Fair Value Versus Original Cost Rate Base Valuation During Inflation

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INTRODUCTION

Valuation of public utility property for rate-making purposes has been controversial since the beginning of public regulation. Despite much academic research and practical experience, there is no consensus of academicians or practitioners concerning the appropriate value of physical property used for providing service to customers. In public utility rate making, the value of this physical property, net of depreciation, is called the rate base. An important question is how well regulatory processes adjust the rate base for price level changes during periods of inflation.

Statutes of the individual states determine how public utility property will be valued for rate-making purposes. Three basic methods are employed. *Original cost jurisdictions* set the rate base at the value of the property when it was first installed in a public utility application; the *fair value* method attempts to adjust the base to a level that more correctly reflects its current value; and the *reproduction cost* approach tries to establish a value that would permit reproduction of the property. Because the reproduction cost approach is not now being used by any state, this study focuses on the original cost and fair value methods.

The rate base valuation issue is not of academic interest only; indeed, it has been said that the rate base is at the core of the rate determination process in practice. Several recent cases before the Illinois Supreme Court

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illustrate the importance of the issue. Ruling on an appeal of a rate case that had been heard by the Illinois Commerce Commission, for example, the court decided that the Commerce Commission must use "fair value" in the rate making process.[1] Interestingly enough, Illinois had previously used a "fair value" basis for rate making but had changed to "original cost" on March 13, 1973. This situation clearly reflects recent interest by the courts. It also indicates that the court and the utility company involved believe that the end result of a given rate case is likely to depend significantly on whether original cost or fair value rate base valuation is used in the proceedings. Although the illustrations are from Illinois, the problem is general; it exists wherever rate base regulation exists (that is, throughout the United States).

Much regulatory energy and academic research has been devoted to examining what constitutes the "correct" basis for valuation of the rate base of utility firms. Several studies have shown that statistically there is no earnings difference between firms regulated in original cost and fair value jurisdictions. These results suggest that the recent ruling of the Illinois Supreme Court lacks a sound basis in economic reality; a change in rate base methods would not affect utility firms' realized earnings.

The topic is important, but results of past research have obviously not been convincing to regulators and the court; consequently, further research on the performance effects of different rate base methods is useful and necessary.

This study attempts to answer two important questions. First, do rate base methods matter? That is, do changes in regulatory regimes from fair value to original cost, or vice versa, have any important effects? Second, if regulators do cause any important changes, do they compensate utility firms adequately or excessively for changes taking place on the price level? The main purpose of this study is to determine whether methods of rate base valuation affect the earnings, prices, and output of electric utility firms. We use techniques and data designed to avoid some problems found in other studies of rate base methods.

Generally, our results show no systematic relationship between methods of rate base determination and profits or prices charged by electric utility firms. Regulatory commissions were usually either overcompensating or undercompensating for inflation occurring in the economy.

1. Union Electric Co. v. Illinois Commerce Commission (1978)—Ill. 2d—381 N.E. 2d 1002; appeal: Union Electric Co. v. Illinois Commerce Commission (1979)—Ill. 2d—396 N.E. 2d 510; rehearing denied November 30, 1979. A similar case was Illinois Bell Telephone Co. v. Illinois Commerce Commission (1978)—Ill. 2d—381 N.E. 2d 999.

PREVIOUS STUDIES

Economists have been considering the rate base issue for years. For example, Hayes (1913), Ruggles (1924), and Bonbright (1926) all contributed to the early study of rate base methods and examined important issues of rate base determination. More recently, Eiteman's (1962) seminal paper found that original cost regulatory jurisdictions have *permitted* the highest rates of return on rate bases, whereas permitted returns were lowest for firms operating in reproduction cost jurisdictions. The higher permitted rates were only partially compensatory, however, because *actual* rates of return to book value of securities have been lowest in original cost jurisdictions. Past research of rate base matters is interesting and important; however, the data, approach, and questions raised in this paper set it apart from earlier studies.[2]

THE THEORY

The regulators of public utility firms are responsible for setting rates high enough to permit the firm to earn a fair return, but without excessive profits. The rate-making equation comprises the "cost of service," or revenue requirements of the firm. It includes current operating expenses and depreciation, current taxes, and the return on the rate base.

