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WATER SUBSIDIES IN SOUTHERN CALIFORNIA: DO THEY EXIST AND HAVE THEY CONTRIBUTED TO URBAN SPRAWL? A COMMENT ON AN ARTICLE BY STEVEN P. ERIE AND PASCALE JOASSART-MARCELLI TITLED 'UNRAVELING SOUTHERN CALIFORNIA'S WATER/GROWTH NEXUS: METROPOLITAN WATER DISTRICT POLICES AND SUBSIDIES FOR SUBURBAN DEVELOPMENT, 1928-1996'

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I. INTRODUCTION AND SUMMARY

Steven Erie and Pascale Joassart-Marcelli recently co-authored a paper reviewing the financing methods of the Metropolitan Water District of Southern California (MWD) and analyzing the relationship between this financing and historical growth in Southern California.[1] They make several assertions, including:

- regional water policy has shaped suburban development in Southern California and promoted sprawl as opposed to "smart growth";[2]

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1. *See* Steven P. Erie & Pascale Joassart-Marcelli, *Unraveling Southern California's Water/Growth Nexus: Metropolitan Water District Policies and Subsidies for Suburban Development, 1928-1996*, 36 CAL. W. L. REV. 267 (2000).

2. *See* Erie & Joassart-Marcelli, *supra* note 1, at 270, 288-89.

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- subsidization of water costs to the rest of the region by the City of Los Angeles has been a central element of this policy;[3] and
- pricing water wheeled through MWD at incremental costs would perpetuate this subsidization and related sprawl.[4]

The authors, however, fail to provide adequate support for any of these claims. In particular, their definition of a "subsidy" is flawed. In the context of joint payment for a common resource, a "subsidy" implies that existing users of the resource sacrifice funds to supply another user at less than the incremental cost imposed by that user. This definition, which the authors have apparently ignored, is well supported in the literature regarding pricing by utilities. The "subsidy" that they measure is simply a difference in total historical payments,[5] which bears little, if any, relationship to the actual prices faced by the various members of MWD, the benefits they ultimately received, or their share of MWD's total costs. They present no evidence that any of MWD's members have paid less than the incremental cost of serving them. Ultimately, they present no evidence that a true economic subsidy exists. In fact, it is quite likely that the City of Los Angeles has benefited from the annexation of the outlying areas, such as San Diego County Water Authority, into MWD. Determining the existence and magnitude of any subsidy, properly defined, is beyond the scope of this inquiry. However, using an alternate definition of the term, one might just as easily state that the outlying areas have "subsidized" the City of Los Angeles.

Erie and Joassart-Marcelli then use their "subsidy" measure to draw conclusions about "overpayments" and "underpayments" for water and how these have affected regional growth rates in Southern California.[6] However, even assuming that a difference in average water costs represents a "subsidy," the authors' technique for measuring it is flawed in many respects. They find that, from the years 1929 through 1996, the City and County of Los Angeles paid a higher per-acre-foot price for MWD water than other Southern California counties ($794 and $368, respectively, compared to the MWD average of $349).[7] Based on this, they claim that the City and County of Los Angeles have "subsidized" the other members of MWD by about $2.2 billion.[8] These figures, however, fail to account for numerous important costs and benefits that have differed historically between the member agencies. Using a methodology that we believe represents a more accurate depiction of the net costs and benefits received by each of MWD's constituents, we find that the City of Los Angeles has "subsidized" the other members of MWD by less than $1.0 billion, compared to Erie and Joassart-Marcelli's value of $1.9 billion, and that the "subsidy" received by San

3. *See id.* at 277.
4. *See id.* at 289-90.
5. *See id.* at 277-83.
6. *See id.* at 280-82.
7. *See id.* at 277 tbl.3.
8. *See* Erie & Joassart-Marcelli, *supra* note 1, at 289.

Diego is only about $80 million, compared to Erie and Joassart-Marcelli's value of $1.3 billion.[9] We find that Los Angeles County (excluding the City) has actually received a "subsidy" of over $100 million, rather than paying a "subsidy" of about $300 million. We also find the "subsidy" received by Orange County to be substantially reduced.

In our calculation of average historical costs, we include the following factors that were ignored by Erie and Joassart-Marcelli:

- First, the authors acknowledge that perhaps the primary benefit of MWD to the City of Los Angeles has been insurance against the failure of its Owens Valley supplies.[10] Yet, their average cost measurement includes no accounting for this value. We find that incorporating a conservative estimate of insurance or "option" value reduces the "subsidies" received by San Diego and Orange Counties by about $100 million each and reduces the "subsidy" paid by the City of Los Angeles by almost $300 million.
- Second, agricultural and untreated water has a lower value than treated water. The outlying regions, in particular San Diego, have purchased much more of this lower value water than the City of Los Angeles. Omitting this consideration leads to a faulty measurement of the difference in cost per unit of water between the regions. We find that adjusting for water quality reduces the "subsidy" received by San Diego by over $600 million and by Riverside by about $240 million, while reducing the "subsidy" paid by the City and County of Los Angeles by a combined $700 million.
- Third, even the quality of MWD's treated water has differed between regions. The same outlying regions that Erie and Joassart-Marcelli claim have benefited from a subsidy have also historically received a greater proportion of the lower quality (higher salinity) Colorado River water. Again, ignoring this factor tends to bias their average cost measurement. We find that adjusting for salinity-related costs reduces the "subsidy" received by San Diego and Orange Counties by over $200 million each and reduces the "subsidy" paid by Riverside, Ventura and the City of Los Angeles by a total of almost $500 million.
- Fourth, the authors make no attempt to adjust for the residual value of the investments that have been made into MWD's system. The infrastructure owned by MWD is worth billions of dollars. MWD is currently evaluating claims to the assets of this system based on historical capital contributions. Since the City of Los Angeles has made a greater share of these contributions, according to MWD's methodology, it presumably has a disproportionate claim to these assets. This is yet another omitted factor that skews their results to in-

9. *See id.* at 288-89.
10. *See id.* at 283.

dicate that Los Angeles has "subsidized" the other regions. We find that correcting for ownership shares in MWD reduces the "subsidy" received by San Diego by about $400 million and by Orange County by about $150 million, while reducing the "subsidy" paid by the City of Los Angeles by over $500 million.

- Fifth, Erie and Joassart-Marcelli only used data through 1996 and presented their results in 1996 dollars.[11] We have updated the average cost calculation through 1999.

Erie and Joassart-Marcelli analyze the statistical relationship between historical water costs and growth among the various counties in Southern California using their "subsidy" measure.[12] This analysis is also seriously flawed. Although the cost of water may certainly affect the incentives for growth, the measure used by the authors in no way reflects the actual cost of water faced by developers in Southern California. As is well known, the incremental cost of water has historically been equal across all Southern California regions—any new user of water in an annexed area would have paid MWD's property tax and volume-based water rate, exactly the same as in Los Angeles. Fixed costs paid by member agencies, the primary drivers of the authors' total cost differentials, do not affect individual decisions to locate or develop. In addition, as the authors themselves point out, many other variables affect growth besides costs paid to MWD; however they controlled only for water payments. Erie and Joassart-Marcelli identify only a correlation between growth rates and average historical water cost[13]—they do not demonstrate causation. In fact, an argument can be made that the causation goes the other way: the reason that outlying areas such as San Diego have enjoyed an apparent "subsidy" is *because* they have grown so fast since their annexation to MWD. Differences in water costs between regions, as measured by Erie and Joassart-Marcelli, cannot have had a direct effect on growth rates.

