THE SEARCH FOR ACCEPTABLE WATER RATES: RESEARCH NEEDS AND POSSIBILITIES

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INTRODUCTION

Water for municipal use has been characterized as both the most valuable and costly type of water services to provide (Milliman, 1964). The ways in which public water utilities represent this value and cost in the prices they charge has been blamed for important economic misallocations and redistribution of income (e.g., see Renshaw, 1982, Boland, 1983, Collinge, 1994).[1] References to the water pricing problem began to surface in the literature as early as 1938, when Harold Hotelling made mention of how to price water in a dry country. Ever since, the water pricing debate has been focused on prescribing the most optimal way of charging for publicly-supplied water, given its large fixed costs, its institutional status, and more recently, its environmental importance. Economists have provided first-best, second-best, and probably even third-best solutions to the utility pricing problem. However, still to this day, pricing theory remains generally incongruent with actual rate setting practices. The words of Breslaw (1988) adequately sum up the current state of nature in water utility pricing:

> "Theoretical niceties are fine for academics, but it is the pragmatic requirements of daily existence that shapes choice in the real world (p. 376)."

In order to understand this predicament, one must carefully analyze the context within which water utility pricing takes place. It is a context that necessarily involves interactions of water system functions and the functions of price with the differing objectives and perspectives of those who demand and supply water.

Water rates and pricing structures embody a mix of both broad and specific allocative, environmental, and administrative objectives. Aside from the economic efficiency criterion, there is little theoretical guidance on establishing a price for water. Unfortunately, the economic efficiency criterion is insufficient for rate makers who must incorporate practical and political elements into the ratemaking process. Among other concerns, rate makers usually must consider how new rates will be perceived by the public, whether the rates will recover operating costs, and whether the costs of service are allocated fairly among customers. These additional and simultaneous concerns cause rate-setting to be a multiobjective process, in which utilities *learn by doing*. The process can be characterized as a *search for acceptable rates*. Unfortunately, acceptable rates do not represent a clear target. Acceptability is a vaguely defined notion that varies over time and among perspectives.

If one may make the assumption that current water prices and pricing structures in the United States are indeed acceptable, as implied by their very existence and the willingness of consumers and regulators to tolerate them, then one might blame the search for acceptable rates for the ills that plague the water industry today. Over time, deliberate underpricing of water has fostered public health and safety and economic development, but has led to deferrals of operations and maintenance expenditures and deteriorating supply systems (Goldstein, 1986). In addition, municipal water districts have been shown to earn a low rate of return relative to the opportunity cost of capital, which suggests that significant future subsidies will be required to maintain the system: a persistent "money-losing" activity (Mercer and Morgan, 1986). These and other factors likely play a significant role in the recent finding that currently over 80 percent of public water systems are considered economically nonviable (Dziegielewski, 1997). Thus, one could conclude that acceptable rates are in the eye of the beholder and at the heart of a growing resource allocation problem.

AVENUES FOR NEW WATER PRICING RESEARCH

A look through the water pricing literature does not yield much information on the actual experiences of public water utilities in undertaking substantial rate reform. Typically, the literature is inclined to give diametrically opposed expositions on the best ways to formulate water rates and rate structures. Marginal cost pricing is usually touted from an economic efficiency perspective, while variants of average cost pricing are recommended from rate practitioners that are familiar with the technical and administrative constraints of utility rate making. Of course, there are numerous other options for pricing water that attempt to optimize some specific set of pricing objectives. The literature stops short of describing the intricacies of the process and commonly only suggests that in developing rates utilities must *weigh* their objectives and strike an acceptable balance among competing objectives.