In the process of a rate case, the firm is allowed to recover, through future rates charged for its services, all current operating expenses incurred, including current depreciation and taxes. The firm's rates may also include a component to cover the return on the rate base. (The return amount is the value of the rate base multiplied by a rate of return.)

The appropriate values for current expenses, depreciation, and taxes are relatively straightforward. They essentially consist of expenses that the firm is allowed to recover from rate payers. Although these items may be the cause of an occasional dispute, the rate base is a *crucial* variable in public utility regulation.[3]

In a world of no inflation, original cost and fair value would yield the same rate base value. The fundamental objective of fair value rate base valuation is to compensate business firms for the change taking place in the

2. The literature of rate base valuation methods is too extensive to review here. Hagerman and Ratchford (1978), Pike (1967), Primeaux (1978), Rock (1979), and Primeaux (1979) discuss some of the past studies and some more recent research results. A longer version of this paper, presenting additional background information, is available from the authors on request.

3. See Paul J. Garfield and Wallace F. Lovejoy (1964), pp. 44–134, for detailed discussions of the various components of the rate-making process.

value of money. Clemens (1950) explained that price level changes are the real reason why fair value rate base valuation is advocated. It tends to yield an income of constant purchasing power to investors. Rising (falling) prices result in rising (falling) rate base values, to compensate for the changed purchasing power.

After the commission determines the "cost of service" of the public utility firm, the next step in the rate-making process is to establish the rates customers will pay for services. The commission instructs the utility to prepare, for its consideration, the appropriate rate schedules to generate the allowed return. This procedure, of course, involves assessments of price elasticities in the different market segments. Without inflation, a firm's profits and prices would not be affected by the choice of rate base valuation method. When price level changes occur, however, the fair value and original cost methods yield different results. In comparison with original cost rate base methods, fair value methods would allow higher nominal return amounts to the utility and consequently higher nominal prices. The effect of different rate base methods on *real* returns and *real* prices, however, is not obvious. The result ultimately depends upon the success of the state regulatory commission in compensating the utility firm for inflation occurring in the economy. In actual practice, a firm may be overcompensated, undercompensated, or just compensated by the utility commission as it attempts to make adjustments, through time, to offset the adverse effects of inflation.

If regulation is efficient in a fair value jurisdiction experiencing no inflation, the utility will earn a constant real return amount. The commissioners will establish a target rate of return that they consider reasonable and, in the absence of inflation, there will be no need for adjustments.

When the method of rate base determination is changed, the result on a firm's real earnings (and real prices) cannot be unambiguously determined. If no inflation exists, the earnings path may remain constant. This is also true if the state commission merely compensates the firm for inflation. However, the utility commission may not just offset inflation. That is, the commission may overestimate the amount of adjustment necessary to compensate for the inflation. Real earnings might then rise after the change in rate base method. On the other hand, the commission could underestimate the amount of adjustment necessary to offset inflation occurring in the economy. Here, the real earnings path after the change in rate base method might fall.

Once the regulatory commission begins to use a given approach and formulas to arrive at a fair value rate base, it will probably continue to use those same approaches and formulas for some time. Consequently, if miscalculations occur, they will probably persist over some period of time.

While the *actual* effects of the two different rate base methods on *real* earnings and prices is not obvious, it seems *theoretically* clear that original cost rate making would yield greater welfare benefits than fair value rate making. The electric utility demand curve is downward sloping; consequently, fair value rate making would lead to lower consumption than under the original cost method. Since a larger consumer's surplus would result from original cost pricing, consumer welfare would be enhanced by that valuation method.

The next section presents the procedure used to test empirically for the effects of different rate base methods on realized rates of return, prices, and output of a sample of electric utility firms.

PROCEDURE

Whereas previous studies have used cross-section data, we examine the effect of rate base methods on individual firms. The data consist of time series observations for a selected sample of firms.

The sample consists of firms located in states that changed rate base determination methods any time from 1948 to 1978. Consequently, it is possible to examine the effect of changes in rate base valuation on individual firms.

