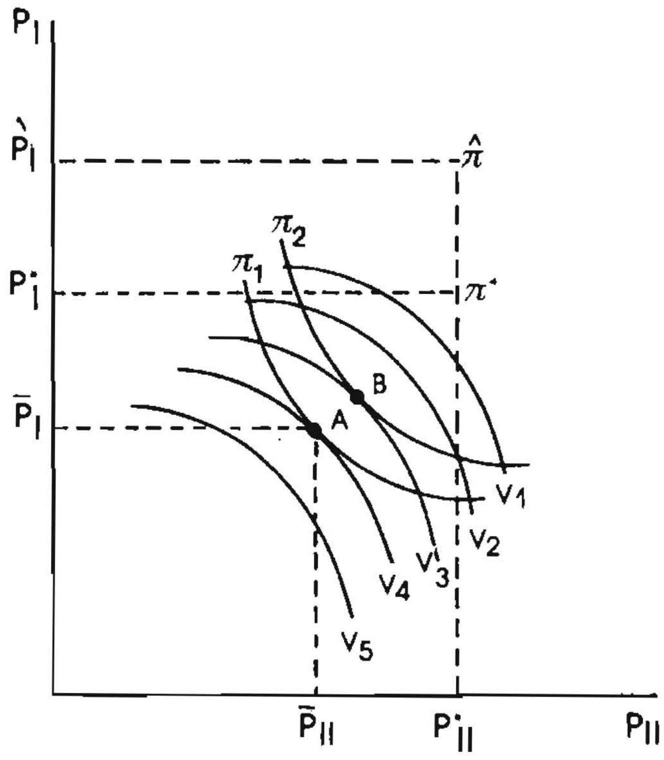
19. *See generally* A. CHIANG, FUNDAMENTAL METHODS OF MATHEMATICAL ECONOMICS 373-424 (2d ed. 1974).

20. Peltzman, *supra* note 6, at 119.

a tangency will occur at point A, and prices of $\bar{P}_I$ and $\bar{P}_{II}$ will be charged groups I and II—maximizing political support given this particular sacrifice in profits.

Peltzman's model immediately lends itself to testable implications. For example, assume that the costs of serving group I increase while the costs of serving group II remain the same. The profit-maximizing discriminating monopolist will still equate marginal revenue with marginal cost for each group. Hence to achieve the profit maximizing level of profits, the discriminating monopolist would charge a higher price to group I, since the costs of serving this group have increased. The monopolist will continue to charge the same price to group II, since the costs of serving it have not increased. The result is that in Figure 5 the discriminating monopolist would charge $\hat{P}_I$ to group I, P^*_{II} to group II, and maximize profits at $\hat{\pi}$.

Figure 5



According to Peltzman, the government manager of a public enterprise would not behave in this way. Given that the government manager is still willing to sacrifice only $(\pi^{*}\text{-}\pi_1) = (\hat{\pi}\text{-}\pi_2)$ profits, he would maximize political support not by charging the combination of prices $\dot{P}_I$ and P^{*}_{II}, but rather the combination of prices that correspond to point B in Figure 5.[21] In other words, there is a leveling effect in the sense that group II will share in the price increase even though the costs of serving this group have not increased, and group I will incur a price increase that is smaller than what would have been without this leveling effect. Group II is in a sense subsidizing group I.

Thus, two of the many testable implications of this model are:[22]

> a. the prices charged by government enterprises to different groups tend to be more highly correlated with each other than the prices charged by private enterprises to different groups.
>
> b. government enterprises place less importance on the particular costs of serving a customer group than private enterprises in determining the price to charge for that group.

B. The Extended Model

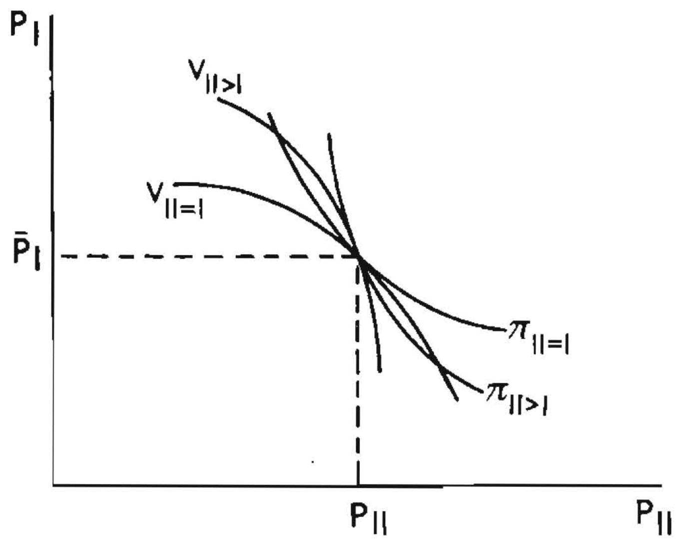
An additional implication of the model described above is that the size of the customer groups within the benefited coalition will not affect relative prices[23]—i.e., the price charged group I relative to the price charged group II. The reason for this is that if one group is very large compared to the other group, in the sense of providing proportionately more of both aggregate revenues and political support, the steepness of both the isovote and isoprofit curves will be affected in such a way that the relative prices charged may not change. For example, if group II is large relative to group I, both the isovote and isoprofit curves will become relatively more steep.

This point is illustrated in Figure 6. Groups I and II are assumed to be of the same relative size in the set of isovote and isoprofit curves labeled $V_{II=I}$ and $\pi_{II=I}$. When group II is assumed to be proportionately larger in both political and revenue support than group I, the relevant isovote and isoprofit curves become $V_{II>I}$ and $\pi_{II>I}$. Thus, when the government manager now maximizes political support subject to a given sacrifice in profits, the net effect is that even though group II is large relative to

21. *Id.* at 117.
22. *Id.* at 117-118.
23. *Id.* at 118.

group I, the prices charged to each group may be the same as if the groups were of equal size.

Figure 6



The above conclusion is true when the large group is large in the sense of providing proportionately more of both aggregate revenues and political support. This conclusion is generally not true, however, if one group is large in providing revenues while the other group is large in providing political support. In order to incorporate this later case, it is necessary to extend Peltzman's model to account for the possibility that managers of public enterprises may be placed in office under different institutional settings. For example, one type of irrigation district may elect its board of directors according to an acreage voting scheme while another irrigation district elects its board of directors according to a popular voting scheme. Once the model is extended to account for this, it predicts that these two types of districts will engage in different pricing policies.

In acreage voting basis irrigation districts that supply only water, revenue contributions, and political support may be expected to be roughly proportional.[24] Large landowners have more votes, but also receive more water than small landowners. Hence, the theoretical implication is that both the isovote and isoprofit curves would be of the same relative steepness—for example $V_{II>I}$ and $\pi_{II>I}$ in Figure 6. The acreage voting basis case thus fits nicely into Peltzman's theoretical prediction that the size of the customer groups within the benefited coalition will not affect relative prices. The same cannot, however, be said of all one vote per landowner districts. This is illustrated in Figure 7.

Figure 7 allows for the fact that political and revenue support may not be proportional. As noted, when one group is large in both political and revenue support, both the isovote and isoprofit curves become steep; consequently, relative prices are not affected. But, if group II is large in political support only, and group I is large in revenue contributions only, the net effect is that the isovote curves become relatively steep while the isoprofit curves become relatively flat. Thus, in one vote per landowner districts with a large number of small farms and a small number of large farms, the small landowners will be large in political support while the few large landowners may be large in revenue contributions. If small landowners hold the political power (yielding $V_{II>I}$ in Figure 7), while large landowners make the largest revenue contributions (yielding $\pi_{II<I}$ in Figure 7), the net result is that we would expect the pricing policies in one vote per landowner districts to be very different from the pricing policies in acreage voting basis districts. Specifically, as Figure 7 shows, we should expect the ratio of the price of water to large landowners (group I) relative to the price of water to small landowners (group II) to be larger in one vote per landowner districts than in acreage voting basis districts, i.e.,

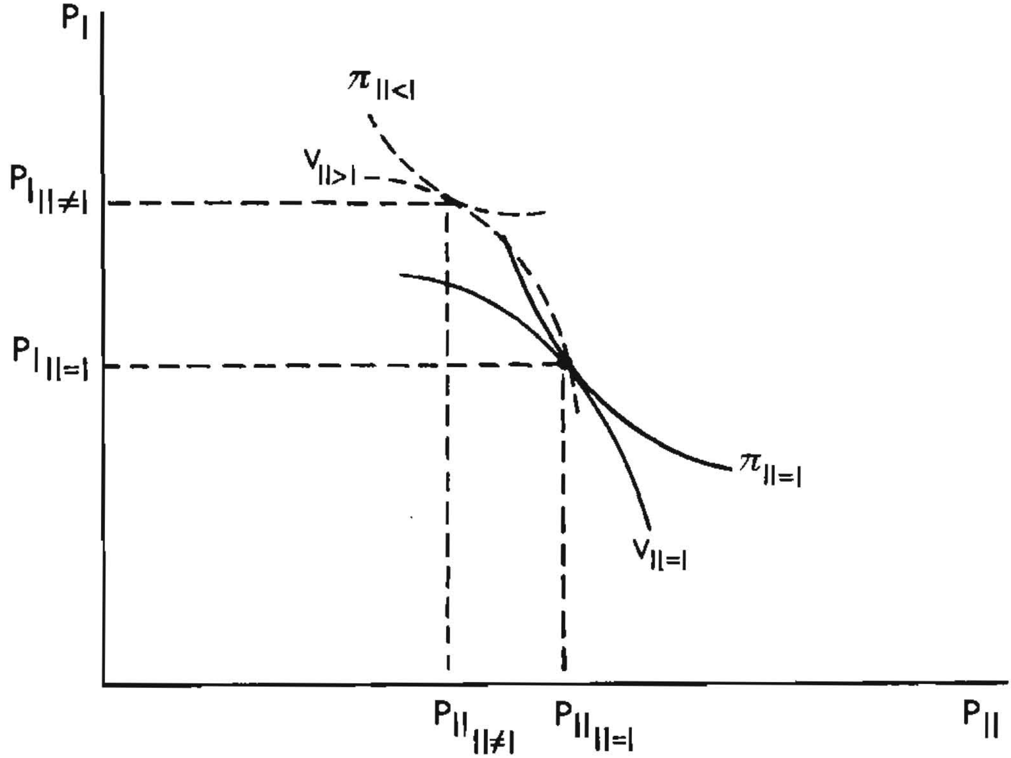
$$\left(\frac{P_I}{P_{II}}\right)_{OV/L} > \left(\frac{P_I}{P_{II}}\right)_{AVB.}$$

Hence, pricing policies in irrigation districts that provide water only should be sensitive to the institutional setting under which the district was formed.