Finally, the authors conclude that if MWD were to charge incremental cost-based wheeling rates for excess capacity, this historic "subsidization" would be perpetuated.[14] By definition, an incremental cost-based wheeling charge will not result in any subsidies. This is the whole point of pricing at incremental cost. Instead, such a policy would finally send the appropriate signals for rational economic growth. Moreover, an unbundled approach to pricing could incorporate differences between the supply and demand profiles of MWD's members, including those mentioned above, and finally provide a connection between how much each of the members pay and what quality and quantity of services they actually receive. The issue of past contributions to MWD's finances is an equity or "fairness" concern, which

11. *See* Erie & Joassart-Marcelli, *supra* note 1, 274-285 tbls.1-6, 8.
12. *See id.* at 286-87 tbls.9-10.
13. *See id.* at 284-87, 290.
14. *See id.* at 290.

should be addressed separately from determining the efficient pricing for MWD's services.

The remainder of this paper is structured as follows. In Section II, we define the meaning of the term "subsidy" from an economic perspective and examine whether Erie and Joassart-Marcelli's measure conforms to this standard. In Section III, we identify four important components of the costs and benefits of membership in MWD that Erie and Joassart-Marcelli's average cost measure does not include. In Section IV, we quantify these adjustments and show that Erie's and Joassart-Marcelli's finding that the City and County of Los Angeles have "subsidized" the rest of MWD is quite sensitive to their omission of these relevant factors. In Section V, we examine Erie's and Joassart-Marcelli's analysis of the relationship between MWD costs and population growth rates. Finally, in Section VI, we discuss the distinction between past practices of MWD and the proper pricing method going forward.

II. WHAT IS THE PROPER DEFINITION OF A "SUBSIDY"?

Erie and Joassart-Marcelli define a subsidy as simply a differing average historical cost for water between two of MWD's member agencies.[15] Thus, if Region A has paid more per acre-foot of water since its annexation to MWD than Region B, including expenditures in the form of property taxes, water purchases and other payments, then the authors would assert that Region A has subsidized Region B. However, this definition does not meet the standard of the economics profession. In fact, there is an extensive literature regarding the allocation of common costs for the provision of public utilities. For example, in a seminal work in the field, Faulhaber defines a subsidy-free pricing scheme as follows: "If the provision of any commodity . . . leads to prices for the other commodities no higher than they would pay by themselves, then the price structure is *subsidy-free*."[16]

Although any pricing scheme for the allocation of common costs may be subject to criticism, economists have developed some minimal requirements for an efficient cost allocation that is also "fair and reasonable."[17] Generally speaking, such a system must pass two tests: the *stand-alone cost* test and the *incremental cost* test.[18] The *stand-alone cost* test simply "requires that the cost borne by each user of the system not exceed that user's

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15. *See generally* Erie & Joassart-Marcelli, *supra* note 1, at 277-283.

16. Gerald R. Faulhaber, *Cross-Subsidization: Pricing in Public Enterprises*, 65 AMER. ECON. REV. 966, 966 (1975).

17. *See generally* David J. Salant & G. Campbell Watkins, *Cost-Allocation Principles for Pipeline Capacity and Usage*, 8 ENERGY STUDIES REV. 91 (1996) (arguing that some current cost allocation plans involving multiple-use pipelines conflict with commonly accepted norms of fairness); ALFRED E. KAHN, THE ECONOMICS OF REGULATION: PRINCIPLES AND INSTITUTIONS (1988).

18. *See* Salant & Watkins, *supra* note 3, at 93.

stand-alone costs."[19] Essentially, this reiterates the above definition: each user must be better off after participating in the enterprise than it would be outside of the system. The *incremental cost* test simply requires that each user must pay at least as much to participate in the system as the incremental cost of including that user on the system.[20]

We can now place these standards into the context of the Southern California water markets. Two conditions must have held in order to characterize MWD's pricing scheme as subsidy-free: 1) MWD's annexation of outlying areas and its subsequent pricing scheme allowed Los Angeles to gain the services of MWD at lower cost than if these areas had not been annexed; and 2) pricing to the outlying areas has covered at least the incremental cost of including them in the system. Thus, if Los Angeles has received benefits since its initiation of MWD that are greater than the costs it has incurred, and if the other regions have at least paid the incremental costs for supplying them from the pre-existing system, then MWD has not subsidized anyone. Clearly, Erie and Joassart-Marcelli have not defined their measure of a "subsidy" according to these well-accepted principles.

Through its early property tax payments, Los Angeles initially provided the major portion of the capital required to start MWD before outlying regions were even invited to join. At the outset, this system had substantial excess capacity. Despite this fact, Los Angeles turned to other sources such as Owens Valley for its primary water supply. According to Erie and Joassart-Marcelli, these sources provided lower cost water because they avoided expensive pumping.[21] MWD, however, provided Los Angeles with a number of benefits in addition to its modest water purchases. As the authors point out, "In effect, Los Angeles bought an expensive drought insurance policy should its Owens Valley supplies prove insufficient."[22]

Subsequently, MWD induced other entities to join by offering water at a low price; that is, below MWD's average historical cost, but not necessarily below the incremental cost of adding the new members to the system.[23] This enabled MWD to earn revenues it would not have earned otherwise, defraying costs while allowing Los Angeles to maintain access to the system as drought insurance and a buffer for growth. The low price reflected the low incremental cost of adding these outlying areas to the system once the main components of the infrastructure were in place. In essence, both Los Angeles and the outlying areas that later were annexed into MWD benefited from the relationship; thus, Erie's and Joassart-Marcelli's use of the term "subsidy" is misplaced.

In order to detect the presence of a subsidy, properly defined, and to measure its magnitude and direction, it would be necessary to calculate the

19. *Id.*
20. *See id.*
21. *See* Erie & Joassart-Marcelli, *supra* note 1, at 273.
22. *Id.* at 283.
23. *See id.* at 276.

incremental costs incurred by MWD with the annexation of each member, as well as each member's net benefits and the costs of their alternatives. This could be achieved via a model simulating the MWD system, but this is clearly beyond the scope of this paper.

III. WHAT FACTORS DETERMINE THE COSTS AND BENEFITS OF MEMBERSHIP IN MWD?

Erie and Joassart-Marcelli calculate the average historical cost of water for the City and County of Los Angeles and the other counties served by MWD.[24] As discussed above, we do not believe that this is an appropriate way to measure whether there have been any interregional subsidies. However, even as a simple measure of costs and benefits, Erie's and Joassart-Marcelli's methodology is flawed. Their first unstated assumption is that all benefits gained by MWD's member agencies can be measured by simply adding up total historical water purchases. Similarly, their only measure of costs is total dollar payments to MWD. Many other factors, however, affect the cost-benefit balances of MWD's constituents. In this section, we examine some of the most important differences between the costs and benefits received by the various members. In the next section we propose a methodology and use it to quantify the effect that including these factors has on Erie's and Joassart-Marcelli's average cost calculation.

First, Erie and Joassart-Marcelli make no attempt to account for any value received by MWD's member agencies other than total water purchases. Although the authors note that the primary benefit obtained by Los Angeles was insurance against the failure of its other supplies to meet demand in drought years or to accommodate future growth, they measure the benefits of membership by simply totaling up historical water withdrawals. They do not account for the value of this insurance.