To be sure, there is a substantial amount of information available with regard to the results of the ratemaking process, namely the range of rates and rate structures that have been designed and implemented in practice. What is missing is sufficient information on the process through which a pricing idea becomes a pricing alternative and ultimately a pricing policy. As the water utility industry faces the challenges of the new century, the water resources research community should make a concerted effort to gather and synthesize information about the rate-making process. Such an effort would address the following questions:

- What is the process that water utilities follow in formulating alternative rate structures in actual practice? In what ways does this rate-making process vary from utility to utility?
- How do utilities perceive the need to reform water rates? Is it always revenue driven?
- How are competing objectives weighted in the rate-making process? What are the trade-offs among objectives? How do utilities recognize and accommodate the trade-offs?
- How do objectives and weights vary over time and space? Does the process change with circumstances?
- What are the qualities of an acceptable rate or rate structure? How do these qualities vary over time and space? How do these qualities differ from those of an economically efficient rate structure? How do water utilities assess the acceptability of their new rates?
- On which metrics can alternative rates and rate structures be standardized, measured, and compared?
- Can the acceptability and costs of alternative rates be modeled and predicted prior to rate reform?

THE NEED FOR A MODEL OF THE RATE MAKING PROCESS

It is evident that the rate setting process is comprised of multiple criteria (e.g., cost recovery, equity, efficiency) and numerous tradeoffs (e.g., higher efficiency-less revenues, higher ease of implementation-decreased equity). These tradeoffs exist because water rates serve more than one economic function. Water rates generate revenues, allocate costs, and provide incentives (Mitchell and Hanemann, 1994), and as a result serve allocational, distributional, and institutional objectives (Boland, 1983). Sometimes alternative rate functions can be performed in harmony. More often, however, as Bonbright (1940) pointed out long ago, "the choice of one desired objective of rate making makes necessary the almost complete abandonment of the other," and "at times, this situation reaches the stage of an almost perfect dilemma (p. 388)."

The fact that there exists a menu of alternative rate structures strongly suggests that utility ratemaking practices are not static. Indeed, analyses have shown that there are visible trends in the choice of rate structure over time. Public water utilities, once bound by metering constraints, seem to be dropping flat rate and decreasing block rate structures in favor of uniform and conservation-oriented rates (Duke and Montoya, 1993). The speed of this transition has been more pronounced in the West and Northeast, which appears to be correlated with scarcity concerns and the need to replace aging infrastructure, respectively (Duke and Montoya, 1993; Goldstein, 1986). It is important to understand that these are industry trends. In other words, decreasing block rate structures still exist in the West, just like flat rates still exist in the East. All one can say at this point is that individual utilities follow their own distinct paths in evolving their rates. To the knowledge of the author, not a single study has attempted to follow the evolution in rate setting practices from the standpoint of the individual utility.[2]