There are other examples where one group is large in providing revenues while another group is large in providing political support. In land-based institutional settings, urban landowners may contribute substantial revenues and yet have very little political power. Another example is the acreage voting basis irrigation districts that also provide electric power;

24. This assumes that all acreage owned is irrigated or that votes are distributed on the basis of irrigated acreage.

Figure 7



for example, the Salt River Project. Large landowners and water users provide substantial political support but little revenue support, while electric power users may provide large revenue support but little political support.[25] A third and more general case is the class of irrigation districts that also provide electric power to many customers in relatively small quantities (e.g., residential consumers)—regardless of institutional setting. Due to the costs of forming an effective and influential political coalition for a widely dispersed group, and the relative smallness of net gains when spread over the entire group, electric power users would be large in

25. *See, e.g.*, C. Smith, The Salt River Project: A Case Study in Cultural Adaptation to an Urbanizing Community 47-56 (1972).

revenue contributions to the district but small in terms of political influence.[26] Conversely, the gains to water users, such as the benefits of lower service charges, are likely to be high as compared to the costs involved in forming an effective political coalition in order to obtain these benefits. Therefore, one would expect water users to be large in political support, although small in revenue contributions.[27]

Consider the case of an irrigation district that also provides electric power to many relatively small consumers. Electric power users may provide the majority of revenues—corresponding to group I in Figure 7—and little political support because of the costs and benefits of organizing as previously explained. Water users or landowners may hold the political clout—corresponding to group II in Figure 7. Therefore, the pricing policies of public enterprises that exhibit this revenue and political clout distinction will be very different from the pricing policies of public enterprises that do not exhibit this distinction. Specifically, as Figure 7 implies, the ratio of the price of electricity to electric power users relative to the price of water to water users will be larger in public enterprises where this revenue and political power distinction exists, i.e.,

$$\left(\frac{P_{elec.}}{P_{water}}\right)_{\text{groups distinguishable}} > \left(\frac{P_{elec.}}{P_{water}}\right)_{\text{groups not distinguishable.}}$$

In the case described immediately above, it is noteworthy that this pricing policy may exist regardless of the institutional setting under which the district is formed. That is, in all cases where an irrigation district provides both water and power, but the power is distributed more widely in smaller quantities than the water, power operations may be expected to subsidize the water operations. The magnitude of the subsidy would, however, depend upon the interaction of institutional setting and the costs and benefits of establishing effective political coalitions.[28] For example, where the costs and benefits involved for different groups to establish effective political coalitions are equal, one might expect the price of electricity relative to the price of water to be greater in acreage voting basis districts than

26. *See generally* Peltzman, *Toward a More General Theory of Regulation*, 19 J. L. & ECON. 211 (1976).

27. This assumes that agricultural irrigators use relatively more water but less power than an urban dweller and that a district that provides power and water is serving most of its water to a relatively few farmers and most of its power to numerous small individual customers. It is possible, however, for a district to serve water and power to the same group of farmers.

28. In our model this would manifest itself in the relative slopes of the isovote and isoprofit curves across institutional settings.

popular voting districts. The assumption would be that irrigators have more political clout relative to electric power users in acreage voting basis districts than in popular voting districts, since power consumption tends not to be tied as directly to the amount of acreage owned as does water consumption.

III. Descriptive Analysis of Water Districts

This section examines empirical data derived from a survey sample of water districts to see if support for the theory developed above exists. Section IIIA will look at irrigation and drainage districts in Arizona and show that within these districts a pricing device exists whereby one group may be able to subsidize another group. Section IIIB will analyze irrigation districts in the western states in general, and present evidence of where the potential for one group to subsidize another group exists.

A. Pricing Policies of Arizona Irrigation Districts

Arizona irrigation districts that provide only water can be divided into those that elect their boards of directors on an acreage voting basis and those that elect their boards of directors on a one vote per landowner scheme. Therefore, Arizona provides a perfect arena for testing the predictive statements of the model outlined above. To test this model, a sample size of fifteen districts was selected—eight acreage voting basis districts and seven one vote per landowner districts.[29] The major question is whether pricing policies of these two categories of districts correspond to the suggestions of the theoretical model.

As previously stated, the extended model predicts that the price of water to large farms relative to the price of water to small farms should be greater in one vote per landowner districts than in acreage voting basis districts. Stated more generally, when revenue support and political support can be separated in an irrigation district—as in one vote per landowner districts—the group providing the revenue support will be charged a higher price, and the group providing the political support will be charged a lower price, than when these groups are not distinguishable—as in acreage voting basis districts.[30]

The price of water per acre-foot per acre was calculated for one to four

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29. A listing of 42 irrigation and drainage districts was obtained from the document K. De Cook, J. Emel, S. Mack & M. Bradley, Water Service Organizations in Arizona (Water Resources Research Center, College of Earth Sciences, University of Arizona, 1978, rev. 1980). Districts were excluded from our sample if they were inactive, owned no facilities, did not deliver water, provided insufficient information in a phone survey, or provided very little agricultural water (see Appendix A).

30. *See supra* Figure 7 and accompanying text.

acre-feet per acre for each of the fifteen districts.[31] The results are reported in Table 1 and are shown graphically in Figure 8. Simple averages for the price of water indicate that acreage voting basis districts seem to

Table 1

Agricultural Average Price of water/ac-ft/acre
Irrigation and Drainage Districts in Arizona
(1979)

Acreage Voting Basic Districts*	1 ac-ft/ac	2 ac-ft/ac	3 ac-ft/ac	4 ac-ft/ac
#1	55.00	40.00	35.00	32.50
#2	33.75	33.75	33.75	33.75
#3	28.50	18.25	17.50	17.13
#4	27.50	22.75	21.17	20.38
#5	22.00	17.00	15.33	14.50
#6	19.00	9.50	6.33	4.75
#7	16.50	16.50	16.50	16.50
#8	6.75	6.00	5.75	5.63
Simple Average	26.13	20.47	18.92	18.14

One-Vote Landowner Districts*	1 ac-ft/ac	2 ac-ft/ac	3 ac-ft/ac	4 ac-ft/ac
#1	30.90	15.45	10.40	7.73
#2	26.46	13.23	8.82	6.62
#3	18.00	9.00	6.00	4.50
#4	17.50	8.75	6.33	5.63
#5	15.00	7.50	5.00	3.75
#6	13.67	9.34	7.89	7.17
#7	8.00	4.00	--	--
Simple Average	18.50	9.61	7.39	5.90

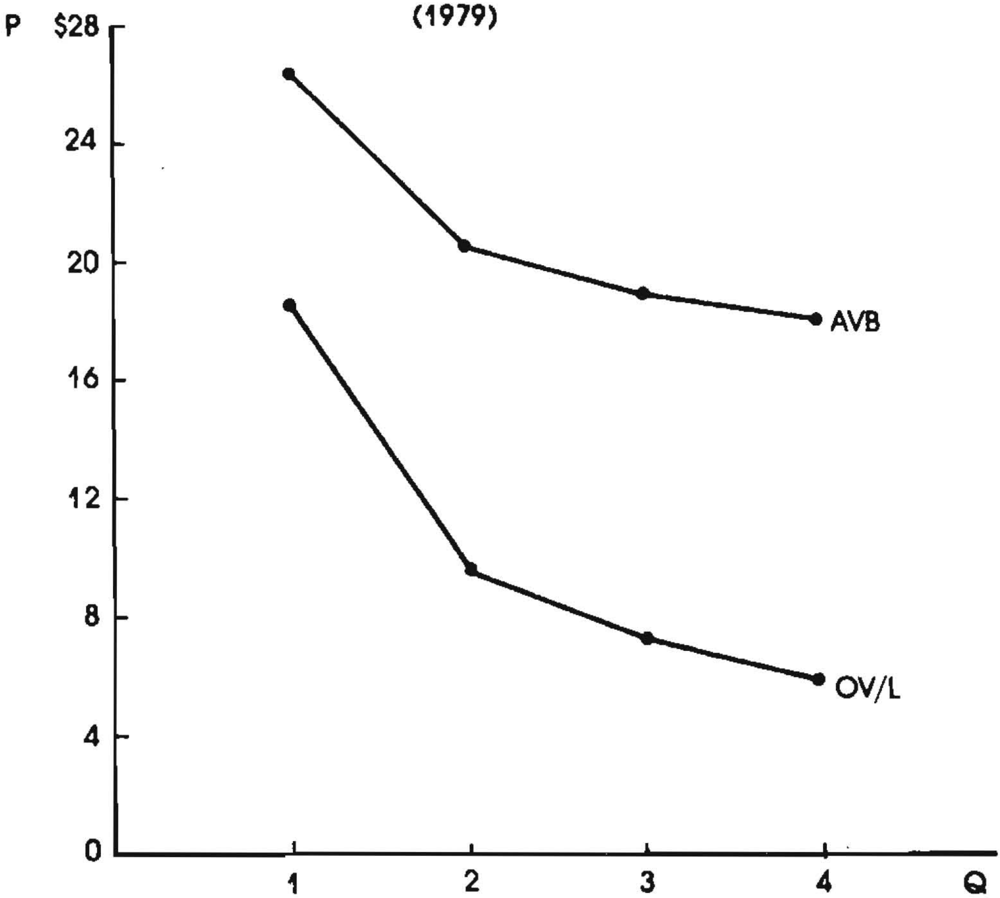
*Arranged according to average price for the first acre-foot of water per acre. The order of districts in this listing does not correspond in any way with the listing of districts in Appendix A.