For some members, the value of this insurance is considerable. For example, the City of Los Angeles has varied its MWD water deliveries far more than any other member agency, relying heavily on MWD during drought years, such as 1987 through 1992, but turning to its other sources during normal and wet years. Figure 1 demonstrates the variability of the City of Los Angeles's purchases compared to those of other regions.[25] This chart shows that the standard deviation of the City of Los Angeles's annual purchases is more than twice that of any other region, except San Bernardino, when taken as a ratio of average purchases.[26] This effect is not related

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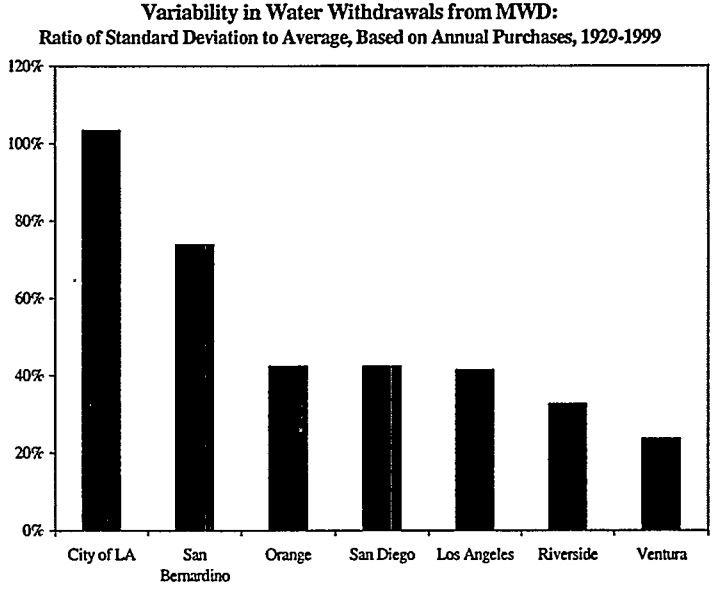
24. *See id.* at 281 tbl.6.

25. Following the methodology of Erie and Joassart-Marcelli, we use the counties served by MWD as the unit of measurement, but separate out the City of Los Angeles. The region identified as "Los Angeles" represents all of Los Angeles County excluding the City.

26. Substantial variation was observed during the first several years of each region's membership in MWD as each region "ramped up" its purchases from MWD. To isolate the variation that occurred after the "ramp up" period, Figure 1 uses annual data omitting the first

to varying rates of population growth; we found similar results when examining per-capita water purchases. This finding reflects the fact that the City of Los Angeles uses MWD as a supplier of last resort, while other agencies rely on MWD for their baseline level of purchases.

Figure 1



Source: MWD. This analysis starts at the eleventh year of each region's purchases from MWD.

When one or more agencies vary their purchases to such an extent, the others must bear the cost of maintaining the system during normal or wet years. MWD has developed substantial supply and conveyance potential to meet peak and dry year demands. The cost of these facilities is primarily related to their peak capacity, rather than the average volumes they handle. MWD's historical rate structure, however, has financed the cost associated with these facilities and supplies primarily from revenues derived from the sale of water during wet and normal years. Essentially, the agencies that support MWD's facilities by providing a baseline level of purchases provide an insurance policy, or option, for those that do not. Obviously, crediting no value to such insurance will lead to an overstatement of any "subsidy" from Los Angeles to the outlying areas.

A further problem with Erie's and Joassart-Marcelli's average cost measure is that the quality of water purchased from MWD has not been constant across the member agencies. As the authors point out, the outlying regions have withdrawn a significant portion of their water for agricultural use.[27] Figure 2 shows that, since their initiation into MWD, the City and

ten years of each agency's membership.

27. *See* Erie & Joassart-Marcelli, *supra* note 1, at 269.

County of Los Angeles, Orange County, and Ventura County have withdrawn primarily treated water for domestic use, while Riverside, San Bernardino, and San Diego Counties have purchased much more lower quality untreated water and less reliable agricultural water. Treated water for domestic consumption has both a higher value and higher cost than the other types of water—based on quality and reliability factors. Erie and Joassart-Marcelli consider all water purchases to be of equal value. This factor further biases their results towards indicating that Los Angeles has "subsidized" these other regions.

In addition, even treated water has historically differed in quality between the member agencies. MWD has two primary sources for imported water, the State Water Project (SWP) and the Colorado River Aqueduct (CRA). CRA water has a much higher salinity content than SWP water. This leads to greater costs for users in the form of wear on plumbing appliances, increased demand for water softening, and adverse effects of water recycling efforts. Historically, MWD has not attempted to deliver the same mix of CRA and SWP water to each of its constituents. Therefore, MWD's members have borne unequal salinity-related costs.

Figure 3 demonstrates the salinity levels at the various MWD treatment facilities. The three facilities that receive primarily CRA water have had a Total Dissolved Solids (TDS) level more than 80 percent higher than the two facilities that receive primarily SWP water.

Figure 2

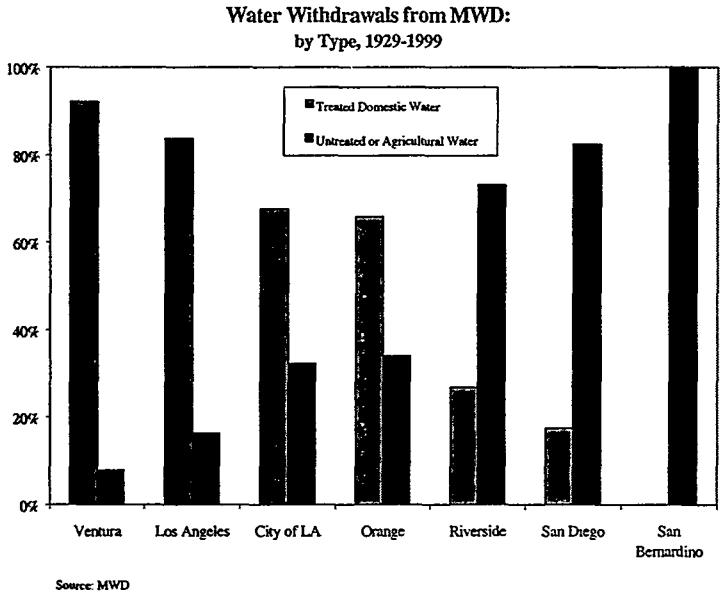
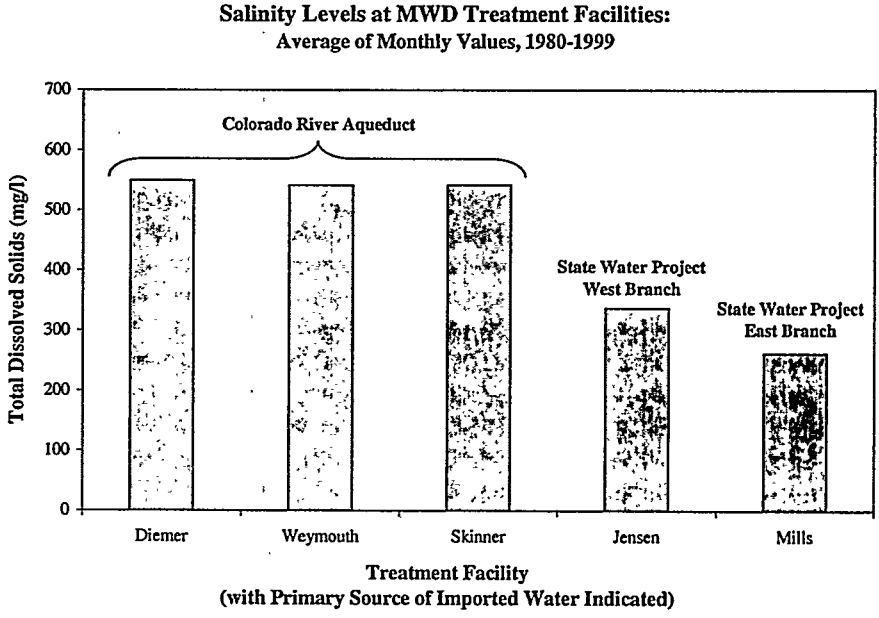


Figure 3



Source: MWD Water Quality division.

