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Fighting at the Spigot: The Story of a Failing Public Water Cooperative

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FIGHTING AT THE SPIGOT: THE STORY OF A FAILING PUBLIC WATER COOPERATIVE

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Abstract. The Metropolitan Water District of Southern California (MET) is a self-regulated, public cooperative that imports the majority of Southern California's water. MET delivers this water to its 26 member agencies through MET infrastructure. MET's members—through its Board of Directors—decide the price of water and allocation of infrastructure costs by majority vote. Although MET's self-regulated cooperative status was an efficient organizational form in the past, changing circumstances (reduced supply, increased demand) have made it less so. The response of MET and its member agencies—conflict over decisions and enactment of policies supported by the median-voter—does not deliver economic or political efficiency. MET could use internal auction markets to allocate water and costs more efficiently and equitably.

The California Legislature established MET as a public corporation in 1928. MET has over 2,000 employees, but it is a self-regulating, cooperative "managed" by its customers—the 26 member agencies that buy MET's water. Fourteen are municipal utilities retailing water directly to customers; twelve are "municipal water districts" wholesaling to over 220 downstream water agencies; see Table 1 on page 3 for descriptive characteristics.

All 26 member agencies receive one *seat* on MET's 37-seat Board of Directors; additional seats come with larger assessed property values. An agency's share of *votes* on the Board is in proportion to its share of assessed property values within the MET service area. MET's Board of Directors decide policy (e.g., the price of water or allocation of infrastructure costs) by majority vote.

MET, as a cooperative, has become less efficient as member agencies' differences have grown more important, i.e., as the "core" has shrunk—either because differences have actually grown or tightening constraints made existing differences more important.[1] The source of the inefficiency is majority voting on policy.

Political allocation of private goods is inefficient because voting power is imperfectly correlated with willingness to pay. This fact was irrelevant for many years, until member agencies' demand for water approached or exceeded MET's supply of water; water and

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[1] I use core—heuristically—to mean a stable arrangement that members have no incentive to change or destroy; a shrinking or absent core requires that members renegotiate their positions, which can lead to instability or breakdown of their coalition as a cooperative.

infrastructure changed from club goods to private goods. Tightening constraints have made heterogeneity relevant—leading to inefficiency from conflict over decisions and enactment of policies supported by the median-voter. (I covered these at ISNIE 2006; see http://www.kysq.org/pubs/ISNIE_paper.pdf.) Here, I argue that MET cannot—in its current cooperative form—be efficient. I begin with a brief history of how conflict emerged.

1. Supply and Demand Causes Trouble

In MET's early years, the "flood" of supply from the Colorado River led it to expand by far more, and on far more favorable terms, than had been anticipated in the 1930s. The nine member agencies that annexed to MET between 1946 and 1955 were large and sparsely populated—increasing MET's area by over 200 percent but increasing its population by only 75 percent.[2] 1956 was the first year MET sold more than one-third of its supply. New member demands were just approaching MET's supply capacity when the Supreme Court ruled in 1963 that California only had rights to 4.4MAF of Colorado River water.[3] Since MET had junior rights to agricultural interests, this ruling cut MET's rights in half. MET had anticipated this ruling and signed contracts in 1960 to buy water from the State Water Project (SWP), which would move water from the Sacramento Delta to Southern California via the California Aqueduct. After the 1963 defeat, MET signed additional contracts for SWP water and received its first SWP deliveries in 1972. In 1982, voters rejected the Peripheral Canal, a project in the Delta that would "complete" the SWP—reducing potential SWP supply below contracted levels.

MET was not able to cope when the next drought hit in 1987. In March 1991, after four years of drought, MET reduced deliveries to member agencies by 20 percent or more with less than a month's notice. MET's member agencies did not suffer equally from these cuts: LADWP actually *increased* its deliveries and relative share of MET supplies, taking over six-times its 1986 delivery in 1990. SDCWA, on the other hand, took only 27 percent more water in 1990 than in 1986.

SDCWA responded by taking unilateral action to increase its water reliability—announcing in 1995 that it would buy and import non-MET water from the Imperial Irrigation District

[2]In 1946, MET had an average density of 4,000 people/mi^2. The new member agencies had an average density of 1,420 people/mi^2 (Source: MET Annual Reports).

[3]MAF means million acre-feet. An acre-foot of water covers an acre to a foot deep. It's also equal to 1,234 cubic meters of water (or 1.234 megaliters), or the amount of water 4 or 5 Californians might use in a year.