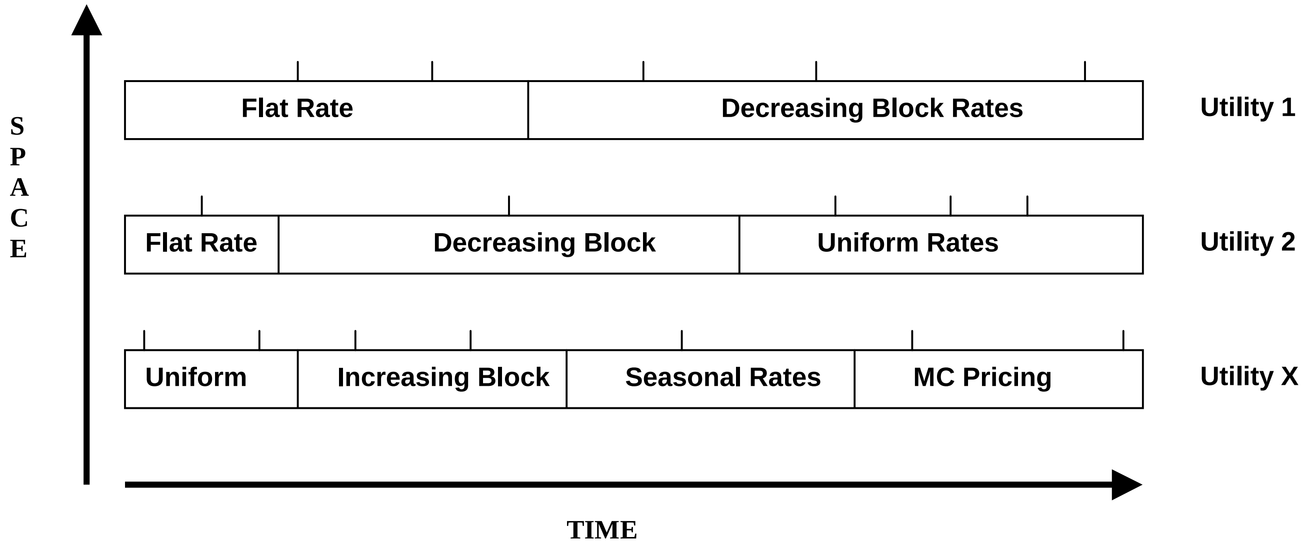

Figure 1. Variance in Rate-Setting Paths

Figure 1 illustrates the problem at hand, showing different paths in water rate structures over time for three hypothetical utilities. Over the same period of time, Utility 1 has changed rate structures once, Utility 2 has changed rate structures twice, and Utility X has changed rate structures three times. The marks along the top of each rectangle indicate when there has been an adjustment to some element of the corresponding rate structure, for example a change in the number, height, or width, of consumption blocks, that does not classify as a change in rate structure. The illustration exemplifies variance in ratemaking practices, which needs to be explained to truly understand the ratemaking process. First, and foremost, what circumstance(s) triggered the decision to change rate structures? Secondly, what factors influenced the decision to adopt the new rate design? And, how long did the utility attempt to adjust the current rate structure before yielding to a new design? Third, why do the ratemaking paths differ? How much of this variance stems from situational characteristics, and how much is due to differing rate setting objectives, differing views on the relative importance of objectives, and the potential for achieving objectives? Finally, how much of this variance is due to a differing process for determining rates? The answers to these questions are critical to understanding the ratemaking process and whether or not the "search for acceptable rates" can be improved.

SPECULATIVE FRAMEWORK OF THE RATE-SETTING PROCESS

One might postulate about the make-up of the water ratemaking process in absence of new primary data. Figure 2 represents a sketch of the potential nature of the ratemaking process, which might serve as working null hypothesis for future research.

Initially, one may assume there arises a need to adjust the price (or the set of prices, price structure) of water. As indicated in the preceding section, little is known about what actually triggers rate reform, and how the cause(s) vary from utility to utility. Regardless, this perceived need will determine a primary objective of a rate change. The primary objective (e.g., water conservation) is narrowly defined at this stage of the game, which allows the ratemaker some freedom to propose ways in which the objective can be achieved. Initially, then, the problem might take the form of a maximization problem, optimizing the choice of water rate policy along a single dimension without constraints.

As the ratemaker seeks input and approval for his proposal, additional secondary objectives surface. These secondary objectives represent a broadened perspective, which takes into account the values and preferences of others involved in and affected by the ratemaking process (e.g., the utility manager, utility accountants, politicians, and customers). These stakeholders introduce constraints on the fulfillment of the primary objective. For example, the new pricing policy must not only encourage water conservation, but must also recoup operating costs and be void of cross-subsidy among customers. Thus, secondary objectives become constraints to the initial problem when one must