31. This information was gathered in a phone survey in which the districts were asked a series of standardized questions ranging from general district characteristics to more specific financial questions.

charge more for water than one vote per landowner districts.[32] On the surface, this evidence seems to not substantiate the theory that large landowners would in some sense be paying more for water in one vote per

Figure 8

Agricultural Average Price of Water/ac-ft/acre (1979)



landowner districts relative to small landowners. Since economic tendencies are often along more subtle lines, it is possible that these tendencies

32. The cost of providing water is not the same for all districts. For instance, costs depend on whether water is pumped groundwater (and therefore more influenced by electricity costs) or stored surface water, topography, distances delivered, whether the storage and delivery facilities are federally subsidized under the reclamation program, and how long ago the facilities were built. Since no attempt has been made to account for all these factors which influence cost, it is very difficult to compare the cost or price in one district versus another. It may be, in other words, that AVB districts have higher costs to get water than OV/L districts, which may explain the evidence presented in Figure 8.

may be manifested in other ways. Examination of the various components of a district's water revenues provides an explanation.

Many districts not only charge per acre-foot of water actually delivered, but also charge a per acre assessment independent of water usage. The average price of water would then be the total acre-foot charges paid plus the total per acre assessments paid, all divided by the quantity of water used, i.e.,

$$\text{average price of water} = \frac{\text{acre-foot charges} + \text{per acre assessments}}{\text{acre-feet}}.$$

Districts that collect a higher proportion of their revenues from per acre assessments receive the majority of their revenue support from large farms relative to small farms. This indicates that the predictions of the model may be empirically manifested in the types of charges used in the different districts. As Table 2 shows, acreage voting basis districts generally charge a per acre assessment plus a per acre-foot charge for water actually used. One vote per landowner districts, on the other hand, tend to charge a per acre assessment only, with no per acre-foot charge. This evidence indirectly supports the implications of the model. When revenue generation and political power are not proportional—as in one vote per landowner voting schemes—then the price charged for water services to large landowners relative to the price of water to small landowners could be greater than in acreage voting districts. These Arizona districts manifest this in the type of water pricing schedule used, where because of the types of charges levied by the two types of districts (holding all other factors constant), the revenue contribution to total revenue from large landowners may be greater in one-vote per landowner districts than in acreage voting basis districts.[33] Conversely, the revenue contributions to total revenue from small landowners may be smaller in one vote per landowner districts than in acreage voting basis districts. Hence, in one-vote per landowner districts (relative to acreage voting basis districts) a device exists by which the large landowners may be subsidizing the small landowners.

33. Whether a subsidy of one group by another actually occurs cannot be conclusively tested with the limited amount of information available for this study. It must therefore be emphasized that the pricing device discussed only indicates the potential for one group to subsidize another group. In one study of the Westlands Water District, a district that operates in an acreage basis institutional setting, J. JAMIESON, S. SONENBLUM, W. HIRSCH, M. GOODALL & H. JAFFE, SOME POLITICAL AND ECONOMIC ASPECTS OF MANAGING CALIFORNIA WATER DISTRICTS (1974), the authors found no "evidence that the structure of water tolls and land assessments established by the board favors the large landowner group, or, for that matter, any particular landowner group . . . ." *Id.* at 277.

Table 2
Pricing Scheme
Irrigation and Drainage Districts in Arizona

Acreage Voting Basis Districts	per individual ac-ft charge (in 1-4 range)	per acre charge
#1	yes	yes
#2	yes	N.A.[1]
#3	yes	yes
#4	yes	yes
#5	yes	yes
#6	no	yes
#7	yes	N.A.[1]
#8	yes	yes
One Vote/Landowner Districts	**per individual ac-ft charge (in 1-4 range)**	**per acre charge**
#1	no	yes
#2	no	yes
#3	no	yes
#4	yes[2]	N.A.[1]
#5	no	yes
#6	no	yes
#7	no	yes

[1]The person contacted in the phone survey was either unable to provide information concerning per acre charges or commented that taxes were paid directly to the county and therefore they were not able to furnish this information.

[2]For this district the individual per acre-foot charge starts with the third acre-foot.

B. A Sample of Special Districts Across the West

To further test the model, data gathered from the Bureau of the Census' periodic survey of special governmental districts throughout the West were examined.[34] To substantiate the theory previously developed it is

34. The data, summarized in Appendix B, was taken from U.S. DEP'T OF COMMERCE, CENSUS OF GOVERNMENTS: GOVERNMENT FINANCES, for the years 1957, 1967, 1972, 1977, in which such data as total revenues, current charges, property taxes, and total expenditures for special districts are reported. Included in the category special districts are irrigation districts; hence, although limited, Finances of Special Districts is a valuable source of information. It provides an overall picture of the finances of irrigation districts, but it is limited in that it does not show direct per acre-foot pricing data or water delivery data. Appendix B gives a listing of the usable observations of irrigation districts according to how the district's Board of Directors are placed in office and the years in which the districts appeared in the document. To provide usable information a district had to meet certain size

necessary to determine where these districts obtain their operating revenues. As previously stated, when revenue support and political support can be separated in a district, the group providing the revenue support will be charged a higher price, and the group providing the political support will be charged a lower price than when these groups are not distinguishable.[35]

The districts sampled from the Census compilation, like the Arizona districts, often not only assess per acre-foot water charges, but also have the power to levy taxes or assessments. In such situations, the average price of water is the total acre-foot charges paid plus the total property taxes paid to the district, all divided by the quantity of water used, i.e.,

$$\text{average price of water} = \frac{\text{acre-foot charges} + \text{property taxes}}{\text{acre-feet used}}.$$

Therefore, to the extent that districts obtain a significant portion of their revenues from property taxes, they have a device for increasing the percentage of total revenue received from large landowners or owners of highly valued land. One-vote per landowner districts might be expected to obtain a higher percentage of their revenues from property taxes than do acreage voting basis districts. Conversely, acreage voting basis districts would be expected to obtain a greater proportion of their revenues from water charges than do one-vote per landowner districts.

The evidence presented in Table 3 substantiates the model's predictions. One-vote per landowner districts obtain 28.6% of their operating revenues from property taxes whereas acreage voting basis districts obtain only 9.0% of their revenues from property taxes.[36] Conversely, acreage voting basis districts obtain 91.0% of their operating revenues from water charges whereas one-vote per landowner districts obtain only 71.4% of their revenues from water charges. Again, large landowners in one-vote per landowner districts contribute revenues to the irrigation district via a device which allows for the subsidization of small landowners.

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criteria, not be purely a water wholesaler, and not provide other services such as electric power.

35. *See supra* Section IIB.

36. The averages in Table 3 were calculated in the following manner (using the current charges column as an example): the simple average figures equal the mean of the percentages of each of the individual districts. The weighted average figures were calculated by dividing the sum of all current charges of a particular grouping by the sum of all operating revenues for the same grouping. In the figures for the years grouped (1957-1977), all data were placed in terms of the purchasing power of the dollar in 1977 using the GNP Deflator reported in Economic Report of the President, 206 (1980).

Table 3
Sources of Operating Revenues in a Sample of Irrigation Districts

Type of District	Sample Size	Current Charges Percent of Operating Revenues		Property Taxes Percent of Operating Revenues	
		Simple Average	Weighted Average	Simple Average	Weighted Average
Acreage Voting Basis					
1977	4	89.33%	94.57%	10.67%	5.43%
1972	4	84.59	94.61	15.41	5.39
1967	6	83.65	87.13	16.35	12.87
1957	5	84.33	80.23	15.67	19.77
Years Grouped ('57-'77)	19	85.22	91.03	14.78	8.97
Popular					
1977	7	72.38	67.93	27.62	32.07
1972	8	81.96	81.10	18.04	18.90
1967	12	75.46	65.35	24.54	34.65
1957	10	75.83	77.48	24.17	22.52
Years Grouped ('57-'77)	37	76.38	71.39	23.62	28.61

IV. EMPIRICAL ANALYSIS OF WATER DISTRICT OPERATIONS

This study is based upon data gathered from a mail and telephone survey, which ultimately produced a sample of twenty-four districts suitable for extensive analysis.[37] Section IVA provides a summary description of the districts included in the sample and then examines how rates of return on district operations vary among the various types of districts.[38] Section IVB provides a more in-depth analysis of the water operations in the various districts. Empirical analysis is provided to ascertain whether such factors as institutional setting and the joint provision of water and power affect costs, revenues, and rates of return in water operations.