TABLE 1. MET's 26 member agencies ("MWD" means Municipal Water District) differ in area, population, votes on MET's Board of Directors, purchases from MET, and their uses and sources of water. Source: MET documents.

	Area	Pop	Joined	Board of Dir.		Purchases	Uses %		Sources %	
	mi^2	000s	year	Seats	Votes %	79–05 %	M&I	Ag	Local	MWD
Anaheim	50	340	1928	1	1.7	1.3	61	39	75	25
Beverly Hills	6	41	1928	1	0.9	1.7	100	0	14	86
Burbank	17	105	1928	1	0.9	1.0	100	0	50	50
Calleguas MWD	395	517	1960	1	4.0	5.4	90	10	24	76
Central Basin MWD	227	1,400	1954	2	5.5	5.7	100	0	65	35
Compton	8	93	1931	1	0.2	0.2	100	0	47	53
Eastern MWD	555	105	1951	1	2.8	2.9	95	5	20	80
Foothill MWD	22	80	1953	1	0.6	0.6	100	0	40	60
Fullerton	22	134	1931	1	0.7	0.7	100	0	66	34
Glendale	31	200	1928	1	1.1	1.4	100	0	15	85
Inland Empire Util. Agcy.	242	700	1951	1	3.8	3.0	100	0	70	30
Las Virgenes MWD	122	65	1960	1	0.9	1.0	100	0	0	100
Long Beach	50	487	1931	1	1.8	2.5	100	0	51	49
Los Angeles (LADWP)	465	3,849	1928	4	9.0	10.3	100	0	70	30
MWD of Orange County	600	2,000	1951	4	17.1	14.8	72	28	50	50
Pasadena	26	160	1928	1	0.9	1.2	100	0	40	60
San Fernando	2	24	1971	1	0.1	0.0	100	0	100	0
San Marino	4	13	1928	1	0.2	0.0	100	0	90	10
Santa Ana	27	347	1928	1	1.1	0.8	100	0	66	34
Santa Monica	8	90	1928	1	1.1	0.6	100	0	18	82
SDCWA	1,457	2,840	1946	4	18.3	26.6	85	15	15	85
Three Valleys MWD	133	600	1950	1	2.5	3.5	99	1	40	60
Torrance	20	112	1931	1	1.1	1.1	100	0	8	92
Upr. San Gabriel MWD	144	900	1960	1	3.5	2.3	100	0	20	80
West Basin MWD	185	900	1948	2	6.6	8.7	100	0	20	80
Western MWD	509	600	1954	1	3.6	3.7	70	30	76	24
TOTALS	5,327	16,702		37	100	100	90	10	38	62

Figure 1. MET imports water from the California Aqueduct of the State Water Project and the Colorado River Aqueduct. Los Angeles, not MET, controls the Los Angeles Aqueduct.

(IID); see Figure 1 for the locations of these agencies. Other MET member agencies were unhappy with the deal because it circumvented MET's cost-allocation structure. (MET recovers its fixed costs, which are about 80 percent of total costs, when it sells its water to member agencies—not through fixed charges such as property taxes or readiness-to-serve charges.) If SDCWA were allowed to substitute IID water for MET water, SDCWA could avoid paying the fixed costs embedded in the price of MET water—shifting those onto other MET member agencies. The fight within MET only ended eight years later, when MET got a high wheeling charge, SDCWA got $235 million from the State of California for accepting the charge, and taxpayers lost out (Erie, 2000; IID et al., 2003).

2. How a Cooperative Can Be (In)Efficient

Figure 2 on the next page shows the multiple paths to efficiency. Any of the three "favorable" conditions (abundance, cooperative preferences or homogenous goals) is sufficient for