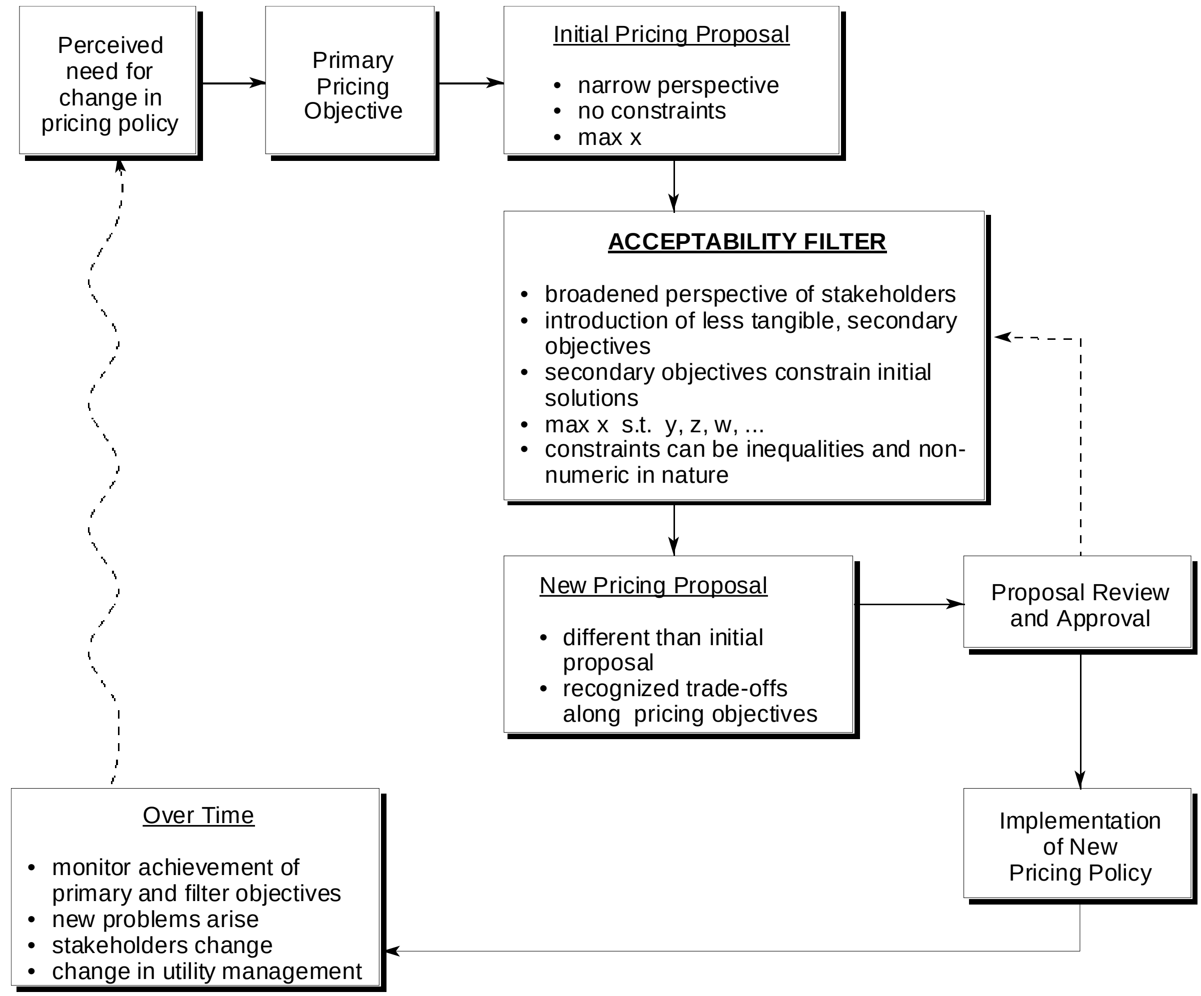

Figure 2. A Model of the Search for Acceptable Rates

forego (or trade off) the degree of achievement of secondary objectives to fulfill the primary objective.

This stage of the ratemaking process ultimately produces a pricing proposal that is considered to be generally acceptable and filtered of undesirable elements. Depending on the number of stakeholders and competing objectives, it may take a long time for the rate to make its way through the *acceptability filter*. Furthermore, the acceptability filter will likely produce a rate proposal that is much different than envisioned at the beginning of the process.

Rate approval may represent an extension of the acceptability filter if the approving authority or members of this entity were not involved in the earlier stages. For example, the final approval for a change in rates may come from a City Council, who can have its own pricing objectives and ideas on how these should be achieved. Once an acceptable rate has been approved, it is administered (typically through the utility's billing and public affairs departments).