A. *Summary Characteristics of District Operations*

Table 4 provides a summary description of the districts included in the sample.[39] Districts are classified by the type of institutional setting as well as by type of primary functions performed. Thirteen of the districts operate within one-person (or one landowner), one-vote institutional arrangements (POP), four districts have appointed directorships (APP), and the remaining six districts are classified as operating within an acreage-weighted voting institutional setting (AVB). Within each institutional classification, water districts are further distinguished by the primary function of the district: "Non-Electric" if the district does not provide both electric power and water delivery services; "Irrigation Only" if the district serves only the function of providing water; or "Electric" if the district provides both electric power and water delivery services. The three districts that do not provide electric power, but are not classified as "Irrigation Only," have either sewage or flood control services as a primary

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37. For the names of the districts included in our sample refer to Appendix C. 81 districts were selected for the initial mail survey. The districts were selected from the listing of water districts provided in the following publications: (1) UNITED STATES DEPARTMENT OF THE INTERIOR, FEDERAL RECLAMATION PROJECTS WATER & LAND RESOURCE ACCOMPLISHMENTS: 1978 PROJECT DATA STATISTICAL APPENDIX III, iii-iv, and (2) CENSUS OF GOVERNMENTS, *supra* note 34. Our sample does not include water districts whose primary function is to deliver wholesale water only, or districts that deliver very little water at all. This latter restriction is necessary because small districts generally have inadequate information concerning their operations to allow their inclusion in our analysis. Of the 81 districts selected for the initial mail survey, 49 ultimately responded by providing some information. Only 24 districts, however, provided sufficient information to be incorporated in our analysis of water district operations. This information consisted of district annual report data supplemented by data gathered in a subsequent phone survey.

38. Districts are classified by type of institutional setting as well as by primary functions performed.

39. Because information on the size of the utility plant was not available, the Northern Colorado Water Conservancy District is not included in the summary data provided in Table 4.

Table 4
Summary Description of Water Delivery, Rate of Return on Total Operations, and Average Price of Water in Surveyed Water Districts
(1979)

		WATDEL	NETREV ÷ PLANT		NETINC ÷ TOTASS		WATREV ÷ WATDEL		WATOR ÷ WATDEL	
	n	S.A.	S.A.	W.A.	S.A.	W.A.	S.A.	W.A.	S.A.	W.A.
POP										
Non-Electric	8	86,320	(1.25)	2.11	0.33	1.71	120.98	64.90	133.24	70.40
Irrigation Only	5	67,637	(0.56)	0.25	(2.88)	1.77	136.91	47.56	156.06	57.74
Electric	5	782,194	5.26	5.72	4.90	5.14	5.63	4.82	6.12	14.98
Total	13	353,964	1.54	3.94	2.09	2.97	76.61	13.83	84.35	14.98
APP										
Irrigation Only	3	40,034	(0.62)	(2.32)	2.06	1.93	15.13	18.76	16.39	20.88
Electric	1	678,686	4.81	4.81	2.46	2.46	2.46	2.46	2.46	2.46
Total	4	199,697	0.74	4.22	2.16	2.41	11.96	4.91	12.91	5.23
AVB										
Irrigation Only	5	403,214	(0.99)	(0.27)	(1.04)	1.50	12.69	17.11	13.36	17.86
Electric	1	1,100,468	6.10	6.10	3.89	3.89	4.29	4.29	4.29	4.29
Total	6	519,423	0.19	5.43	1.52	3.64	11.29	12.58	11.85	13.07
TOTAL										
Non-Electric	16	176,671	(0.82)	1.12	0.88	1.68	67.29	28.85	78.87	30.82
Irrigation Only	13	190,335	(1.63)	(0.37)	0.66	1.63	61.03	21.35	68.94	23.45
Electric	7	812,875	5.32	5.84	4.41	3.85	4.98	4.43	5.34	4.70
Total	23	370,298	1.05	4.89	1.95	3.26	48.33	12.54	53.01	13.37

part of their operations.[40] Seven districts in the sample provide both power and water delivery services and, of the sixteen districts not providing electric power, thirteen only deliver water.

1. Water Delivery

Table 4 presents evidence concerning the amount of water delivered (WATDEL) by districts.[41] Though water customers are generally irrigators, delivery to other customers, such as municipalities or residential users, are also included in the totals.

AVB districts are, on average, the largest suppliers of water (519,423 acre-feet) and APP districts are generally the smallest (199,697 acre-feet). Also, within each institutional classification, districts that provide both power and water services are larger than districts that provide water only. Whereas average water delivery is 812,875 acre-feet per year for districts that provide both power and water, districts not providing power average 176,671 acre-feet delivered per year.

2. Rates of Return on Total District Operations

Two measures of the rate of return on total district operations are also provided in Table 4. The first measure (NETREV ÷ PLANT) is calculated by dividing net operating revenue by the value of the total utility plant. Net operating revenue is determined by subtracting total operating expenses from total operating income.[42] The value of the utility plant is equal to the original cost of the plant net of any accumulated depreciation and construction work in progress. The second measure provided for estimating the rate of return on total district operations (NETINC ÷ TOTASS) is calculated by dividing net total income by the value of total assets.[43] Total district assets include the value of the utility plant, cash

40. All three districts in the sample have one-person, one-vote institutional settings.

41. The amount of water delivered is measured in acre-feet, and represents the net after any losses due to seepage or evaporation which may occur during the delivery process. It indicates the amount of water actually delivered to customers.

42. Operating income includes all revenue received for providing services such as water delivery, electric sales, or any other services provided or sold to customers. This revenue may be received from either direct prices charged or from property taxes imposed on constituents for the purpose of supporting district operations. Operating expenses include expenses incurred while providing services to customers, any general and administrative expenses, tax or tax-equivalent payments, depreciation on plant and equipment, and any purchases, such as of electric power, made by the district from outside the district.

43. In addition to the incomes and expenses included in the net operating revenue concept, the net income figures include any interest earned on investments, interest expenses on loans and revenue bonds, and any other miscellaneous incomes and expenses.

and investments, special funds, accounts receivable, water rights, and other property owned by the district association.

For each rate of return measure, two estimates are provided—a simple average (S.A.) of the rates of return for each of the districts and a weighted average (W.A.) for the districts within each respective classification. The weighted average sums the totals for all districts to determine one aggregated rate of return. Therefore more weight is given to larger districts in the determination of the rate of return.

After aggregating all districts included in the sample (TOTAL), the NETREV ÷ PLANT concept of profitability yields a simple average rate of return of 1.05% on the value of the utility plant compared with a 4.89% weighted average. This evidence suggests that larger districts, in general, achieve a better return on utility plant investment than do smaller districts. Care must be taken in interpreting this finding, however, since this difference may derive from the larger districts' ability to provide a different package of services. That is, differences between simple and weighted average rates of return may not be due only to size specific characteristics, but also may partially be due to the type of functions performed by the districts.

In order to better isolate the effects of size on rate of return, the simple versus weighted averages estimates were considered within each category of districts classified by type of services provided. This evidence suggests that size does play a role in determining rates of return since, within each classification by function, the weighted average is always higher than the simple average rate of return. The weighted average is 1.94 higher than the simple average for districts that do not provide power, 1.26 higher for districts that provide only water delivery services, and 0.52 higher for districts that provide both power and water services. In each case the degree to which the weighted average is higher than the simple average is less dramatic than it is for the total 3.84% difference aggregated across all functions (TOTAL). Thus, one comparing the simple and weighted averages estimates for rate of return must bear in mind that the difference reflects both size and functional differences.

Table 4 also shows how rates of return vary across institutional settings. Aggregating all districts within each institutional classification initially provides conflicting signals of performance. For instance, information provided by the simple averages suggests that one-person, one-vote districts attain the highest rate of return (1.54%) and acreage-based districts attain the lowest average rate of return (0.19%). If the weighted averages are examined, however, the hierarchy is reversed. Thus, once again, the differences across institutional settings may be explained by considering information within particular classes of functions performed by the particular districts.

It is noteworthy that across all institutional settings, districts that provide both electric power and water delivery services have higher rates of return than districts that do not provide power. This evidence suggests that electric users are less able than water users to form effective coalitions that constrain returns on district operations. The inability of electric users to constrain returns on electric operations may be expected to be most apparent in AVB districts, and for those districts which provide both power and water, the rate of return appears to be highest in AVB districts and lowest in APP districts.

The limited size of this sample makes it difficult to generalize as to whether institutional setting actually affects total rates of return for districts that provide both power and water services.[44] For example, the sample of districts that provide both power and water includes only one district in each of the AVB and APP classifications, a sample too small to provide more than casual support for the hypothesis. Therefore, there is not sufficient information to determine if the difference in rate of return is a result of the institutional setting or a reflection of superior or inferior performance by the specific management team within each institutional setting. A further complication is the fact that the water-power district in the APP institutional setting is also subject to state regulatory control, which might influence the lower rate of return in this district.[45]

As mentioned above, districts that do not provide power appear, on average, to have lower rates of return on total district operations. In fact, the estimates resulting from the aggregation of all such districts indicate a slight negative rate of return. As an institutional group, the only districts that do not provide power but make a positive return on operations are those operating within the POP institutional setting. This evidence provides some support for the hypothesis that large water users may find it more difficult to favorably influence management decisions in districts where management is elected via a popular voting scheme. Consequently, the return on water operations is higher in such institutions.

The second measure of rate of return (NETINC ÷ TOTASS) indi-

44. For all investor-owned electric utilities in the United States in 1979, the net operating income divided by the value of net total electric utility plant is equal to 6.09. *See* EDISON ELECTRIC INSTITUTE, STATISTICAL YEARBOOK OF THE ELECTRIC UTILITY INDUSTRY, Tables 51 and 52, 57-58 (1980).