Extreme care was used in classifying the firms included in the sample, for there was some discrepancy in published data sources concerning the rate base methods used in certain states. Six sources were consulted to assure that the correct rate base method was ascribed to each firm in this study.[4] The rate base classifications were examined through time to determine which states had changed method since World War II. In a few cases where there was ambiguity even after reviewing the references, state regulatory commissions were contacted to resolve remaining questions. This review showed that only four states had changed during the 1948–1978 period. Alabama changed from fair value to original cost in 1971; Illinois in 1973; North Carolina in 1964; and Missouri in 1958. The data base is particularly valuable because it includes states that changed both *to* and *from* original cost.

All possible privately owned firms in these four states were included in the sample. Since publicly owned firms are largely free from state regulation and are sometimes given different regulatory treatment from pri-

4. The information was obtained from U.S. Federal Power Commission, *Federal and State Commission Jurisdiction and Regulation of Electric, Gas and Telephone Utilities* (Washington, D.C.: various years); Eiteman (1962); Pike (1967); Phillips (1969); U.S. Senate, *State Utility Commissions Summary and Tabulation of Information Submitted by the Commissions*, Document 56, 90th Cong., 1st sess., Washington, 1967; State of Arizona, *Arizona Corporation Commission*, Annual Report, June 1970.

vately owned ones, they were excluded from the sample. The final sample consisted of one firm from Alabama, seven from Illinois, eight from Missouri, and four from North Carolina. Some firms were excluded from certain equations becasue they were only generating companies and did not have residential sales. A few firms were totally omitted because of insufficient data.

A separate set of equations was run for each firm in the sample; ordinary least squares multiple regression was the approach used to develop the equations. The procedure involved the use of five different reduced-form equations for assessing the effects of rate base methods on the earnings and prices of the individual firms in the sample.

A model of the demand and cost functions for firms was derived to obtain the reduced-form equations. This step was necessary to specify correctly the variables that would affect the performance of the dependent variables for the profit-maximizing monopolists included in the sample.

Sequentially, the econometric procedure was as follows. First, the data for all sample observations were included in the reduced-form equations for each individual firm. Second, an equation was run for each firm, for each dependent variable, using only the long subsample of data. For example, in Illinois, the rate base method was fair value from 1948 to 1972 and original cost from 1973 on. Consequently the long subsample, for *firms* in that state, would consist of the fair value observations from the 1948–1972 period. The long subsample period differed from state to state, depending on when the rate base valuation change took place. The residuals computed from these regressions were used in subsequent steps in the analysis.

In the third step, the long subsample regression was extrapolated (forward or backward, depending upon the situation) through the short subsample time period and the mean error was computed for the short subsample. Fourth, the standard error of forecast was computed for each short subsample time period based on estimates for the long one. Fifth, under the assumption that the standard errors of forecast are independent across time, the standard error of the mean forecast error was computed during the short subsample period. Finally, the ratio of the mean error for the short subsample to the standard error of the mean forecast error was used to compute a t ratio for the mean forecast error of the short subsample. Each of these steps was followed for each dependent variable, for each firm in the sample.[5]

5. An alternative means for testing for a change in the reduced-form equations (coincident with the change of regulatory regimes) would be the more conventional Chow tests. In cases where the short subsample is less than the number of regressors, this test is somewhat cumbersome, but not difficult to apply. The shortcoming of such tests, from the perspective of this investigation, is that they fail to reveal whether the real rate of return (or prices) goes up or down in cases where the hypothesis of stability across the regimes can be rejected. In this

EMPIRICAL RESULTS[6]

Realized Rate of Return Proxies

The reduced-form equation for the rate base effects for the firm is as follows:

$$Y = B_1 + B_2LGNP + B_3LVA + B_4LPOP + B_5LPE + B_6LC + B_7LCAP + B_8T + B_9LGP + B_{10}IT + U$$

where: Y = dependent variable, explained below
$LGNP$ = natural log of real GNP, in billions of dollars
LVA = natural log of real value added by manufacturing, in billions of dollars
$LPOP$ = natural log of state population, in thousands of persons
LPE = natural log of real production expenses, in dollars
LC = natural log number of ultimate consumers, by number of consuming units
$LCAP$ = natural log of the number of production plants operated by the firm
T = a time trend, a linear index where $1948 = 0, 1949 = 1, \ldots, 1978 = 30$
LGP = natural log of real natural gas price, state averages, in thousands of dollars per trillion BTUs
IT = a profitability trend for the industry (net income of all electric utilities in the United States, divided by operating revenue of all electric utility firms in the United States)
U = a random disturbance term.