Determining which facilities supply each of MWD's members is a difficult task, since many agencies are served by more than one MWD facility. We do know, however, that San Diego receives all of its water from the Skinner facility, and thus has suffered a high salinity level. Orange and San Bernardino Counties also obtain most of their water from the high-salinity sources. On the other hand, Los Angeles, Ventura and Riverside Counties obtain lower salinity water.

MWD has recently evaluated changes to its blending policy. Section 136 of the MWD Act states that MWD shall provide an equal blend of SWP water and CRA water to each of its members, to the extent reasonable and practicable. MWD is now considering the adoption of a 500 mg/l TDS target for each of its members. A recent study by MWD indicated that a difference in TDS levels of 100 mg/l is worth about $100 million per year across the whole of MWD.[28] In a similar analysis, MWD found that the cost to San Diego is currently about $45 million per year, relative to a more equitable policy of providing each agency with 500 mg/l TDS.[29] Such historical cost differences are not accounted for in Erie's and Joassart-Marcelli's analysis; they omit any consideration of costs suffered by the agencies receiving high

28. *See* METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, U.S. BUREAU OF RECLAMATION, SALINITY MANAGEMENT STUDY FINAL REPORT 2-20 Fig.2-18 (June 1999).

29. Results from MWD salinity model provided to San Diego County Water Authority [hereinafter SDCWA].

salinity water.

Finally, Erie and Joassart-Marcelli ignore the fact that the investments into MWD have not been used up; all the historical capital contributions made by MWD's members have generated a massive infrastructure that has considerable value going forward. According to MWD's latest annual report, the book value of the assets in its system is over $4 billion. This amount is likely to be conservative in comparison to MWD's true economic value.

To put this value in perspective, consider the hypothetical situation of privatizing MWD. In this scenario, the shares of MWD's assets would be distributed to the member agencies according to some measure of total historical contributions. Such a scenario is not totally unthinkable; MWD has, in fact, considered a "shareholder model" as a candidate for restructuring and has also developed algorithms for determining equity shares. In any case, MWD's assets are ultimately owned by its members, so some method must be used to determine allocation.

MWD has identified several potential measures to determine representation by its members. Under almost all of these, the City and County of Los Angeles have the largest shares, much larger than their shares of historical water purchases. Erie's and Joassart-Marcelli's calculations do not consider the fact that MWD's members have disproportionate claims to MWD's assets. Their methodology essentially assumes that the value of MWD's assets is zero, or, equivalently, that each member agency has a claim that is proportionate to their total historical water purchases.

The bias introduced by failing to account for this value is demonstrated in Figure 4. The pie-graph on the left shows one of MWD's measures for representation based on some components of historical capital payments, known as "preferential rights."[30] We do not endorse this method for allocating MWD's assets; however, for the purposes of this analysis, we assume that this method, or one like it, will ultimately be used. The pie-graph on the right shows each region's share of total water purchases. This demonstrates that, according to MWD's methodology, San Diego has a much smaller claim to MWD assets than its share of historical water purchases. The City of Los Angeles has a much larger claim. Any measure of the benefits received from membership in MWD should account for claims on the assets owned jointly by the member agencies. Omitting such a measure again biases a "subsidy" measurement in favor of Los Angeles and against the outlying regions.

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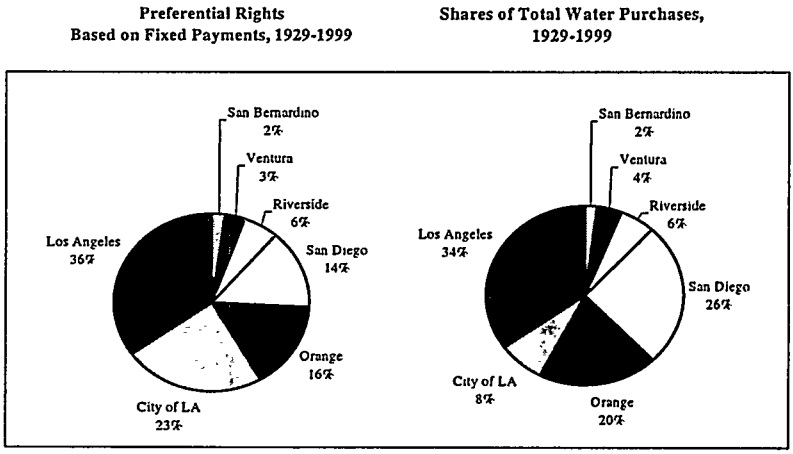
30. Preferential rights are defined in Section 135 of the Metropolitan Water District Act (1969). *See* CAL. WATER CODE § 135 (West 2000). This measure includes property taxes and other fixed annual fees (not adjusted for inflation) that are unrelated to water purchases. *See id.* Shares for MWD members have been combined by county and rounded in Figure 3. MWD has also begun evaluating adjustments to this method that incorporate inflation and interest and also some components of water rate revenues that have been set aside for capital expenditures. Their adjustments do not substantially change the rankings or relative shares.

Figure 4



Source: MWD.

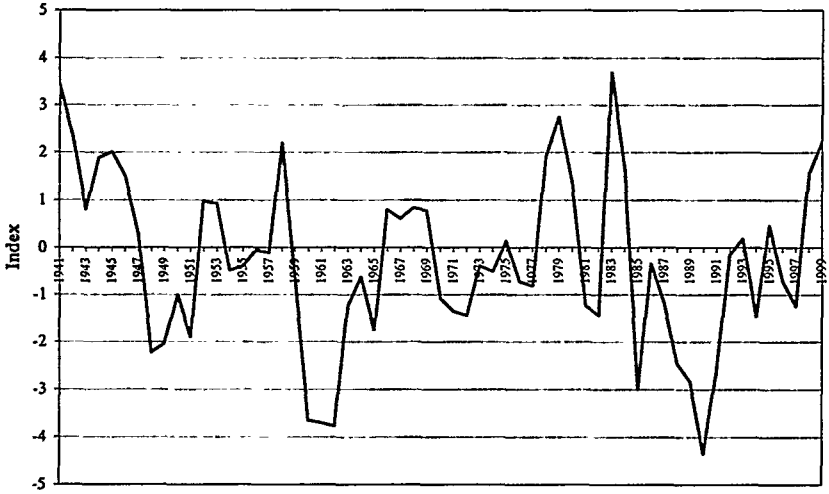
IV. ACCOUNTING FOR IMPORTANT DIFFERENCES BETWEEN MWD'S MEMBERS SUBSTANTIALLY ALTERS THE AVERAGE COST CALCULATION

The discussion in the previous section illustrates how a simple average cost measure fails to capture the true differences in the benefits received by MWD's member agencies. In general, such a measure should attempt to account for other costs and benefits derived from membership in MWD in addition to the total quantity of water purchased and the total amount of payments made. In this section, we propose an improved methodology and use it to quantify the value of each of the adjustments proposed above. After each adjustment, we report the effect on the average historical cost to each of MWD's regions. At the end of the section we summarize the total effect these adjustments have on Erie's and Joassart-Marcelli's "subsidy" calculation.