45. In 1975 the Texas Public Utility Commission was created, and the Lower Colorado River Authority, along with other special districts became subject to the Commission's jurisdiction regarding water and power rate regulation commencing on September 1, 1976. TEX. STAT. ANN. § 1446c (Vernon 1980). *See generally* Adams, *Utility Regulation: A Public Demand*, 28 BAYLOR L. REV. 771 (1976).

cates net total income divided by total district assets. Regardless of the institutional setting, the aggregated totals (Total) indicate a positive rate of return. Furthermore, districts classified within each category of function performed by the district attain a positive return (W.A.) on total assets. Thus, all districts appear on average at least to break even on their overall operations. The evidence suggests that larger districts generally earn higher overall returns than do smaller districts, and districts that provide both power and water services earn higher overall returns than do districts that do not provide power. In districts that do not provide power, institutional setting does not appear to dramatically affect overall rates of return. The evidence indicates that APP districts earn a slightly higher return. The comparison of POP and AVB districts is unclear, however, since it depends upon whether one considers the simple or weighted average measure for rates of return.

3. Average Price of Water

The remaining evidence presented in Table 4 concerns the average price charged for water delivery service. Two measures are provided: (WATREV ÷ WATDEL) is equal to the revenue collected for water delivered plus land assessments charged for the purpose of supporting water operations, divided by the total amount of water delivered to customers; (WATOR ÷ WATDEL) is equal to the total operating income earned in water delivery operations divided by the number of acre-feet of water delivered. Thus both measures provide an estimate of the average per unit charge for water delivery.

The average revenue per unit of water delivered varies considerably depending on the type of institution considered as well as the primary functions performed by the particular district. It is particularly noteworthy that regardless of the institutional framework the average price of water is lower in those districts that also provide power. Although the cost of water may vary with several factors and thus influence price,[46] two possible factors deserve analysis: subsidy of water users by electric users, and economies of scale in water operations. As will be shown later,[47] there appear to be economies of scale in the delivery of water services. That is, as the scale of delivery increases, unit costs are lowered. Since districts that provide power have larger scale water operations, part of the lower price of water in those districts may be due to the fact that the lower costs associated with larger water deliveries are passed along to consum-

46. *See supra* note 32.

47. *See infra* text accompanying notes 50-54.

ers in the form of lower prices. Therefore, the evidence in Table 4 does not clearly prove that electric users are subsidizing water users by allowing lower prices to be charged for water deliveries. The more formal test of this set forth below controls for the scale of operations.[48]

How does institutional setting affect water revenues in districts that provide only water services? The highest weighted average water prices are found within POP institutions ($57.74/acre-foot), followed by APP ($20.88/acre-foot) and AVB ($17.86/acre-foot) districts. Because AVB districts are generally larger, however, the lower prices in these districts may partially be the result of scale effects rather than simply institutional setting. On the other hand, APP districts are, on average, smaller than POP districts. Despite this, water prices (W.A.) in APP districts are roughly one-third the level of the prices found in POP districts. Therefore, the evidence presented in Table 4 may suggest subsidy related differences in water prices across institutional settings. This evidence, which indicates higher prices for water delivered by POP institutions, is consistent with the hypothesis that in such institutions water users' influence in affecting management decisions is relatively low compared with that of other institutional settings. It can therefore be expected that, other things being equal, water prices in POP institutions would be higher than in the other institutions.

B. Analysis of Water Operations

With the exception of the information pertaining to average price of water, the information in Table 4 provides insight into only the total operations of districts. The information presented in Table 5 deals specifically with the water operations in each district.[49] This information concerns the average cost of water delivery operations, average revenue generated by water operations, and average rates of return on water operations.

48. *See Infra* text accompanying notes 59-61.

49. The sample of districts used to generate the information provided in Table 5 is smaller than that used for Table 4. The districts not included in the summary data presented in Table 5 are: Northern Colorado Water Conservancy District, North Unit Irrigation District, Collbran Conservancy District, Elephant Butte Irrigation District, and Carpinteria County Water District. These districts are excluded because information was not available on either water operating expenses or value of the water utility plant.

Table 5
Summary Description of Average Cost, Average Revenue, and Rates of Return for Water Operations in Surveyed Water Districts
(1979)

		WATOE ÷ WATDEL		WATREV ÷ WATDEL		WATOR ÷ WATDEL		RETWAT	
		S.A.	W.A.	S.A.	W.A.	S.A.	W.A.	S.A.	W.A.
POP									
Non-Electric	6	128.50	48.74	128.20	59.81	143.30	65.56	2.80	4.61
Irrigation Only	4	170.17	52.86	155.00	44.35	177.10	55.07	0.55	0.68
Electric	5	8.08	5.91	5.63	4.82	6.12	5.20	(8.32)	(1.48)
Total	11	74.77	11.55	72.46	12.06	80.94	13.15	(2.26)	1.77
APP									
Irrigation Only	3	62.67	29.00	15.13	18.76	16.39	20.88	(0.62)	(2.23)
Electric	1	2.81	2.81	2.46	2.46	2.46	2.46	(1.26)	(1.26)
Total	4	47.70	6.75	11.96	4.91	12.91	5.23	(0.78)	(2.00)
AVB									
Irrigation Only	2	13.89	18.24	12.62	16.75	12.86	17.06	(2.60)	(0.89)
Electric	1	9.91	9.91	4.29	4.29	4.29	4.29	(7.44)	(7.44)
Total	3	12.57	14.47	9.82	11.11	10.01	11.28	(4.22)	(2.97)
TOTAL									
Non-Electric	11	89.73	27.73	76.32	29.37	84.96	31.36	0.89	(1.70)
Irrigation Only	9	99.61	24.67	76.76	21.41	87.03	23.56	(0.54)	(0.62)
Electric	7	9.14	6.31	4.98	4.43	5.34	4.70	(7.19)	(3.17)
Total	18	58.39	11.97	48.58	11.02	54.00	11.74	(2.26)	(0.25)

1. Average Cost of Water Delivery

The average cost estimates are in the columns headed (WATOE ÷ WATDEL).[50] With the exception of the AVB districts that only provide water, the weighted average for each category is lower than the simple average estimates for each district. This finding suggests that economies of scale characterize water delivery operations. The existence of economies of scale may also partially explain why average costs are generally lower for those districts which also provide power. In addition to scale influences on costs of water operations, there may be complementary effects that arise when both water delivery service and power generation are provided by a district. These complementary effects may be technological in nature. That is, it may be that the total cost of producing a given amount of water and power service may be lower if the functions are performed jointly by one producer as opposed to being provided separately by two distinct producers.[51]

In order to determine whether average cost of water delivery varies across institutional setting, it is necessary to recognize that many factors influence costs: scale of operations, type of water user served, source of water, area served, distance from storage to consumer, and topography. The information available, however, makes it possible to control for only some of these factors.

In order to isolate the separate influences of various factors on the average cost of water delivery, a simple regression model is developed to explain total operating expenses incurred during the process of delivering water.[52] This model is expressed:

$$(1)\ \text{WATOE} = f_1\ (\text{WATDEL, DELSQ, PERAGR, DENSITY})$$

where the variables are defined as:

50. Not all the districts' annual reports categorize their data by specific service provided. For this reason some judgment was necessary on the part of the authors in order to allocate costs and utility plants across the various services provided. The major problem occured in allocating depreciation, construction in progress, and general administration expenses in districts that provide more than one primary service. The method used was to allocate an amount of total depreciation expense and construction work in progress to a particular service in proportion to the percent of total utility plant devoted to a particular service. In allocating general administrative expenses, a general fifty-fifty sharing of expenses between water and power was assumed.

51. Of course, on theoretical grounds alone, it is possible for the relationship to be reversed. That is, it may be more costly for one company to provide both services jointly as compared with separate firms providing the services.

52. A regression model attempts to determine if the variations in a dependent variable (WATOE) can be explained by the variations in certain independent or explanatory variables. *See generally* J. KMENTA, ELEMENTS OF ECONOMETRICS 197-246 (1971).

WATOE = total operating expenses incurred by the water utility
WATDEL = total number of acre-feet of water delivered to consumers
DELSQ = (WATDEL) X (WATDEL)
PERAGR = percentage of total water delivered to irrigators
DENSITY = total number of acre-feet delivered divided by the total number of acres served.

Total operating expenses are expected to be positively related with the number of acre-feet actually delivered. DELSQ is incorporated into the model in order to determine if economies of scale exist in the delivery of water services. A negative value of the DELSQ coefficient indicates that economies do exist. That is, as the scale of operations increases, the unit costs decline. The percentage of total water delivered that is delivered to irrigators (PERAGR) is expected to be negatively related with operating costs, since such water deliveries may not require the extensive water treatment process necessary for water delivered to residential users. Finally, the total number of acre-feet delivered divided by the total number of acres served (DENSITY) is expected to be negatively related with total costs of water operations. In other words, the facilities required, and therefore the costs incurred, are expected to be less if five acre-feet of water is delivered to an acre plot of land as compared with five acre-feet of water delivered in one acre-foot allotments to five separate acres of land.

The ordinary least square estimates for the above model are:

$$\text{(2) WATOE} = \underset{(2.5585)}{5564082\ \text{CONSTANT}} + \underset{(3.8171)}{20.3445\ \text{WATDEL}}$$

$$- \underset{(2.7139)}{5.6297 \times 10^{-6}\text{DELSQ}} - \underset{(1.8382)}{52058.2\ \text{PERAGR}} - \underset{(2.2906)}{701790\ \text{DENSITY}}$$

$$n = 17$$
$$R^2 = .67$$

where the numbers in parentheses are absolute t-statistics. A t-statistic of 1.782 or higher indicates significance with ninety-five percent confidence (i.e., at a 0.05 level of significance) in a one-tail test or with ninety percent confidence (i.e., a 0.10 level of significance) in a two-tail test.[53]

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53. With a two-tail test we are essentially acknowledging that we have made no assumptions that help us formulate the alternative hypothesis. Therefore, the alternative hypothesis is of the form that the estimated coefficient is equal to zero. However, if we are able to make assumptions that permit a less general specification of alternative hypotheses, such as the claim that the coefficient is greater than zero, we would use a one-tail test of significance.