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sense the test is not constructive. The major caution concerning the test applied here is the assumption of independence of the forecast errors over time. If the regression residuals are seriously autocorrelated, our estimates of the standard error of forecast are biased upward. Consequently our test would be biased in favor of failing to reject the hypothesis of no change in structure. However, in most of the regressions reported below there does not appear to be a serious autocorrelation problem.

6. All data in dollar terms used here were expressed in real terms via the implicit price deflator. The electric utility operating data were obtained from *Statistics of Privately-Owned Electric Utilities in the United States* (Washington, D.C.: U.S. Federal Power Commission, various years). Pricing data were obtained from *Typical Electric Bills* (Washington, D.C.: U.S. Federal Power Commission, various years). Population data were obtained from *Statistical Abstract of the United States* (Washington, D.C.: U.S. Government Printing Office, various years). GNP data were obtained from the *Economic Report of the President, 1980* (Washington, D.C.: U.S. Government Printing Office, 1979). Value added by manufacturing came from two sources: *Historical Statistics of the United States, Colonial Times to 1970* (Washington, D.C.: U.S. Government Printing Office, 1975) and *Statistical Abstract of the United States*. Natural gas prices were obtained from revenue and physical sales data found in *Gas Facts* (American Gas Association annual report, various years).

To develop a thorough analysis, two different realized rate of return dependent variables were used and different realized rate of return equations were run for each firm in the sample. Consequently, Y was defined in two different ways when examining the effect of rate base methods on realized earnings of the firms in the sample.

Log Y = natural log of real firm operating income per thousand kWh sold to ultimate consumers.

Y = firm operating income as a percent of net plant.

The procedure involved in this section, and the study as a whole, generated a large number of regressions and variables. Consequently, only partial information is reported in the tables.

The next two sections show the empirical results for the two different dependent variables used as proxies for the realized rate of return earned by firms in the sample.

Real Firm Operating Income per Thousand kWh Sold. Table 1 presents some statistics extracted from the individual firm equations with the log of real operating income per unit sold as the dependent variable. As mentioned above, throughout the analysis the size of the long subsamples used to develop the firm equations in each state depended on the year in which the rate base method was changed.[7]

The t statistics indicate whether the change in rate base method affected real operating income. The table shows that eight firms (one in Alabama, four in Illinois, two in Missouri, and one in North Carolina) earned a higher real operating income per thousand kWh sold under the original cost valuation method. These results reveal that the utility commission overcompensated for inflationary effects in permitting the firm to earn higher real profits after the method of rate base determination was changed to original cost.

However, seven firms (one in Illinois, four in Missouri, and two in North Carolina) earned higher income under fair value regulation. In four other cases the utility commissions held real earnings constant, allowing the firm to earn the same real per unit income under both fair value and original cost regulation.

The effects of changes in rate base methods were rather mixed. State regulatory commissions did not tend to hold real operating income of firms in their jurisdictions constant when rate base valuation methods were changed.

Net Income as a Percent of Net Plant. Table 2 presents some test statistics for changes in rate base methods in the equation, with operating

7. In the case of Missouri, backward extrapolation was used to compute the mean error and standard deviation of the forecast because the short subsample occurs before the change in regulatory regimes.