Over time following implementation of the new rate, the utility will receive signals and collect and process information as to the effectiveness of the new rate in fulfilling the primary and secondary objectives. The degree of effectiveness will dictate whether and how soon this process will need to be repeated. Regardless, it will be necessary to re-examine rates in the future in response to evolving objectives and circumstances (Farnkopf, 1996).

TOWARD A MULTICRITERIA FRAMEWORK FOR CHOOSING AMONG RATE OPTIONS

This speculative model of the water rate setting process, and particularly the notion of the acceptability filter, has elements of a multidimensional decisionmaking problem. Borrowing from statistics, modeling the choice of rates is akin to fitting a statistical response surface of the consequences of a water pricing decision or policy. Figure 3 translates the multidimensional ratemaking problem onto a two dimensional surface and creates what can be called a *web of acceptability*.[3] A rate or rate structure will fulfill to some lesser or greater degree many simultaneous rate setting objectives, which are represented by the various labeled vectors that begin at the origin. The example shown in Figure 3 scores the fulfillment of various objectives arbitrarily along the interval [0,1]. As implied above, different rate structures *and* specific characteristics of similar rate structures will produce different scores on the multiple criteria, and will therefore form differently shaped webs. The goal of the ratemaking process, then, would be to expand the frontier of the web along some or all dimensions that are relevant to the ratemaker, either by "fine-tuning" existing rates or my revamping the rate structure altogether.