Based upon criteria of commonly used statistical standards,[54] the above model explains very well the operating expenses incurred; all coefficients have the expected signs and are significant.[55] WATOE indeed appears to be influenced by scale of operations, and the type and density of customers served.

The above model will now be utilized to examine whether institutional setting or the provision of electrical power have any significant influence on the level of operating expenses. The methodology used is to add control variables indicating the institutional setting and whether a district provides power to the model described above in Equation (1). The model is therefore respecified to the following form:

$$\text{(3) WATOE} = f_2(\text{WATDEL, DELSQ, PERAGR, DENSITY, AVB, POP, APP, ELECT})$$

where the new variables are defined:

AVB = 1, if the institution is acreage-based voting
0, otherwise

POP = 1, if the institution is one person/one vote
0, otherwise

APP = 1, if the institution is appointed
0, otherwise

ELECT = 1, if the district provides both power and water
0, otherwise.

The results of this test are provided in Table 6. Estimates for fourteen models are presented in this table. Note that in each model the included variables are indicated by the presence of either a "+" or "-" sign, indicating the direction of the control variables' impact on operating expenses. The table also indicates, for each variable included in a particular model, whether the coefficient is statistically significant (S) or not significant(NS) as measured at the .10 level of significance in a two-tail test.

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54. J. KMENTA, *supra* note 52, at 112-191.

55. Another method of illustrating the "goodness" of the above model specification is to examine how well the coefficients predict actual values. If the mean values (WATDEL, 445,717; DELSQ, 600,934,133,110; PERAGR, 70.9; and DENSITY, 3.12) are substituted in for each explanatory variable in the above model, the predicted operating expenses per acre-foot of water delivered is equal to 12.04 dollars. The actual weighted average cost per acre-foot of water delivered is 11.89 dollars. Thus the model performs well both upon standard statistical criteria as well as predictive ability.

Table 6
Analysis of Factors that Influence Water Operating Expenses
(Dependent Variable: WATOE)

Model	WATDEL	DELSQ	PERAGR	DENSITY	AVB	POP	APP	ELECT	d.f.	R^2
(1)	+,S	−,S	−,S	−,S	. . .	. . .	. . .	. . .	12	.66
(2)	+,S	−,NS	−,S	−,S	+,NS	. . .	. . .	. . .	11	.68
(3)	+,S	−,S	−,NS	−,S	. . .	−,NS	. . .	. . .	11	.67
(4)	+,S	−,S	−,NS	−,S	. . .	. . .	−,NS	. . .	11	.67
(5)	+,S	−,S	−,NS	−,S	. . .	. . .	. . .	−,NS	11	.74
(6)	+,S	−,S	−,NS	−,S	−,NS	. . .	. . .	−,NS	10	.74
(7)	+,S	−,S	−,NS	−,NS	. . .	+,NS	. . .	−,NS	10	.75
(8)	+,S	−,S	−,NS	−,NS	. . .	. . .	−,NS	−,NS	10	.75
(9)	+,S	−,NS	−,NS	−,NS	+,NS	+,NS	. . .	. . .	10	.68
(10)	+,S	−,NS	−,NS	+,NS	+,NS	. . .	−,NS	. . .	10	.68
(11)	+,S	−,NS	−,NS	−,NS	. . .	−,NS	−,NS	. . .	10	.68
(12)	+,S	−,S	−,NS	−,NS	+,NS	+,NS	. . .	−,NS	9	.75
(13)	+,S	−,S	−,NS	−,NS	−,NS	. . .	−,NS	−,NS	9	.75
(14)	+,S	−,S	−,NS	−,NS	. . .	+,NS	−,NS	−,NS	9	.75

Models (2) through (4) use a single institutional control variable in order to test whether the institutional setting controlled for has a statistically different effect on water operation expenses as compared with the two excluded forms of institutional settings.[56] Thus, Model (2) examines whether, after controlling for other factors, operating expenses in AVB districts are different from operating expenses incurred by districts in the other two institutional settings. The evidence in Model (2) suggests that operating expenses in AVB districts are higher, but not significantly higher, than in districts in the other institutional settings. Similarly, estimates for Models (3) and (4) suggest that costs are lower in POP and APP districts, as compared with other excluded districts, but not significantly lower.[57]

In Models (5) through (8) a control is added to indicate whether a particular district provides both water and power services. Once again, none of the institutional controls proved to be significantly related to operating expenses. Moreover, though providing both power and water services appears to reduce a district's water operating expenses, this relationship does not achieve a statistically significant level. Therefore, the provision of both water and electric services does not appear to significantly reduce water operating expenses.

A further set of tests is provided by Models (9) through (14). In each of these, model specifications are included two institutional control variables. These variables test whether either of the controlled for institutional settings has operating expenses that are statistically different from the excluded institutional setting.[58] The evidence suggests that if there is no control for the provision of electric power, operating expenses are highest in AVB districts and lowest in APP districts. None of the absolute t-statistics for the institutional control variables is as large as 1.0; therefore statistically significant differences do not exist. After controlling for whether or not a district provides both power and water services, through the hierarchy of operating expenses across institutional setting changes,

56. J. KMENTA, *supra* note 52, 409-418.

57. In each of the models (2), (3), and (4), the respective institutional control variable has an absolute t-statistic of less than 1.0 and therefore is not significantly different from zero. A formula for calculating a t-statistic may be found in J. KMENTA, *supra* note 52, at 142. To carry out a test of the hypothesis that a coefficient is significantly different from zero, we have to specify the boundary between the acceptance and the critical region for the test statistic. This depends on the desired level of significance and on the number of degrees of freedom. *See* J. KMENTA, *supra* note 52, at 143. In Models (2), (3), and (4) in Table 6, a t-statistic of 1.796 or higher is necessary to reject the hypothesis that the respective institutional control variable is different from zero at a 0.10 level of significance. Therefore none of the institutional control variables in these models is statistically different from zero.

58. *See supra* note 56.

institutional setting still does not appear to significantly influence the level of operating expenses, nor does the joint provision of power and water services.

The above analysis suggests that certain factors such as scale of operations, type of water delivered, and density of the users served, do appear to be significantly related to the level of water operating expenses. Nevertheless, institutional setting has not been found to be significantly related with a particular district's water operating expenses. Furthermore, the joint provision of both water and power services does not appear to significantly alter water operating expenses.

2. Factors Affecting Water Revenues

Tables 4 and 5 provide a summary description of average revenue per acre-foot of water delivered. Since the findings are essentially the same under both the water operating revenue (WATOR) and water revenue (WATREV) concepts, only the evidence pertaining to water operating revenue is presented and discussed.

In order to explain what factors affect water operating revenues, the following basic model specification is used:

$$(4) \quad \text{WATOR} = g_1(\text{WATDEL, DELSQ, PERAGR})$$

where the explanatory variables are the same as defined above for Equation (1).

WATDEL is expected to be positively related with WATOR and, once again, the DELSQ term is included to determine if there are any scale effects related with operating revenues. PERAGR is expected to be negatively related with water revenues, since agricultural political coalitions are expected to be relatively strong and since water delivered to irrigators may be of lower quality (i.e., untreated) as compared with deliveries to domestic users. The ordinary least squares estimates of the model are:

$$\begin{aligned}(5)\ \text{WATOR} = \ & 7078346\ \text{CONSTANT} + 8.8720\ \text{WATDEL} \\ & (3.3960) \qquad\qquad\qquad (1.7245) \\ & - 1.1864 \times 10^{-6}\ \text{DELSQ} - 72422.2\ \text{PERAGR} \\ & (0.5892) \qquad\qquad\qquad (2.7601)\end{aligned}$$

$$n = 24$$
$$R^2 = .44$$

where the numbers in parentheses are absolute t-statistics. Absolute t-statistics greater than or equal to 1.725 indicate statistical significance at the 0.10 level of significance in a two-tail test.[59]

59. Based upon commonly used statistical criteria, the model expressed in Equation (5) does not

In order to test whether either institutional setting or the joint provision of power and water influence water revenues, the model is respecified to the following form:

(6) WATOR = g_2(WATDEL, DELSQ, PERAGR, AVB, POP, APP, ELECT, ELAVB, ELPOP, ELAPP)

where the new variables are defined:

ELAVB = 1, if the institution is AVB and the district provides both power and water
0, otherwise

ELPOP = 1, if the institution is POP and the district provides both power and water
0, otherwise

ELAPP = 1, if the institution is APP and the district provides both power and water
0, otherwise.

The methodology used for testing the influence of various factors upon WATOR is essentially the same as that developed previously.[60] That is, specific control variables are selectively included in order to ascertain whether a particular factor significantly influences water revenues.

The results of this test are provided in Table 7. Models (2) through (4) analyze whether districts in the included institutional setting have operating revenues that differ significantly from districts in the other types of institutional settings. The evidence suggests that no institutional setting is significantly different from the others because all absolute t-statistics on the various institutional control variables are less than 1.0.

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perform as well as the model expressed in Equation (3). *See supra* notes 54 and 55 and accompanying text. This suggests that variables excluded from the specification in Equation (5), such as institutional controls, may prove to be important factors in explaining variations in water revenues.

60. *See supra* notes 56, 58 and accompanying text.