Table 1. Equation, Log Real Electric Utility Operating Income Per Unit Sold to Ultimate Consumer (000 kWh)

	Mean Error	*Standard Deviation*	*t Value*	*D.W.*	*n*	$\bar{R}^2$
Alabama (Fair value 1948–1970; original cost 1971–1978)						
Alabama Power Company	0.2132	0.0402	5.30[a]	2.02	23	0.99
Illinois Fair value 1948–1972; original cost 1973–1978)						
Central Illinois Light Company	0.2288	0.0742	3.08[a]	2.14	25	0.90
Central Illinois Public Service Company	0.3390	0.0920	3.68[a]	1.54	25	0.97
Commonwealth Edison Company	0.1227	0.0719	1.71[b]	1.98	25	0.95
Illinois Power Company	0.0336	0.0549	0.61	1.49	25	0.98
Mount Carmel Utility Company	0.4137	0.1131	3.66[a]	1.58	25	0.99
Sherrard Power System	−0.7104	0.1428	−4.97[a]	2.03	25	0.96
South Beloit Water, Gas and Electric Company	—	—	—	—	—	—
Missouri (original cost 1948–1957; fair value 1958–1978)						
Empire District Electric Company	−0.4237	0.0700	−6.05[a]	1.55	21	0.98
Kansas City Power & Light Company	−0.1217	0.0306	−3.98[a]	3.04	21	0.99
Missouri Edison Company	0.3448	0.1277	2.70[a]	2.22	21	0.97
Missouri Power & Light Company	0.1343	0.1175	1.14	1.48	21	0.95
Missouri Public Service Company	−0.0858	0.1598	−0.54	2.44	21	0.95
Missouri Utility Company	0.3399	0.1417	2.40[b]	1.95	21	0.89
St. Joseph Light & Power	−0.7065	0.0789	−8.95[a]	2.54	21	0.98
Union Electric Company	−0.9965	0.1528	−6.52[a]	2.21	21	0.87
North Carolina (original cost 1948–1963; fair value 1964–1978)						
Carolina Power & Light Company	−0.1893	0.1681	−1.13	2.02	16	0.98
Duke Power Company	1.086	0.1956	5.55[a]	2.32	16	0.90
Nantahala Power & Light Company	−3.609	0.6182	−5.84[a]	2.98	16	0.75
Yadkin, Inc.	5.216	2.0460	2.55[b]	3.01	16	0.92

Source: Extracted from complete equations containing all variables in the model.
[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.

income as a percent of net plant as the dependent variable. As in the previous case, the results are inconsistent and scattered.

Seven firms earned a higher percent of net plant under fair value regulation, and eleven firms earned a higher percent under original cost regulation. Identical earnings rates were experienced by only two firms, both located in Illinois.

Overall, the effects of changes in rate base methods on net incomes as a percent of net plant were mixed. State regulatory commissions seemed to

Table 2. Equation, Net Income as a Percent of Net Plant

	Mean Error	Standard Deviation	t Value	D.W.	n	$\bar{R}^2$
Alabama (Fair value 1948–1970; original cost 1971–1978)						
Alabama Power Company	−0.0067	0.0027	−2.48[b]	2.22	23	0.85
Illinois Fair value 1948–1972; original cost 1973–1978)						
Central Illinois Light Company	0.0055	0.0089	0.62	1.88	25	0.52
Central Illinois Public Service Company	0.0118	0.0079	1.49[c]	1.56	25	0.55
Commonwealth Edison Company	−0.0002	0.0059	−0.03	1.92	25	0.92
Illinois Power Company	0.0120	0.0043	2.79[a]	2.08	25	0.94
Mount Carmel Utility Company	0.0320	0.0091	3.52[a]	2.57	25	0.82
Sherrard Power System	−0.0219	0.0079	−2.77[a]	2.17	25	0.87
South Beloit Water, Gas and Electric Company	−0.0965	0.0086	−11.22[a]	1.86	25	0.98
Missouri (original cost 1948–1957; fair value 1958–1978)						
Empire District Electric Company	0.0199	0.0065	3.06[a]	1.21	21	0.54
Kansas City Power & Light Company	0.0040	0.0027	1.48[c]	1.82	21	0.85
Missouri Edison Company	0.0379	0.0067	5.66[a]	2.61	21	0.79
Missouri Power & Light Company	0.0199	0.0090	2.21[b]	1.62	21	0.51
Missouri Public Service Company	0.0653	0.0206	3.17[a]	1.74	21	0.70
Missouri Utility Company	0.0169	0.0085	1.99[b]	1.99	21	0.74
St. Joseph Light & Power	−0.0217	0.0075	−2.89[a]	1.96	21	0.76
Union Electric Company	−0.0628	0.0099	−6.34[a]	2.31	21	0.90
North Carolina (original cost 1948–1963; fair value 1964–1978)						
Carolina Power & Light Company	−0.0200	0.0067	−2.99[a]	2.40	16	0.92
Duke Power Company	0.0690	0.0122	5.66[a]	2.11	16	0.89
Nantahala Power & Light Company	−0.1634	0.0279	−5.86[a]	2.40	16	0.84
Yadkin, Inc.	0.0628	0.0317	1.98[b]	2.73	16	0.90