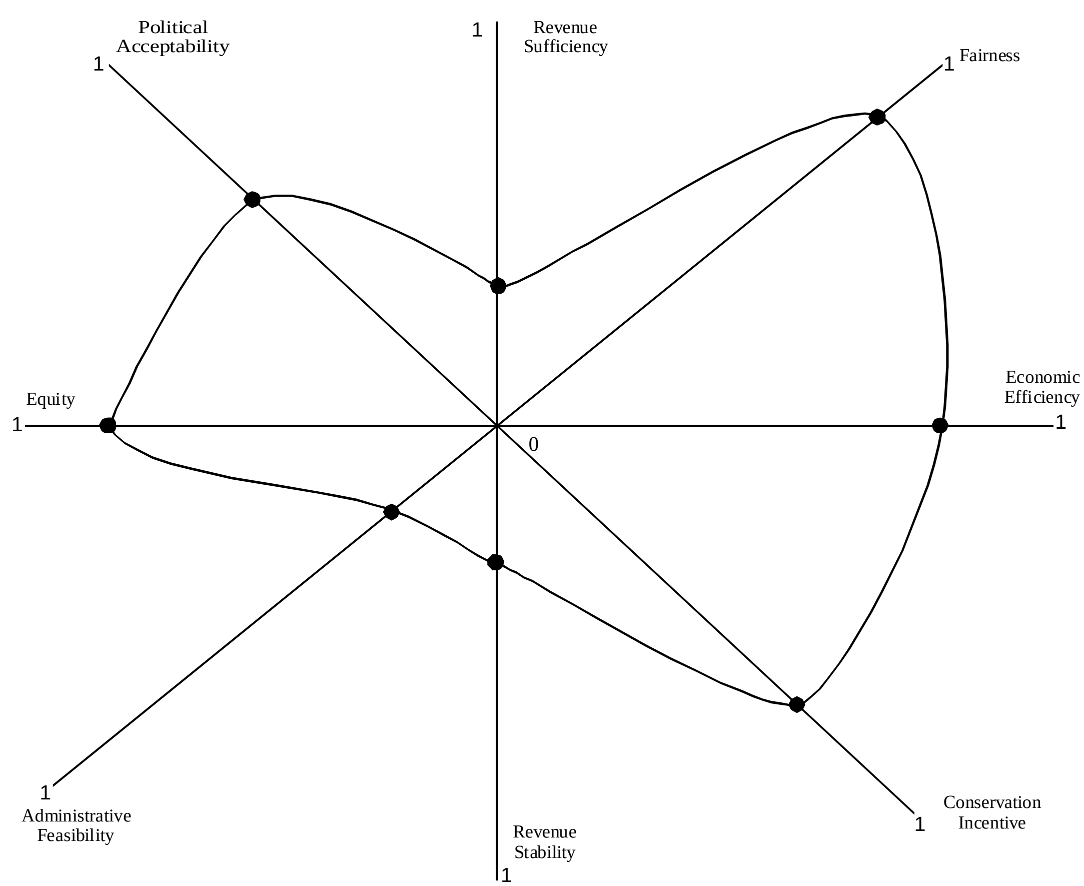

Figure 3. The Web of Acceptability

The ratemaker might be expected to assign more or less importance to the objectives depicted in acceptability web of Figure 3. If this is the case, and indeed the literature indicates that it is, then the concept of rate acceptability can be related through a numeric index or scale. An *acceptability index*, would calculate a total score for each of *s* pricing alternatives (R_s) as a simple weighted sum:

$$R_s = \sum_{k=1}^{q} w_k \cdot r_{sk} \qquad \text{(Eq. 1)}$$

where the scores given to a particular rate setting criterion (r_{sk}) are standardized on the interval [0,1] for each of *q* criteria that are assigned policy weights (*w*). The goal of the ratemaker would then be to choose the rate configuration that would maximize the weighted score, R_s,[4] subject to certain constraints.

A primary goal of future pricing research should be to determine if, how, and why the components of Equation 1 differ among utilities, as well as within a single utility over time. Further, such research should seek to determine who is involved in the ratemaking process and how and to what extent this affects the search for acceptability. If one can (a) learn the components of Equation 1, (b) understand variation in and standardize the values of these components, and (c) identify and establish constraints that are inherent to this process, then it will be possible to anticipate the impacts of various rate policies. Hence, it would be possible to predict the relative acceptability of various rate policies. Such a model would improve on the current process, which seems to be based on trial and error.

CONCLUSIONS

The search for acceptable water rates imposes certain costs on utilities, ratepayers, and taxpayers, particularly when rate-setting objectives are not met, and especially when the balancing of multiple objectives does not represent the best long-term management of scarce water supplies. However, aside from what is known about standard utility practices with regard to revenue requirements and cost accounting, little is known about the actual process of water rate reform. In other words, there is a lack of understanding of the intricacies of rate reform and how public utilities construct *acceptable* rates. Thus, there exists no framework within which to model what is clearly a multicriteria decisionmaking process. Further, there is currently no mechanism through which to balance and assess the achievement of and trade-offs among multiple rate setting objectives. The water industry and its constituents need a way to anticipate whether rate reform will result in rates that are both acceptable and effective in meeting multiple pricing objectives.

This paper has presented important questions for future water pricing research and has indirectly proposed some first steps in constructing a generalized planning framework for rate reform. A model for constructing acceptable water rates and rate structures, which embodies multiple pricing objectives and the practical considerations of the water utility industry, will lower the total cost of water rate reform and may increase overall economic efficiency as rate setting objectives and trade-off's become more transparent.

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ENDNOTES

1. Collinge (1994) goes as far as to suggest that rate setting practices are detrimental and comparable to "inefficiencies of the sort that plagued Eastern Europe and the former Soviet Union under communist rule. Specifically, costs rise, innovation lags, and output is not allotted to its highest valued use (p.48)."

2. As long ago as 1983, Professor John Boland hinted at the need for such a study, suggesting that little is known about the overall experience with rate changes and pointing to a lack of information on how many rate proposals are rejected, modified, or approved before a decision is made to change rates.

3. This construct admittedly borrows from the concept of the agro-ecological continuum developed by Duram (1997).

4. See Stewart and Scott (1995) for an application of this technique in the general context of multicriteria water resources planning. Also, see Kiefer and Kocik (1994) for a practical application of mathematical indexing using standardized scores.

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