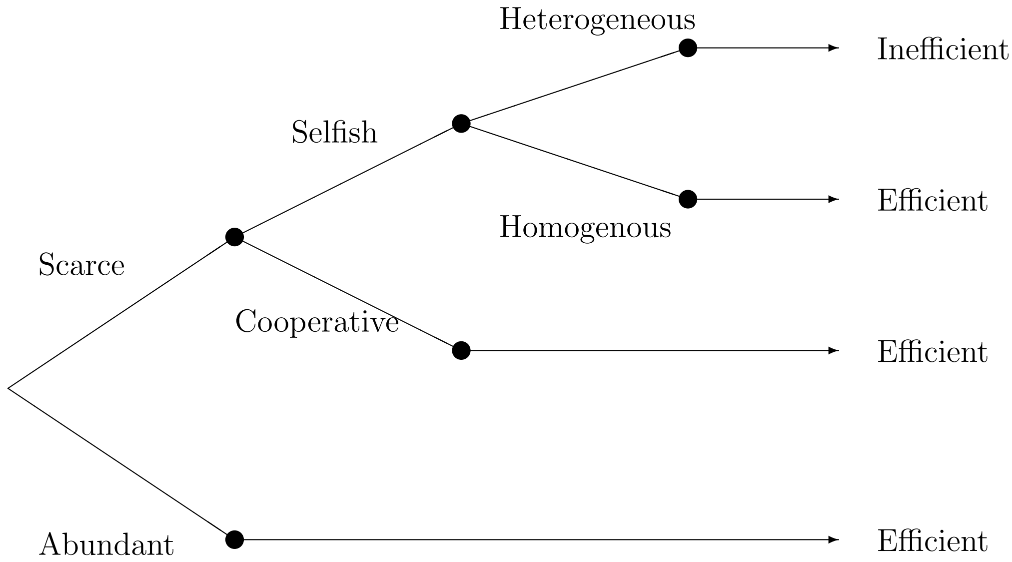

FIGURE 2. Sufficient conditions for efficiency within a cooperative are *any of* abundance, cooperation or homogeneity. The order of presentation is arbitrary.

the cooperative to be efficient. I put abundance/scarcity in the first position because MET began with "too much" water. The absence of all three sufficient conditions implies that inefficiency is a necessary condition. I now discuss the absence of all three.

2.1. **Abundance.** Without scarcity, the cooperative can operate with little discord and perfect allocation. With scarcity, the cooperative's club good becomes a private good, which can only be managed efficiently with economic (price) rationing.[4]

2.2. **Homogeneity.** MET entered a time of scarcity in the 1970s, and the voting mechanism suddenly mattered. We know from Hart and Moore (1998, pp. 23–26, 33-34) and Herbst and Prüfer (2005, p. 24) that cooperatives are more efficient than professionally-managed corporations if and only if the cooperative has one goal or member agencies share the same ordering of goals.[5] Unfortunately, MET's member agencies are heterogeneous in at least one important dimension—water dependency.

[4]Eckstein, in his 1958 study of the British National Health Service, concluded "the extent to which the potential conflict among goals becomes an actual conflict depends on the level of abundance" (paraphrased in Cyert and March (1963, p. 197)).

[5]More rigorously, a necessary and sufficient condition for efficiency is that the members of a cooperative are homogenous OR give the same ranking to important decisions (e.g., reliability vs. cost). If they are NOT, *at least* one important decision will be made inefficiently, i.e., $Homogeneity \Leftrightarrow Efficiency \therefore Heterogeneity \Rightarrow \exists \geq 1\ Inefficiency$.

I calculate a member agency's *dependency* as its share of MET's deliveries multiplied by MET's share of its total supply (local plus MET).[6] I normalized the average dependency for 1960, 1970, 1980, and 1990 to 1.0 for the most-dependent member agency. One can see in Table 2 that member agencies are heterogeneous in dependency.

TABLE 2. SDCWA is the most dependent member agency, while LADWP is far less dependent. Period 1970–2004. *Source:* Author calculation

Member Agency	MA's share of MWD sales	MWD's share of MA supply	Dependency Index
SDCWA	26	83	1.00
MWDOC	16	63	0.46
West Basin	11	92	0.43
Calleguas	5	75	0.16
Central Basin	7	47	0.15
LA	8	23	0.09

Although homogeneity among MET's members leads to policy consensus (and thus efficiency), heterogeneity means majority rule occurs with more friction and produces results that are less-useful for the minority; efficiency falls.

2.3. **Cooperative Members.** If water is scarce and members are not homogenous, MET can still achieve efficiency through cooperation, i.e., members that share water so that the marginal value of units equates across all members. Since water managers often suggest they are that cooperative, I set out to measure their cooperation through an experiment in which they play a public goods game. I ran three sessions with water managers—one with MET executives (MWD), one with Member Agency Managers (MAM) and one with executives from investor-owned water companies (CWA)—and eight sessions with undergraduates at UC Davis.[7] According to the cooperation hypothesis, the water managers should achieve higher efficiency than students. (Efficiency is a direct measurement of social welfare maximization in the game.)