Source: Extracted from complete equations containing all variables in the model.
[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 10 percent level.

be unsuccessful at holding real earnings constant and either overcompensated or undercompensated for the effects of inflation.

Price Effect Proxies

Two different price variables were used as proxies for the pricing structure of firms in the sample. Individual price equations were run for each firm, for each of these two variables. Consequently, Y was defined in two

Table 3. Equation, Log Real Price of 250 kWh of Residential Electricity

	Mean Error	*Standard Deviation*	*t Value*	*D.W.*	*n*	$\bar{R}^2$
Alabama (Fair value 1948–1970; original cost 1971–1978)						
Alabama Power Company	0.2564	0.0251	10.22[a]	1.80	23	0.98
Illinois Fair value 1948–1972; original cost 1973–1978)						
Central Illinois Light Company	0.2142	0.0401	5.34[a]	2.12	25	0.94
Central Illinois Public Service Company	0.0265	0.0468	0.57	1.91	25	0.97
Commonwealth Edison Company	−0.1630	0.0346	−4.71[a]	2.14	25	0.97
Illinois Power Company	−0.1177	0.0226	−5.21[a]	2.53	25	0.99
Mount Carmel Utility Company	0.1182	0.0081	14.59[a]	3.00	25	0.999
South Beloit Water, Gas and Electric Company	0.0516	0.0358	1.44[b]	1.92	25	0.99
Missouri (original cost 1948–1957; fair value 1958–1978)						
Empire District Electric Company	−0.3106	0.0681	−4.56[a]	0.89	21	0.98
Kansas City Power & Light Company	−0.1431	0.0308	−4.65[a]	2.31	21	0.98
Missouri Edison Company	0.1971	0.0387	5.09[a]	2.77	21	0.97
Missouri Power & Light Company	−0.2257	0.0629	−3.59[a]	2.55	21	0.95
Missouri Public Service Company	0.8274	0.2048	4.04[a]	2.47	21	0.72
Missouri Utility Company	0.3253	0.0899	3.62[a]	1.99	21	0.80
St. Joseph Light & Power	−0.4467	0.0603	−7.41[a]	2.41	21	0.97
Union Electric Company	−0.7224	0.1432	−5.04[a]	2.04	21	0.94
North Carolina (original cost 1948–1963; fair value 1964–1978)						
Carolina Power & Light Company	0.0827	0.0136	6.08[a]	2.74	16	0.999
Duke Power Company	0.1574	0.0240	6.56[a]	3.16	16	0.998

Source: Extracted from complete equations containing all variables in the model.
[a] Significant at the 1 percent level.
[b] Significant at the 10 percent level.

different ways when examining the effect of rate base methods on prices charged by firms in the sample.

log Y = natural log of the real price of 250 kWh sales of electricity.
log Y = natural log of the real price of 500 kWh sales of electricity.

The same method of deriving and estimating the reduced-form equations was used for these two equations as in the realized rate of return equations.