Table 7
Analysis of Factors that Influence
Water Operating Revenues
(Dependent Variable: WATOR)

Model	WATDEL	DELSQ	PERAGR	AVB	POP	APP	ELECT	ELAVB	ELPOP	ELAPP	d.f.	R^2
(1)	+,S	−,NS	−,S	...	...	...	...	...	...	...	20	.44
(2)	+,NS	−,NS	−,S	+,NS	...	...	...	...	...	...	19	.45
(3)	+,NS	−,NS	−,S	...	+,NS	...	...	...	...	...	19	.45
(4)	+,NS	−,NS	−,S	...	...	−,NS	...	...	...	...	19	.46
(5)	+,S	−,NS	−,S	...	...	...	−,S	...	...	...	19	.58
(6)	+,S	−,NS	−,S	−,NS	...	...	−,S	...	...	...	18	.59
(7)	+,S	−,S	−,S	...	+,S	...	−,S	...	...	...	18	.64
(8)	+,S	−,NS	−,S	...	...	−,NS	−,S	...	...	...	18	.60
(9)	+,S	−,S	−,S	...	...	...	−,S	−,NS	...	...	18	.64
(10)	+,S	−,S	−,S	...	...	...	−,S	...	+,S	...	18	.65
(11)	+,S	−,NS	−,S	...	...	...	−,S	...	...	−,NS	18	.59
(12)	+,NS	−,NS	−,S	+,NS	+,NS	...	...	...	...	...	18	.47
(13)	+,NS	−,NS	−,S	+,NS	...	−,NS	...	...	...	...	18	.47
(14)	+,NS	−,S	−,S	...	−,NS	−,NS	...	...	...	...	18	.47
(15)	+,S	−,S	−,S	−,NS	+,NS	...	−,S	...	...	...	17	.64
(16)	+,S	−,S	−,S	−,NS	...	−,NS	−,S	...	...	...	17	.64
(17)	+,S	−,S	−,S	...	+,NS	+,NS	−,S	...	...	...	17	.64
(18)	+,S	−,S	−,S	...	...	...	−,S	−,NS	+,NS	...	17	.66
(19)	+,S	−,S	−,S	...	...	...	−,S	−,S	...	−,NS	17	.66
(20)	+,S	−,S	−,S	...	...	...	−,S	...	+,S	+,NS	17	.66

Models (5) through (8) add a control for whether a particular district provides both power and water. Regardless of whether a control for institutional setting is included, districts that provide both power and water have significantly lower water revenues than districts that do not provide power. In addition, districts in POP institutional settings have significantly higher water revenues than do AVB and APP districts combined. This finding seems to be further substantiated by the evidence presented in Models (9) through (11). In these models the control for the joint provision of power and water (ELECT) is interacted[61] with a particular institutional control variable. The question is whether joint provision of water and power affects water revenues and, if so, whether this effect is enhanced or mitigated by an institutional setting. Note first that, after inter-

61. Interacting explanatory variable involves multiplying one explanatory variable (ELECT) times another (an institutional control). This procedure tests whether water revenues in a district that provides power and is in a particular institutional setting differ from those in another district that also provides power but is in a different institutional setting. If these variables are not interacted, we are presuming that the mean water revenues depend on type of institutional setting and whether the district provides power, and that the difference between the mean revenues in the districts that do provide power and those that do not provide power is the same for all institutional settings. *See* J. KMENTA, *supra* note 52, at 418-425.

acting ELECT with institutional setting, the joint provision of water and power still appears to reduce water revenues significantly. It is particularly noteworthy that the interaction term ELPOP is positive and significant. This indicates that the joint provision of services does reduce water revenues, but that this effect is significantly reduced if the district functions within a POP institution.

Models (12) through (20) include two institutional control variables. These models therefore test whether districts in a particular institutional setting have significantly different water revenues as compared with districts operating in the excluded institutional setting. The most important findings in these models are: first, if the joint provision of water and power is not controlled for, institutional setting does not appear to significantly affect the level of water revenues; second, those districts that provide both power and water have significantly lower water operating revenues than those districts that do not provide power; and finally, though providing both power and water reduces water revenues, this effect appears to be significantly mitigated if the district operates in a POP institutional setting rather than in an AVB setting.

The findings thus far indicate that neither institutional setting nor the joint provision of water and power are significantly related to water operating expenses. If a water district provides electric power, however, water revenues appear to be significantly reduced. Moreover, institutional setting may influence the extent to which joint provision of water and power reduces water revenues, and districts that provide water and power in POP institutional settings appear to have higher water revenues.

3. Factors Affecting Rates of Return of Water Operations

A summary description of the rates of return of water operations may be found in the above Table 5.[62] Specifying the functional form of a model designed to explain rates of return is a difficult task. Therefore, the initial model is of the following very modest form:

$$(7)\quad \text{RETWAT} = h_1\,(\text{WATDEL, PERAGR})$$

where the variables are the same as defined above.[63]

WATDEL is incorporated in the model in order to determine whether the scale of operation influences rates of return, since it is possible, for example, that larger operations may have more monopoly power and therefore are able to attain a higher rate of return. While this monopoly

62. *See supra* text accompanying note 49.
63. *See supra* Equation (1).

power hypothesis cannot be conclusively tested by the limited amount of information available for this study, this scale control variable will provide some evidence worth considering. PERAGR would be expected to be negatively related to water rates of return, since the relatively strong coalition of agricultural interests would be expected to monitor and influence water operation decisions more closely in those districts which primarily serve irrigators.

The results from ordinary least square estimates of Equation (7) are:

$$(8)\ \text{RETWAT} = \underset{(0.8286)}{0.0320\ \text{CONSTANT}} + \underset{(0.7045)}{2.0753 \times 10^{-8}\ \text{WATDEL}} - \underset{(1.9191)}{9.6485 \times 10^{-4}\ \text{PERAGR}}$$

$$n = 17$$
$$R^2 = .21$$

where absolute t-statistics are in parentheses. If t-statistics are greater than or equal to 1.782, significance is indicated at the 0.10 level in a two-tail test.

This model, as specified, has very low explanatory power. Only PERAGR appears to have any significant influence on rate of return, and even this is not particularly high. Thus it appears that the following respecification is necessary to incorporate more explanatory variables:

$$(9)\ \text{RETWAT} = h_2(\text{WATDEL, PERAGR, AVB, POP, APP, ELECT, PERRET})$$

where the new variable (PERRET) is defined as equal to the percent of total electricity sales which are sold retail as opposed to wholesale.[64]

Again the methodology used includes specific control variables in the model in order to determine what variables have a significant impact on rates of return on water operations. The findings from these tests are provided in Table 8. If only institutional setting is controlled for, the evidence suggests that rates of return are generally higher in APP institutional settings and generally lower for AVB institutional settings. None of the institutional control variables are statistically significant, however. This conclusion is based upon evidence found in Models (2) through (7).

64. Wholesale customers are relatively large in size and small in number as compared to retail customers, and therefore wholesale customers may be expected to be better able to organize and resist high prices for power which may serve to subsidize water services. In addition, wholesale customers may have more potential sellers from which to buy than would retail customers residing in a particular district's jurisdiction. For these reasons, we expect the rate of return on water operations to be negatively related to the percent of total electric sales which are sold retail as opposed to wholesale.

Table 8

Analysis of Factors That Influence Rates of Return in Water Operations (Dependent Variable: RETWAT)

Model	WATDEL	PERAGR	AVB	POP	APP	ELECT	PERRET	d.f.	R^2
(1)	+,NS	−,S	....	....	....	....	....	14	.21
(2)	+,NS	−,S	−,NS	....	....	....	....	13	.22
(3)	+,NS	−,S	....	−,NS	....	....	....	13	.22
(4)	+,NS	−,S	....	....	+,NS	....	....	13	.22
(5)	+,NS	−,S	−,NS	−,NS	....	....	....	12	.25
(6)	+,NS	−,S	−,NS	....	+,NS	....	....	12	.25
(7)	+,NS	−,S	....	+,NS	+,NS	....	....	12	.25
(8)	+,S	−,NS	−,NS	−,NS	....	−,S	....	11	.49
(9)	+,S	−,NS	−,NS	....	+,NS	−,S	....	11	.49
(10)	+,S	−,NS	....	+,NS	+,NS	−,S	....	11	.49
(11)	+,S	−,S	−,NS	+,NS	....	−,NS	−,S	10	.88
(12)	+,S	−,S	−,S	....	−,NS	−,NS	−,S	10	.88
(13)	+,S	−,S	....	+,S	+,NS	−,NS	−,S	10	.88

Models (8) through (10) include controls for whether a particular district provides both water and power. Districts that provide both power and water have a significantly lower rate of return on their water operations as compared with districts that do not provide power.[65] When electric power is controlled for, institutional setting does not appear to be significantly related with rate of return on water operations. The evidence presented in Tables 7 and 8 indicates that joint provision of water and power lowers a district's operating revenues and its rate of return on water operations. This suggests a cross-subsidization from electric users to water users in districts that provide both water and power. The degree to which this cross-subsidy is likely to occur would be expected to be related to the particular market of electric users considered. For instance, if the electricity users are primarily retail purchasers within a particular district's jurisdictional boundaries, then the ability to cross-subsidize water consumers would be enhanced as compared with the situation where electricity purchasers are primarily wholesale buyers.[66] This hypothesis is tested in Models (11) through (13), where the PERRET variable is incorporated in the regression specification.

After controlling for the percent of electric sales that is sold retail, the

65. Using a model which includes a control for the provision of electric power (ELECT), but not including institutional controls, the predicted rate of return on water operations for districts that do not provide power is 0.85 percent as compared with negative 7.84 for those districts that provide both power and water.

66. *See supra* note 64.

coefficient on ELECT is no longer significant. It is particularly noteworthy, however, that the percent of electricity sold in the retail market appears to be negatively related to the rate of return on water operations. Thus, providing electric power reduces a district's rate of return on water operations most in those districts where the electric power is sold retail. The evidence provided by Models (11) through (13) also indicates that rates of return on water operations are significantly lower in the AVB districts than they are in POP districts.