[6]I multiply them to reinforce the effects of dependency, since they are negative compliments. The first type of dependency, which may not be obvious, arises from the *size* of MET's big customers—their actions affect regional water resources, and they lack outside options if MET should fail. In Table 1 on page 3, one can see that Los Virgenes gets 100 percent of its water from MET, yet takes only 1 percent of MET's total deliveries. If MET should fail, Los Virgenes could replace MET's water by purchasing water from another agency (e.g., LADWP). LADWP, in contrast, buys "only" 30 percent of its water from MET but that is 10 percent of MET's total sales. LADWP would have a hard time finding additional water—quickly or at all.

[7]The test is really between "older water managers who know each other" and "younger students who don't" since I cannot control for greater age and existing relationships between water managers. This is not a problem because age has no predetermined effect on cooperation, relationships should increase cooperation, and I am not trying to compare water mangers who know each other to those who do not.

Table 3. Shares of each type and average cooperation, by experimental session. I drop results from the first student (UG1) and water manager (AWWA) sessions due to a change in the experimental design. I classify 143 of 144 students and 40 of 42 water managers into types using the LCP; see `g1Aggregate.xls` and `exp.mdb` for details.

	Defector	Reciprocator	Cooperator	Cooperation
UG2	15	85	0	40
UG3	13	88	0	27
UG4	8	92	0	23
UG5	5	90	0	39
UG6	20	75	0	40
UG7	19	50	31	43
UG8	33	67	0	37
UG9	35	65	0	31
CWA	50	42	0	32
MAM	36	50	14	46
MET	43	43	14	37

The most-important, main result is the above-average cooperation among managers of MET's MAs (session MAM); see Table 3 and Figure 3 on the following page. For MAM, I cannot reject the null hypothesis that water managers are more cooperative than students.[8] That result is encouraging but not the end of the story: there is a difference between relative and absolute performance. It should not be so hard to be more cooperative than a random group of undergraduates. Further, the absolute level of cooperation (47 percent) implies that the group of MAM contributed an average of 47 percent of their endowment to the group's public good. This number is much lower than the 100 percent, socially optimal figure, but it—combined with the high (36 percent) share of defectors—indicates that the MAM do not lack cooperation but they are far from the level sufficient to solve collective problems.

3. Reform

Auctions allocate with price—not political, bureaucratic or engineering methods—thereby reducing conflict.[9] They can also increase cooperation by lowering inequality. MET can solve

[8]Although the order of results—MAM were more cooperative than MET managers (MET) who were more cooperative than investor-owned managers (CWA)—matches our prior intuition, the fact that they are so close to the average for a random group of undergraduates is a bit depressing for those who believe in cooperation rising with familiarity. These results match Cooper (2006), who attributes experienced managers' ability to solve coordination problems in the laboratory to their workplace experience.

[9]Member agencies with cheap local supplies would buy *less* at auction—leaving more for dependent member agencies.

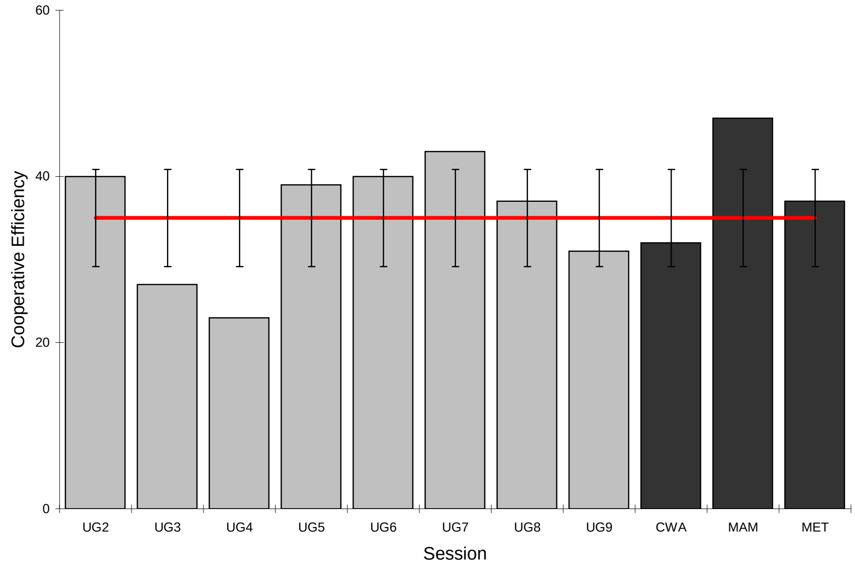

FIGURE 3. Average cooperation—contribution to the group's public account—in the student sessions was 35±5.85 percent of the maximum. Water managers were in—or above—this range.