As discussed in the theory section, if regulatory commissions just compensate for inflation, a given firm's real prices would be expected to remain

Table 4. Equation, Log Real Price 500 kWh of Residential Electricity

	Mean Error	Standard Deviation	t Value	D.W.	n	$\bar{R}^2$
Alabama (Fair value 1948–1970; original cost 1971–1978)						
Alabama Power Company	0.2089	0.0195	10.71[a]	2.23	23	0.98
Illinois Fair value 1948–1972; original cost 1973–1978)						
Central Illinois Light Company	0.2324	0.0313	7.42[a]	1.97	25	0.98
Central Illinois Public Service Company	0.0441	0.0470	0.94	1.94	25	0.97
Commonwealth Edison Company	−0.1210	0.0334	−3.62[a]	1.81	25	0.98
Illinois Power Company	−0.1101	0.0539	−2.04[b]	2.29	25	0.95
Mount Carmel Utility Company	0.1859	0.0116	16.03[a]	2.06	25	0.999
South Beloit Water, Gas and Electric Company	0.1156	0.0409	2.83[a]	1.82	25	0.98
Missouri (original cost 1948–1957; fair value 1958–1978)						
Empire District Electric Company	−0.3339	0.0381	−8.76[a]	1.23	21	0.99
Kansas City Power & Light Company	−0.1786	0.0354	−5.05[a]	2.24	21	0.98
Missouri Edison Company	0.1071	0.0391	2.74[a]	2.62	21	0.97
Missouri Power & Light Company	−0.2221	0.0564	−3.94[a]	2.93	21	0.97
Missouri Public Service Company	0.3794	0.1352	2.81[a]	2.48	21	0.73
Missouri Utility Company	0.4471	0.1041	4.29[a]	2.73	21	0.92
St. Joseph Light & Power	−0.3836	0.0538	−7.13[a]	3.08	21	0.98
Union Electric Company	−0.7594	0.1745	−4.35[a]	1.69	21	0.79
North Carolina (original cost 1948–1963; fair value 1964–1978)						
Carolina Power & Light Company	0.1254	0.0136	9.22[a]	2.74	16	0.999
Duke Power Company	0.1994	0.0265	7.52[a]	3.15	16	0.998

Source: Extracted from complete equations containing all variables in the model.
[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.

unchanged as a state changes from fair value to original cost rate base valuation. Consequently, one would expect a change in real prices to be associated with a change in rate base method only if the state commission makes imperfect adjustments. This section assesses the price effects of different rate base regulatory regimes by examining two different price proxies: the price of 250 kWh of residential electric service and the price of 500 kWh of residential electric service.

Tables 3 and 4 show that there were substantial differences among firms in the direction of real price movements after rate base methods were changed. Yet for each individual firm in the sample, both 250 kWh and 500 kWh real prices moved in the same direction after the change. For this reason, Tables 3 and 4 will be discussed together.

Table 5. Equation, Log Sales (000 kWh)/State Population (000)

	Mean Error	*Standard Deviation*	*t Value*	*D.W.*	*n*	$\bar{R}^2$
Alabama (Fair value 1948–1970; original cost 1971–1978)						
Alabama Power Company	−0.1145	0.0209	−5.48[b]	1.74	23	0.999
Illinois Fair value 1948–1972; original cost 1973–1978)						
Central Illinois Light Company	−0.2167	0.0749	−2.89[a]	1.94	25	0.99
Central Illinois Public Service Company	−0.2696	0.0337	−8.00[a]	2.24	25	0.999
Commonwealth Edison Company	−0.0939	0.0926	−1.01	1.42	25	0.99
Illinois Power Company	−0.0254	0.0151	−1.68[c]	2.01	25	0.999
Mount Carmel Utility Company	−0.1799	0.0729	−2.47[b]	2.77	25	0.99
Sherrard Power System	−0.2969	0.0389	−7.63[a]	1.25	25	0.999
South Beloit Water, Gas and Electric Company	−0.2976	0.0377	−7.89[a]	2.19	25	0.998
Missouri (original cost 1948–1957; fair value 1958–1978)						
Empire District Electric Company	0.4110	0.0664	6.19[a]	1.27	21	0.99
Kansas City Power & Light Company	−0.0883	0.0168	−5.26[a]	2.35	21	0.999
Missouri Edison Company	0.2468	0.0732	3.37[a]	1.10	21	0.997
Missouri Power & Light Company	−0.0297	0.0315	−0.94	1.90	21	0.999
Missouri Public Service Company	−0.3417	0.0588	−5.81[a]	2.34	21	0.999
Missouri Utility Company	−0.1594	0.0316	−5.04[a]	2.19	21	0.998
St. Joseph Light & Power	−0.0745	0.0220	−3.39[a]	2.60	21	0.999
Union Electric Company	−0.0826	0.0778	−1.06	2.41	21	0.998
North Carolina (original cost 1948–1963; fair value 1964–1978)						
Carolina Power & Light Company	0.1807	0.0544	3.32[a]	2.40	16	0.999
Duke Power Company	0.0397	0.0777	0.51	2.07	16	0.998
Nantahala Power & Light Company	0.3419	0.1192	2.87[a]	3.38	16	0.92
Yadkin, Inc.	0.3289	0.8988	0.37	2.68	16	0.94