4. Summary of Part IV

The evidence provided in this section leads to the following conclusions. While neither institutional setting nor the joint provision of power and water appear to significantly affect a district's expenses incurred in providing water delivery services, both these factors may be related to water revenues. The joint provision of water and power seems to have a particularly important negative influence on water revenues. Since water revenues are lower in this situation, it is not surprising that the joint provision of water and power also appears to reduce a district's rate of return on water operations significantly. It is also important to note that this apparent subsidy of water users by electric users appears to be somewhat mitigated in POP institutional settings and to be enhanced to the extent that electric sales are retail as opposed to wholesale in nature.

V. Summary and Concluding Comments

Section II presents and develops a model that enhances understanding of how voting institution affects policy decisions in public enterprises. The model is based on Peltzman's hypothesis that "an important object of the utility of the management of government enterprises, one for which they are willing to trade owner wealth, is the maintenance of political support for the enterprise and for the continued tenure of management."[67] Peltzman appears to be correct that managers of political firms may utilize selective price policies to buy political support for themselves and their enterprises. Thus, where one group of constituents can be distinguished as providing large revenue to district operations while another group provides large political support, district policies may be expected to favor the politically powerful group. Certain institutional arrangements will facilitate this distinction between the provision of revenue and political support, and therefore institutional setting will influence the extent to which

67. Peltzman, *supra* note 6, at 112.

one group of constituents subsidizes another group.

Though the theory developed in this paper requires further empirical investigation, the limited sample discussed here does provide some insights. The evidence presented in Section III indicates a device—varying the proportion of direct water charges to land assessments for water delivery services—whereby one group of water users may potentially subsidize another group. In Section IV additional evidence is presented suggesting how the policies of some water districts appear to subsidize one group relative to another. This evidence indicates that, after controlling for the total amount of water delivered as well as the proportion of water delivered to irrigators, the joint provision of water and power is negatively related to the level of water operating revenues. Districts that provide both power and water delivery services also have significantly lower rates of return on their water operations than do districts that do not provide power. These findings suggest a cross-subsidization in district operations from electric users to water users. It is particularly noteworthy that while this apparent subsidy of water operations appears to be reduced if a district operates within an one-person, one-vote institutional setting, the effect is enhanced to the extent that electric sales are retail as opposed to wholesale in nature.

Though the research does not indicate the appropriate institutional setting for water districts,[68] it does indicate that institutional setting appears to have some influence on district behavior. Because of this, consideration of institutional setting is relevant to the political judgment of state legislatures in deciding whether to have and how to implement a state policy for provision of water and power. Consideration should be made, for instance, of how a district's policies would be affected if the district were subject to regulation by a statewide elected body, such as the Arizona Corporation Commission,[69] or the Texas Public Utility Commission's regulation of the Lower Colorado River Authority.[70]

Much of the analysis pertaining to public enterprises may be extended to regulated enterprises. That is, much of the current literature on the effects of regulation perceive in regulation the operation of a political market place. For instance, in their study of the consequences of govern-

68. Further research in this area should include expanding our time frame beyond the analysis of one year of district operations as well as increasing the sample size of districts examined. Without this expanded information we suggest a cautious interpretation of our findings.

69. For instance, the policies of the private, regulated Arizona Public Service Company (APS) may be expected to differ from SRP's because APS's regulators have to consider the entire state as their constituents, since commissioners are elected by popular vote statewide, while SRP's Board needs to consider only its landowners who are the only ones who can vote for Board members.

70. *See supra* note 45.

ment regulation, Stigler and Friedlander conjectured that regulators would respond to the political popularity of lower rates by favoring the more numerous consumers who also tend to buy smaller quantities.[71] According to this view, regulated rates would therefore tend to favor the relatively numerous domestic users relative to industrial or business users.

If Stigler and Friedlander are correct in their expectations, then we might speculate that regulation by a statewide agency may reduce the extent to which some water districts' policies tend to favor the relatively strong political coalition of large water users. The Stigler-Friedlander view, however, is not universally accepted. DeAlessi, for example, suggests a very different scenario for the effect of regulation by asserting that "once regulation is introduced, larger users—with greater wealth at stake—have greater incentive to seek lower rates (including smaller increases) by lobbying before regulators and by exercising political pressure."[72] DeAlessi goes on to suggest that, in general, regulators may be expected to respond to the "more intensive, persistent, and persuasive pressure exerted by larger users."[73] This latter view of the effects of regulation leaves less room for optimism concerning the prospect that regulation will eliminate or even reduce the extent to which a water district's policies tend to subsidize the interest of one group of constituents relative to another.[74]

Until more is known about the costs, benefits, and alternative methods of influencing regulatory decisions, it is impossible to conclusively say what the effect of regulation would be on district behavior. A comparative study of the Salt River Project with a private-regulated monopoly like Arizona Public Service, or an analysis of how the policies of public districts like those in Texas have changed now that they are regulated by a statewide body, would provide much insight into what differences, if any, this alternative control mechanism has upon the actual allocation of resources. With this additional information, more informed choices may be made among alternative policy instruments for implementing a state policy for the provision of water and power.

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71. *See generally* Stigler & Friedland, *supra* note 5.

72. De Alessi, *supra* note 3, at 10.

73. *Id.*

74. One noted authority on the subject of regulation argues that regulation is a form of disguised taxation; that is, through regulation, government attempts to tax one group for the benefit of another group. *See generally* Posner, *Taxation by Regulation*, 2 BELL J. OF ECON. & MGMT. SCI. 22 (1971).

APPENDIX A

Irrigation and Drainage Districts in Arizona
Acreage Voting Basis Districts
Buckeye Water Conservation and Drainage District
Chandler Heights Citrus Irrigation District
Cortaro-Marana Irrigation District
Maricopa County Municipal Water Conservation District No. 1
Roosevelt Irrigation District
Roosevelt Water Conservation District
St. Johns Irrigation District
San Tan Irrigation District
One-Vote/Landowner Districts
Chino Valley Irrigation District
North Gila Valley Irrigation District
San Carlos Irrigation and Drainage District
Unit B Irrigation and Drainage District
Wellton-Mohawk Irrigation and Drainage District
Yuma Irrigation District
Yuma Mesa Irrigation and Drainage District

Appendix B

Irrigation Districts Included from Sample of Districts in Finances of Special Districts

Institutional Setting District (State)	Years Included in Data from Finances of Special Districts			
	1957	1967	1972	1977
A. Board Elected Under Acreage Voting Scheme				
Maricopa County (AZ)	X	X	....	....
Roosevelt Irrigation (AZ)	X	X		
Roosevelt Water (AZ)	....	X	....	....
Arwin-Edison (CA)	....	....	X	X
Helix[1] (CA)	X	X	X	X
Los Alisos (CA)	....	....	X	X
Westlands (CA)	....	X	X	X
Carlsbad (NM)	X	....	....	....
Elephant Butte (NM)	X	X	....	....
Acreage Voting Basis Sample (19)	5	6	4	4
B. Board Elected Under Popular Voting Scheme				
San Carlos (AZ)	X	....	....	....
Wellton-Mohawk (AZ)	X	X	X	X
Yuma Mesa (AZ)	X	X	....	....
Carpinteria (CA)	X	....	....	....
Casitas (CA)	....	....	X	X
Coachella (CA)	X	X	....	X
Contra Corte (CA)	....	X	X	X
Fresno (CA)	....	X	....	....
Goleta (CA)	X	X	X	X
Solano (CA)	....	X	X	X
Black Canyon (ID)	X	X	....	....
Truckee-Carson (NE)	....	X	....	....
Arch-Hurley (NM)	X	X	....	....
Middle Rio Grande (NM)	....	X	X	X
Central Oregon (OR)	....	....	X	....
North Unit (OR)	X	X	X	....
Belle Fourche (SD)	X	....	....	....
Popular Voting Basis Sample (37)	10	12	8	7
Total Sample (56)	15	18	12	11

[1]Became a popular based district after 1977.

Appendix C

Annual Report Survey — Usable Districts

Districts	Voting Scheme	Services			
		Irrigation	Electricity	Sewer	Flood Control
Carpinteria County Water District (CA)	OP/OV	X			
Central Nebraska Public Power and Irrigation District (NE)	OP/OV	X	X		
Central Utah Water Conservancy District (UT)	APP	X			
Collbran Conservancy District (CO)	APP	X			
Elephant Butte Irrigation District (NM)	OV/AC	X			
Goleta County Water District (CA)	OP/OV	X			
Helix Water District (CA)	OP/OV	X			
Imperial Irrigation District (CA)	OP/OV	X	X		
Irvine Ranch Water District (CA)	OP/OV	X		X	
Lower Colorado River Authority (TX)	APP	X	X		
Merced Irrigation District (CA)	OP/OV	X	X		
Metropolitan Water District of Salt Lake City (UT)	APP	X			
Middle Rio Grande Conservancy District (NM)	OV/L	X			
Modesto Irrigation District (CA)	OP/OV	X	X		
North Unit Irrigation District (OR)	OV/L	X			
Northern Colorado Conservancy District (CO)	APP	X			
Orange County Water Agency (CA)	OV/+100	X			
Orchard-Mesa Irrigation District (CO)	OV/AC	X			
Salt River Project (AZ)	AVB	X	X		
Santa Clara Valley Water Conservancy District (CA)	OP/OV	X			X
Southeast Colorado Water Conservancy District (CO)	APP	X	X		
Tarrant County Water Control and Improvement District No. 1 (TX)	OP/OV	X			X
Turlock Irrigation District (CA)	OV/$1	X			
Westlands Water District (CA)	OV/$1	X			