As described in the previous section, some of MWD's members have other sources for a large portion of their water needs. These agencies, in particular the City of Los Angeles, turn to MWD in times of drought, but in normal and wet years do not purchase substantial volumes. Essentially, membership in MWD confers an "option" to a municipal water agency. That is, the payment of property taxes and other fixed fees allows each agency to purchase water at MWD's volume-based water rate, up to their preferential right, should they decide to exercise that option. The value of this option is dependent on several factors, including the probability that the

Figure 5

Palmer Drought Index for Southern California
1941-1999



Source National Oceanic and Atmospheric Administration, http://www.ncdc.noaa.gov/onlineprod/drought/temp/drought_204.txt.

option will be exercised, the value of water during the years the option is exercised, and the maximum quantity of water that can be purchased.

The probability of exercise is related to weather conditions—the more often a drought occurs, the more frequently the options are likely to be exercised. The widely used Palmer Drought Severity Index (PDSI) is one measure of the conditions that determine water use.[31] A PDSI value less than –3.0 indicates "severe" drought conditions; a value between –2.99 and –2.0 is considered to indicate a "moderate" drought; and a value between –1.99 and –1.0 denotes a "mild" drought.[32] Figure 5 charts the value for this index in Southern California over the last 50 years.[33] From this data, we determined that Southern California has experienced droughts in these categories 7 percent, 10 percent, and 20 percent of the time, respectively, since 1941. For purposes of our analysis, we assume that these probabilities are representative of the expectations for any given year.

The value of water during drought years will depend on the water rate

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31. *See* Dr. Michael J. Hayes, *Drought Indices, National Drought Mitigation Center* 1 (visited March 2000) <*http://enso.unl.edu/ndmc/enigma/indices.htm#palmer*>. Western states often supplement the PDSI with other indices, for example the Surface Water Supply Index, which takes into account a non-uniform topography. *See id.*

32. *See id.* at 4.

33. For more information on the PDSI and other indices used to measure the deviation of precipitation from established norms, see Dr. Michael J. Hayes, *Drought Indices, National Drought Mitigation Center* (visited) <*http://enso.unl.edu/ndmc/enigma/indices.htm#palmer*>.

charged by MWD and the alternatives available to each agency. In the past, MWD has not increased its water rate during drought periods. Thus, water purchased during a dry year has a greater value—but not a greater cost—than water purchased during a wet year. This excess value is one of the components of the option value. To measure this value, we examine the cost of alternative water supplies during dry periods. In fact, MWD's own policies give some indication of this value. Currently, MWD provides a subsidy of $250 per acre-foot for local reclamation or demand-reducing projects. This provides evidence that the policy-makers at MWD believe that during periods of severe drought, when these resources will be fully utilized, the value of water is at least $250 per acre-foot greater than the basic volume-based water rate charged by MWD.[34] MWD currently charges $431 per acre-foot for domestic treated water. We therefore assume that the value of water in a "severe" drought (as defined by the PDI) is 58 percent higher ($250 / $431) than the value of water in a wet year. We assume that the premium on water in a "moderate" drought is half as much, or 29 percent, and that the premium in a "mild" drought is half of this, or 14.5 percent.

Finally, the quantity of options available in a given year depends on the difference between the typical annual purchases of each agency and that agency's preferential right. No option value is available for members that generally purchase more than their preferential right, such as San Diego and Orange Counties, since they would not be able to substantially increase their purchases in drought years.

We now have the pieces needed to construct a valuation of the option to purchase extra water. For each region in each year, we calculate the difference between the average annual purchases over the prior fifteen years and the preferential right of that region (a portion of total MWD sales in that year). This generates the "quantity" of options, measured in acre-feet, that is available in that year. The value of each option is then calculated by weighting the premium on water value in each of the three drought scenarios by the probability that each scenario will occur. The total option value for each year is then simply this "price" multiplied by the "quantity."

Essentially, one can consider membership in MWD to confer two separate benefits: 1) actual water purchases; and 2) for regions that generally purchase less than their preferential right, options for a higher level of purchases during periods when the value of water is more than MWD's price. In order to calculate an average per-unit cost measure, like Erie's and Joassart-Marcelli's,[35] which incorporates this option value, we subtract the calcu-

34. This is probably a very conservative estimate of the premium for water in a severe drought year. Other alternative water sources that are being examined to fulfill drought needs, such as desalination, cost as much as $1000 per acre-foot above MWD's water rate. In its 1996 assessment of dry year supply options, MWD identified the cost of the "last resort" option before desalination, groundwater recovery, to be more than $400 per acre-foot higher than the cost of its imported supplies. *See* 1 METRO. WATER DIST., SOUTHERN CALIFORNIA'S INTEGRATED RESOURCE PLAN 3-29 (Mar. 1996).

35. *See* Erie & Joassart-Marcelli, *supra* note 1, at 277 tbl.3.

lated option value from total annual payments made by each region. Summing total payments through 1996 (after converting to 1996 dollars) and then dividing by total water purchases results in a new value for each regions' average per-unit cost.

Table 1 shows the results of this calculation.

Table 1

AVERAGE HISTORICAL WATER COST:
ADJUSTMENT FOR "OPTION" VALUE ONLY

Region	Change from Erie's and Joassart-Marcelli's Value ($1996 per acre-foot)
City of LA	-78
San Bernardino	-10
AVERAGE	-9
Los Angeles	-7
Orange	0
Riverside	0
San Diego	0
Ventura	0

Next, we examine the purchasing patterns of MWD's constituents by water type. To account for the fact that some agencies purchase lower quality or less reliable water from MWD, either untreated or agricultural water, we created a "quality-adjusted" measure of annual water purchases for each agency. Essentially, we assume that the value of each different type of water is reflected in its price, and we then weight the quantity purchased in each year by this value. For example, suppose MWD's price for untreated agricultural water in a given year is half its price for treated domestic water. Then suppose one agency purchased 100 acre-feet of agricultural water in that year. We would then assume that this purchase was equivalent to 50 acre-feet of treated domestic water. Using this method, we calculate the equivalent volume of treated domestic water purchased by each agency in each year. By reducing the measure of water purchased by those agencies that used significant quantities of untreated water, this method increases such agencies' average costs.

Table 2 shows the effect this correction alone has on the average historical costs.

Table 2

AVERAGE HISTORICAL WATER COST:
ADJUSTMENT FOR WATER TYPE ONLY

Region	Change from Erie's and Joassart-Marcelli's Value ($1996 per acre-foot)
Ventura	8
Los Angeles	14
Orange	31
AVERAGE	46
City of LA	48
San Diego	74
San Bernardino	80
Riverside	122

Next, we account for the different levels of salinity in the water received by MWD's members. First, we use data on the TDS levels at each of MWD's treatment facilities and calculate an average TDS for all of MWD's imported water.[36] We then determine which facility supplies each region.[37] This allows us to compare the TDS level attained by each region to the average across MWD.

A recent MWD salinity study reported that, at current consumption rates, a 100 mg/l increase in the TDS level of all imported water results in a cost increase of about $100 million across all of MWD.[38] This translates to $0.60 per acre-foot for each 1 mg/l increase or decrease in TDS.[39] By apply-

36. We used water quality data back to 1980. This adjustment does not account for any difference in salinity-related costs before that year. The State Water Project came online in the mid-1970's. Annual TDS data is based on a simple average of monthly values at each treatment facility. *See* Spreadsheet from MWD Water Quality Division (March 2000) (on file with the authors).