Source: Extracted from complete equations containing all variables in the model.
[a] Significant at the 1 percent level.
[b] Significant at the 5 percent level.
[c] Significant at the 10 percent level.

Seven firms established higher real prices under original cost valuation. Nine others, however, charged real prices under fair value regulation. Only one firm maintained identical real prices after the change in valuation method; that firm is located in Illinois.

As in the case of the rate of return proxies, regulatory commissions seemed to be unable to just maintain real prices when their states changed from one rate base method to the other. Consequently, firms were required to establish rates that either over- or undercompensated for the effects of inflation when methods of rate base valuation were changed.

Consumer Welfare Proxy

This section examines the effect of different rate base valuation methods on consumer welfare. If a particular rate base valuation method leads to higher prices, per capita consumption would be expected to decline after a switch to that method, thus reducing consumer welfare. Accordingly, the proxy used for consumer welfare was per capita sales to ultimate consumers. As in previous analyses, individual equations were run for each firm in the sample. The dependent variable for these equations was defined as

log Y = natural log of per capital electricity sold (total kWh sold to ultimate consumers, divided by state population).

The same derivation and estimation method was used for these reduced-form equations as in the earlier realized rate of return and price equations.

The welfare effects of changes in regulatory regimes are reflected, to some extent, by the information in Table 5.

Overall, thirteen firms experienced higher sales per capita under fair value regulation. Only two firms had higher sales under original cost, while five experienced no change in this variable after the change in valuation method.

These results do not reflect any systematic pattern. It is not at all clear, contrary to previously stated expectations, that any welfare benefits can be claimed for one rate base method over the other. Of course, the weak result may be caused by the ineffectiveness of the proxy used to reflect welfare effects. It is very difficult, given the data that are available, to establish a better measure.

CONCLUSIONS

Our results do not support the notion that the use of fair value rate base valuation allows firms to realize higher real earnings or higher real price levels than under an original cost method. Neither can a case be made for enhanced consumer welfare because of higher consumption levels under original cost rate regulation. In scattered instances, accounting profit, pricing, and sales figures supported the theory, but these results were certainly not general.

Since we examined individual firms experiencing changes in regulation, holding a large number of variables constant, our findings provide insight different from earlier cross-section studies. One previous cross-sectional study, which found no significantly different effects betwen rate base methods, hypothesized that regulators allowed higher rates of return when original cost rate base methods were used.[8]

The results developed here clearly demonstrate that a change from original cost to fair value rate making will not necessarily mean higher accounting profits. The higher rate base value seems to be offset by lower allowed rates of return whenever that valuation method is used.[9]

Indeed, if the spirit of the Hope case[10] permeates the state commissions, as Murray (1974) suggests, and they "manipulate" the rate of return to arrive at a "predetermined" return amount, this practice very likely helped to bring about the overall results presented in this analysis. From the commission perspective, the method of rate base valuation is only one key variable in the rate-making process. The rate of return allowed on the rate base is also of crucial importance.

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8. See Primeaux (1978), p. 105. Joskow explains, however, the determination of the allowed rate of return is a complex process affected by a number of variables. See Paul L. Joskow, "The Determination of the Allowed Rate of Return in a Formal Regulatory Hearing," *Bell Journal of Economics and Management Science* 3, No. 2 (Autumn 1972), pp. 632–44.

9. Deloitte Haskins & Sells (1980) makes the point that the inverse relationship between rate base and rate of return is not necessarily inequitable.

10. Hope Natural Gas Co., Re, 44 PUR (NS) 1, 24 (1942).

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