its problems by auctioning water and conveyance among its members (Plott and Porter, 1996; Joskow et al., 1998). Since auctions would allocate water *within* MET, they would avoid problems from third-party impacts, conveyance losses, etc. within its current structure (Quinn, 1983; McCann, 1998; Murphy et al., 2003; Klemperer, 2003; **?**). If, for example, some-fraction of "lifeline water" is allocated on a per-capita basis (bringing equity), marginal water allocated by auction would increase efficiency. "Excess" profits could go to member agencies according to past contributions (equity) and present conservation (efficiency). MET would also have a simpler role—providing water and conveyance at minimal cost—without needing to set prices, determine quality, allocate in scarcity, etc.

For example, a Q^{th}-price Vickrey auction mechanism could work this way:

(1) Member agencies bid, by the acre-foot, for water by MET source (i.e., CRA or SWP). They also bid for conveyance.[10] (I omit further details on the conveyance auction, which would be similar.)
(2) Bids are ordered from highest to lowest price to form a demand schedule for each source of water.

[10]Conveyance is between MET's SWP delivery point and the member agency's system intake/drop off point. MET's current uniform price is simple but inflexible when conveyance, but not water, shortages appear. Conveyance auctions allow bidders to balance between fast and cheap delivery.

(3) Given that each supply has Q_k lots, where k is the source, the first Q_k lots are accepted at a common price (p_k) equal to the bid for the marginal lot (Lot Q_k) and lower than all other accepted bids.

(4) Member agencies can change their bids until the end of the auction to ensure they have a chance to buy the quantity they want. Daily auctions would replace the current mechanism and provide continuous feedback to member agencies and customers.[11]

(5) If p_k is above VC_k, profit would go towards
   (a) MET's fixed costs. After these are paid, remaining profits are
   (b) rebated to member agencies for past tax assessment payments (adjusted to real dollars).[12] After these are paid off, remaining profits are
   (c) rebated to member agencies in proportion to their population—allowing member agencies to subsidize other services or lower prices to customers. A per capita distribution promotes water-use efficiency by rewarding under-average use.[13]

(6) If auctions did not cover costs, MET member agencies could pay remaining costs in proportion to their assessed values. This shortfall mechanism is the mirror image of payouts of profit if auction revenues exceed variable costs.

Some notes:

- Prices fall when water is abundant and rise when it is scarce. MET would no longer have to administer agricultural or replenishment programs, blend water, forecast demand or supply, or set prices.
- To address equity concerns that some member agencies may be priced out of the action before buying some minimal quantity of water, auctions could be used to allocate water *after* a certain per capita quantity is sold as a "basic entitlement"—similar to MET's current Tier 1 water.[14] The basic allocation would have a use it or lose it character, i.e., a member could take or sell it but *not* ask MET to store it for later delivery. This prevents banking basic water for delivery when the system is

[11]According to Thomas (2006), "While the administrative rules governing demand changes state that changes can be made only twice a day, in reality we make changes more frequently as demands require."
[12]These payments would give Los Angeles a helpful incentive to renounce its preferential rights in favor of the auction scheme.
[13]I assume groundwater is adjudicated and priced to account for externalities, so overpumping does not result.
[14]According to Gleick (1996), the volume of water appropriate as a basic human right is 50 liters/capita/day. Residential use in the US varies 170–300lcd. I suggest 200lcd (73m^3 or 0.06AF/year) as a target entitlement, but this number will result from a negotiated agreement between member agencies.

under-stress (and price signals are most important). Higher demands would have to come from local supplies or purchase at auction. Basic water should also be bundled with "basic conveyance" to increase reliability and simplicity.

- Although this auction mechanism would address our main concerns of how to allocate and price water, it does not address issues of cost. Both fixed and variable costs are the endogenous outcome of operating decisions at MET. If MET were virtually divided into divisions that competed to sell water and conveyance and earn profits, efficiency would rise through benchmarking (Shleifer, 1985). Although the CRA/SWP division seems most obvious, it may not create the most competition; see Murphy et al. (2000) for an example.

I tested a simplified version of this mechanism in experiments with undergrads and MET executives, comparing it to an alternative mechanism with initial endowments. Surprisingly—but reassuringly—both groups did well with both mechanisms, accomplishing 87–90 percent efficiency after less than 15 minutes of instruction and practice.

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