37. We assume that the regions obtain their water from the following facilities: City of Los Angeles: 50% Jensen, 25% Weymouth, 25% Diemer; County of Los Angeles: 50% Weymouth, 25% Jensen, 25% Diemer; Orange County: 100% Diemer; San Diego County: 100% Skinner; San Bernardino County: 100% Weymouth; Riverside County: 100% Mills; Ventura County: 100% Jensen. *See generally* 2 METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, SOUTHERN CALIFORNIA'S INTEGRATED RESOURCE PLAN (March 1996).

38. *See* METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, U.S. BUREAU OF RECLAMATION, SALINITY MANAGEMENT STUDY FINAL REPORT 2-20, Fig.2-18 (June 1999).

39. This appears to be a conservative estimate for salinity costs in prior years. An earlier study by the Bureau of Reclamation, published in 1988, found that salinity-related costs have been even higher, as much as $2 per acre-foot for each 1 mg/l change in TDS levels. *See*

ing this figure to the difference between each agency's TDS and the average TDS, we then calculate the costs or benefits imposed on each region due to MWD's blending policy, relative to a scenario where each region received water with the system-wide average TDS level. We add or subtract this dollar amount from the total payments by each region in each year. Once again, we calculate the effect this adjustment had on each region's costs through 1996. Table 3 reports the effect this adjustment alone has on has on the average historical costs.

Table 3

AVERAGE HISTORICAL WATER COST:
ADJUSTMENT FOR SALINITY ONLY

Region	Change from Erie's and Joassart-Marcelli's Value ($1996 per acre-foot)
Riverside	-83
Ventura	-74
City of LA	-14
Los Angeles	2
AVERAGE	0
San Diego	20
Orange	20
San Bernardino	31

Up to this point, all our adjustments have incorporated costs or benefits derived from past membership in MWD. However, MWD now controls assets that have a significant value going forward. One estimate of the total value of these assets is MWD's current book value, which, according to MWD's latest annual report, is about $4 billion. In fact, the actual market value is likely to be much higher, especially if demand for water services and scarcity of supply continue to increase as expected.

In order to determine what fraction of this amount is "owned" by each of the member agencies, some allocation method must be assumed. For example, MWD calculates preferential rights by finding the cumulative sum of all fixed payments, unadjusted for inflation or interest, and then calculating the fraction of these payments made by each agency.[40] MWD and some of its members are currently evaluating other possible methods to determine equity proportions, such as adjusting for inflation and the time value of

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ESTIMATING THE ECONOMIC IMPACTS OF SALINITY OF THE COLORADO RIVER, U.S. BUREAU OF RECLAMATION (1988).

40. Memorandum and spreadsheet from the Metropolitan Water District (Nov. 1999) (on file with the authors).

money.

We do not endorse these methods; they are generally based on accounting principles rather than on any consideration of true economic value. For example, MWD's volume-based water rates and treatment surcharges are much higher than the marginal cost of providing these services. That is, a large portion of these payments is used to cover the capital and other fixed costs associated with conveyance, distribution and treatment. However, for the purpose of this analysis, we assume that an allocation system based only on historical "fixed payments" (such as property taxes, standby charges and connection charges) will be adopted.

To determine the effect of including this asset value on the net benefits attained by each agency, we applied the preferential rights shares to MWD's 1996 book value of $3.363 billion.[41] The resulting amounts were then subtracted from each agency's total historical payments. This calculation has the result of lowering each region's historical per-unit cost. However, the regions are not affected equally. Because San Diego has purchased such a large quantity of water and yet has made a much smaller fraction of fixed payments, it benefits the least from this adjustment on a per-unit basis; its share of MWD's assets is worth about $53 for each acre-foot of water purchased to date. On the other hand, the City of Los Angeles's share of MWD's assets is worth about $188 per acre-foot. Table 4 reports the effect this adjustment alone has on has on the average costs for each region.

Table 4

AVERAGE HISTORICAL WATER COST:
ADJUSTMENT FOR ASSET VALUE ONLY

Region	Change from Erie's and Joassart-Marcelli's Value ($1996 per acre-foot)
City of LA	-188
San Bernardino	-77
Los Angeles	-63
AVERAGE	-62
Riverside	-61
Ventura	-49
Orange	-48
San Diego	-33

Finally, we update this average cost measurement through 1999. Erie and Joassart-Marcelli used data through 1996 and reported their results in

41. *See* METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA, ANNUAL FINANCIAL REPORT (1999).

1996 dollars.[42] We add the most recent three years of water and payment data and then apply an inflation adjustment to report results in 1999 dollars.[43] Figure 6 summarizes the results for this entire process (for comparison purposes, both sets of results in this figure are presented in 1996 dollars). We find that the ranking of the regions in terms of average costs is much different than that found by Erie and Joassart-Marcelli. For example, Ventura County's costs fall significantly, due to the high quality of water purchased by the county. Los Angeles County (excluding the City) also falls below average. We find the disparity between the City of Los Angeles's average cost and those of other regions to be substantially reduced, though not eliminated.

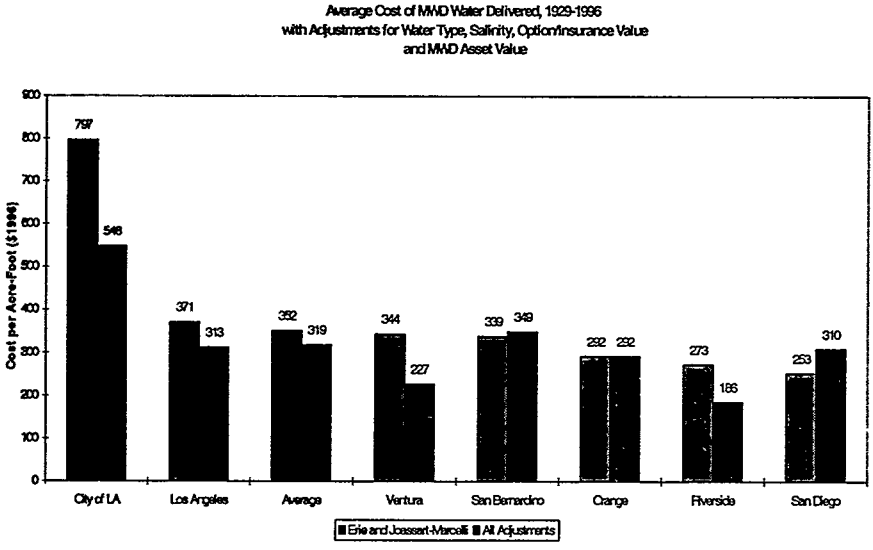

Figure 6

Erie and Joassart-Marcelli use their average cost measure to calculate an "overpayment" or "underpayment" made by each region, relative to the average.[44] Once again, although they claim this measures a "subsidy," they are only correct in their use of the term in a limited, non-economic sense. We perform the same calculation, based on our corrected average cost figures. Table 5 reports the results of this calculation. The first row shows the total "subsidy" value reported by Erie and Joassart-Marcelli. Rows two through five show the individual effect of each of the adjustments made above. The sixth row shows the cumulative effects of all the adjustments together. Finally, the last row incorporates the update to 1999.

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42. *See* Erie & Joassart-Marcelli, *supra* note 1, at 273-285 tbls.1-6, 8.

43. We used the Consumer Price Index. *See* ECONOMIC REPORT OF THE PRESIDENT 43-44 (1999).

44. *See* Erie & Joassart-Marcelli, *supra* note 1, at 280.

TABLE 5
Total MWD "Subsidy" Measurement:
Adjusted from Erie and Joassart-Marcelli
(millions of 1996 dollars)

	City of LA		Los Angeles		San Diego		Orange		Riverside		San Bernadino		Ventura	
	Subsidy	Net Change from E&J's Value	Subsidy	Net Change from E&J's Value	Subsidy	Net Change from E&J's Value	Subsidy	Net Change from E&J's Value	Subsidy	Net Change from E&J's Value	Subsidy	Net Change from E&J's Value	Subsidy	Net Change from E&J's Value
(1) Erie and Joassart-Marcelli[1]	**-1,922**		**-362**		**1,366**		**643**		**245**		**13**		**16**	
(2) Adjust for Option Value Only	-1,624	298	-393	-31	1,240	-125	548	-96	218	-28	14	1	-3	-19
(3) Adjust for Water Type Only	-1,821	101	251	613	759	-607	731	88	5	-241	-17	-30	92	76
(4) Adjust for Salinity Only	-1,854	68	-368	-6	1,113	-253	443	-200	510	265	-17	-30	172	159
(5) Adjust for MWD Asset Value Only	-1,376	545	-340	23	960	-406	495	-148	244	-1	29	16	-12	-28
(6) All Adjustments[2]	-930	992	115	477	95	-1,271	270	-373	288	42	-25	-38	187	171
(7) All Adjustments – Update to 1999[3]	**-944**	**977**	**116**	**478**	**79**	**-1,287**	**292**	**-351**	**297**	**52**	**-29**	**-42**	**189**	**173**

Notes:

A positive number indicates an "underpayment" relative to the average; a negative number indicates an "overpayment."

[1]We attempted to replicate Erie and Joassart-Marcelli's values, but could not do so exactly. This row reports the values we obtained using their methodology. For example, they report a subsidy of $1,322 million for San Diego and -$309 million for Los Angeles County.

[2]The effects of the individual adjustments are not additive. The total effect of all four is less than the sum of the effect of each of them taken separately.

[3]This row is in 1999 dollars.

https://scholarlycommons.law.cwsl.edu/cwlr/vol37/iss1/9

In summary, we find that Erie and Joassart-Marcelli overestimate the net "subsidy" received by San Diego by over $1 billion. Incorporating our adjustments reduces it from about $1.3 billion to about $0.1 billion. The "subsidy" measurement for Orange and San Bernardino Counties are also substantially reduced. On the other hand, our measurement of the "subsidy" paid by the City of Los Angeles is almost $1 billion less than Erie's and Joassart-Marcelli's. We also find that Los Angeles County (excluding the City) has in fact received a "subsidy" from MWD of over $100 million, rather than paying a "subsidy" of about $300 million, as claimed by Erie and Joassart-Marcelli.[45] We find that Riverside and Ventura Counties' "subsidies" are somewhat increased.

The adjustments we have undertaken in this section are by no means an exhaustive set of corrections needed to identify the true costs and benefits of past membership in MWD. In addition, many of the data sources are imperfect, but could be improved with access to the proper data and additional research. We do not intend for our final "overpayment" or "underpayment" results to be considered as definitive, although they certainly do provide a better approximation of net costs than the measure used by Erie and Joassart-Marcelli. Our results show that the simple measure of average historical cost is of little use in determining whether a particular agency or region benefited from its membership in MWD more or less than the average, and it certainly cannot be used to determine whether one region has subsidized another. Finally, any such measure of average historical cost is inappropriate to identify a link between water prices and regional growth rates, as will be discussed in the next section.

V. DIFFERENCES BETWEEN WATER COSTS, AS DEFINED BY ERIE AND JOASSART-MARCELLI, HAVE NOT BEEN A FACTOR IN DETERMINING ECONOMIC GROWTH

Erie and Joassart-Marcelli test for a statistical relationship between water "cost," as they have defined it, and population growth.[46] They conduct a correlation analysis between their "subsidy index"[47] for each of MWD's twenty-seven member agencies, and the agencies' average annual population growth since joining MWD. Unfortunately, this analysis suffers from several serious limitations.

First, their subsidy measure is inappropriate for studying the relationship between water cost and development. In addition to the problems identified in Section II, their measure does not reflect the price actually faced by developers, businesses, and households. Water consumers in the Southern California counties served by MWD do not make expansion or location de-

45. *See* Erie & Joassart-Marcelli, *supra* note 1, at 280 tbl.5.

46. *See id.* at 284-287.

47. *See* Erie & Joassart-Marcelli, *supra* note 1, at 286-87 tbls. 9-10. This measure is simply the total historical costs divided by total water withdrawals as described in Section II.

cisions based on the "real cost" of water as defined by Erie and Joassart-Marcelli. To the extent their decisions are influenced by water costs, users refer to the per-unit water rate, rather than some total cost measure that is largely independent of the quantity of water consumed. In fact, all potential consumers of water in Southern California have faced *equal* unit costs—MWD does not discriminate between regions. Consider a developer in Southern California faced with a decision to build homes in either Los Angeles or Orange Counties in the 1940's or 1950's. The developer knew that his clients would ultimately pay the same amount in water-related costs, no matter where he decided to build.[48] The MWD component of property taxes has been the same across counties, and the volume-based water rate has been the same. Recognizing this fact should end any discussion of growth generated by water "subsidies."

In addition, most of the agencies drawing water from MWD have had other sources to turn to. In particular, Los Angeles has obtained most of its water from the Los Angeles Aqueduct, and at a lower average cost than water drawn from MWD. Therefore, the retail water price faced by Los Angeles consumers has actually had very little bearing on the "real cost" of MWD water as measured by Erie and Joassart-Marcelli. The authors actually note this earlier in their paper. They state: ". . .the retail cost of water to Los Angeles customers remained relatively low and did not represent an inhibitor to development."[49] Here, the authors seem to recognize that retail price is what matters to developers, and that this alone is the factor that can influence growth. However, they seem to lose this point when they examine the correlation between water cost and growth later in the paper. There is no reason to expect a relationship to exist between the authors' derived water cost and growth. In order to study the true effect of water prices on growth, it would be necessary to look at actual retail prices across all Southern California regions. These prices are determined by the cost of *all* the alternatives available to local water agencies (including groundwater, local reservoirs, and the Los Angeles Aqueduct, in addition to MWD), and the pricing mechanisms employed by the agencies.

Not surprisingly, the statistical fit found by Erie and Joassart-Marcelli suggests a much less important relationship than they imply. Their finding of a modest statistical relationship between water cost and growth in the 1929-1970 period, denoted by an R^2 of 0.383, does not necessarily support a

48. There may be differences in costs faced by end-users associated with the rate structures of the individual municipal water agencies. Even though all of MWD's members face the same volume-based water rate, the agencies may choose to pass these costs on to their users in different ways. For example, some may include sewage fees or other charges in the volume-based rate they collect. MWD has recently begun charging additional fixed fees to its member agencies, known as "standby" and "connection" charges. These have only been in place, however, since 1993 and 1996, respectively, and thus have not contributed to historical differences in population growth.

49. *Id.* at 281.

claim that "the relationship is quite robust."[50] They give no indication of what they mean by "robust," or what the standard is for such a claim. In a statistical context, "robust" generally means that the results would not change significantly if the input data were altered slightly. Yet, in the very next sentence, the authors point out that the result is "fundamentally driven by two key agencies,"[51] indicating that just a couple of outliers may be the source of their result. This statement also contradicts an earlier claim by the authors, that "the early subsidy/growth relationship also appears to hold for all 27 member agencies."[52] Even a cursory examination of the data indicates that the relationship is far less direct than they imply.

Erie and Joassart-Marcelli imply a degree of causality in this relationship; lower water costs, as measured by the "subsidy index," lead to faster growth. While lower water prices, as measured by the incremental cost faced by developers or other consumers, undoubtedly have some effect on growth, the analysis presented in their paper does not demonstrate such causality. As the authors admit, there are many other variables that are likely to affect population growth.[53] These variables include transportation access, weather, zoning and environmental regulations, property taxes (exclusive of water costs), and pre-existing uses. The introduction of any one of these variables could virtually eliminate the correlation found in their analysis.

Perhaps most importantly, the idiosyncrasies of their measurement method may themselves lead to a false conclusion regarding causality. Causality may, in fact, be in the reverse direction. Because of the way the authors calculate their "subsidy index," rapid population growth will, by definition, lead to lower costs (and higher "subsidies"). For example, because San Diego had a small property base when it was annexed into MWD, its initiation fees were relatively low. However, as San Diego grew rapidly, it began to draw a greater share of the water supply. This reduced the average historical cost per unit of water consumed. Thus, high population growth "causes" the subsidy level (as measured by Erie and Joassart-Marcelli) to rise, rather than the vice versa. The fact that the correlation between growth and subsidy level is stronger in the 1929-1970 period than in the 1971-1996 period could just as readily support this interpretation. As the authors note, both the degree and variation of this "subsidy" was greater in the early period.[54]

To confirm this fact, we used a statistical test known as the "Granger Causality Test" to determine in which direction the causality actually runs. This test identifies whether historical values of one variable help explain the pattern observed in a second variable, or vice versa.[55] In this case, the test

50. *See id.* at 280.
51. *Id.*
52. *Id.* at 279.
53. *See* Erie & Joassart-Marcelli, *supra* note 1, at 287.
54. *See id.* at 285 & tbl.8.
55. For a more in-depth description of the method, see RAMU RAMANATHAN,

will help us determine if historical values of the water subsidy (as defined by Erie and Joassart-Marcelli) explain, or "cause," population growth, or, alternatively, if historical values of population growth explain the water subsidy. It is also possible that neither one "causes" the other, but that they are simply both correlated with a third set of variables.

Table 6 shows the results of these tests.[56] We find that for most of the Southern California regions, population growth actually "caused" the increased water subsidy, rather than the reverse as implied by Erie and Joassart-Marcelli. For San Diego and San Bernardino, no causation was identified in either direction. For Ventura, the test determined that some causation was evident, but that the direction was indeterminate. This confirms what we have stated above: water "subsidies," as defined by the authors, have not been a factor in the different growth rates experienced by Southern California's various regions. This should be no surprise, since all consumers and potential consumers of water in Southern California face identical water prices.

TABLE 6

	Does the Water Subsidy "Cause" Population Growth?		Does Population Growth "Cause" the Water Subsidy?	
	F-Statistic[1]	Result	F-Statistic[1]	Result
City of LA	0.37	No	2.57	Yes
Los Angeles	0.49	No	16.62	Yes
Orange	0.84	No	3.09	Yes
San Diego	0.67	No	0.97	No
Riverside	0.60	No	4.42	Yes
San Bernardino	0.60	No	2.18	No
Ventura	3.59	Yes	2.86	Yes

[1] An F-statistic of about 2.5 represents a 95 percent confidence level.

In conclusion, Erie and Joassart-Marcelli's statistical analysis does not support their conclusion that, "The Metropolitan Water District . . . for forty years subsidized suburban sprawl . . . at the expense of the taxpayers and

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INTRODUCTORY ECONOMETRICS WITH APPLICATIONS 113 (4th ed. 1998). *See also* C.W.J. Granger, *Investigating Causal Relations by Econometric Models and Cross-Spectral Models*, 37 ECONOMETRICA 424-438 (1969) (describing the statistical methods involved in the Granger Causality Test.).

56. Two time series regressions were run using annual data, by region. First, we ran a regression with current year population growth as the dependent variable and lagged values of both population growth and water cost (calculated on an annual basis) as independent values. The second regression used the same independent variables but used current year water cost as the dependent variable.

ratepayers of the metropolitan center."[57]

VI. INCREMENTAL PRICES WILL ELIMINATE SUBSIDIES—NOT PERPETUATE THEM

Erie and Joassart-Marcelli come to the conclusion that "charg[ing] only nominal wheeling rates for water purchased from the Imperial Valley could further institutionalize this long-term pattern of subsidization."[58] The authors are apparently referring to the state law that requires wheeling charges through unused capacity to be set at a measure of "fair compensation" as defined by statute for facilities used.[59] However, even if subsidies occurred in the past, this assertion is simply not correct. In fact, incremental cost-based pricing guards against subsidies and should promote "smart growth" as opposed to sprawl.

Incremental cost-based pricing requires that water rates cover current and, to some extent, future costs. These rates reflect economically efficient prices. Consumers cover the costs of the goods or services they buy, including both operating costs and capital costs. Under incremental cost pricing, prices rise if there is congestion or shortages. Price increases can then provide the means to cover any expansion made necessary by the limits on available capacity. This guarantees that all further expansion costs are recovered and that consumers are made aware of the costs of increased demand.[60] Historical costs are "sunk" and are irrelevant to efficient pricing.

To the extent that the recovery of prior investment costs is jeopardized by a switch to incremental pricing, some other mechanism can be established to handle the problem. This is precisely what has taken place in California, where the electric utility industry has recently been restructured. For a lim-

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57. Erie & Joassart-Marcelli, *supra* note 1, at 290.

58. *Id.* MWD and SDCWA have entered into a contract to exchange conserved water that is made available to SDCWA by the Imperial Irrigation District. The exchange has a pricing structure for firm transportation that includes capital and other costs directly associated with the transportation of the water on a regular basis. Additional financial considerations are also included. Erie and Joassart-Macelli's reference to "nominal wheeling rates" is a mischaracterization.

59. CAL. WATER CODE § 1812(b) (West 2000). The issue of the proper calculation of "fair compensation" for wheeling water as required by the Water Code was the subject of litigation initiated by MWD to validate certain wheeling rates charged to its member agencies, which resulted in a ruling invalidating its rates. *See* Metropolitan Water Dist. Of Southern Cal. v. All Persons Interested, et al., No. BC164076 (Cal. Super. Ct. Jan. 12, 1998). The judgment invalidating MWD's rates was subsequently reversed upon appeal. *See* Metropolitan Water Dist. Of Southern Cal. v. Imperial Irr. Dist., et. al., 96 Cal. Rptr. 2d 314 (2000). The Imperial Irrigation District, the SDCWA, the Center for Public Interest Law, the Cherneheuvi Indian Tribe, the Quechan Indian Tribe, and Cadiz, Inc. were all defendants in the validation action.

60. Note that when common or joint costs are present, incremental pricing may be inadequate to cover total costs. In such cases, it may be necessary to modify rates to reflect the relative price sensitivities of customer groups. Such modifications, however, should maintain the link between the specific services provided, their costs, and customer demands.

ited time period, utilities are allowed to collect for certain "stranded costs," assets deemed uneconomic after restructuring, in their rates. Note that, in the case of MWD, the risk of stranding prior investments may be quite small in view of the growing demand for water and limits on existing transportation infrastructure.

"Smart growth" is best served when water is priced to reflect its true incremental or marginal cost. Consumers must be guided by the cost of the next increment of water demanded. Not only should prices reflect incremental costs, they must be tied to the provision of specific services. Rather than perpetuate a subsidy, a move to incremental cost pricing will create the proper incentives for efficient consumption. To the extent that water costs influence economic development, incremental cost-based prices will provide the correct signals unencumbered by history's mistakes. MWD's current pricing and financing practices are the ones that perpetuate inefficient signals to consumers and are detrimental to "smart growth."