

"The Public Utility Research Center:  
Problem Solving Through Research"

by  
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Energy and Communications are two sectors of the economy which are heavily regulated and which are highly visible to consumers. Because of the benefits from linking research and education to concrete issues, the College of Business Administration of the University of Florida established the Public Utility Research Center (PURC). Since its inception in 1971, PURC has attempted to increase student awareness and faculty involvement in public utility issues by training students for employment in utilities or regulatory agencies and by stimulating policy research in the area. To accomplish these goals, PURC has provided student fellowships and assistantships, supported student and faculty research, hosted conferences and workshops, and acted as a meeting-ground for members of the business community, government and academia to discuss issues of common concern.\*

The purpose of this article is to describe the activities and projects of PURC. This format facilitates examination of the problems faced by public utilities, regulators, and the public at large. In addition, consideration is given to PURC as a prototype for linking research to Florida state problems and for augmenting university resources. The specialized skills of faculty and the contribution of advanced students can aid decision-makers outside academia who confront new problems which are surfacing in the state, suggesting that the university community can be a useful resource for clarifying, analyzing, and solving important policy issues.

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### Research Activity

PURC has supported a broad range of research activities designed to illuminate some relatively unexplored issues facing the utility industry. A major area of concern within the realm of economics has been the need for improved understanding of the determinants of demand for utility services. The first funded project in this area was an analysis of the 1972 electric energy "crisis" in the state of Florida [20]. Historical data on electricity consumption and capacity in Florida were gathered, and forecasts were made of consumption and capacity for the years 1980 and 1990 under various hypotheses concerning price and population trends.

Subsequently, a Masters thesis developed a more comprehensive econometric model of the demand for electricity in Florida [2]. Cross section data for nine cities over time were used to test models of residential, commercial, and industrial electricity consumption. The responsiveness of amount demanded to price changes indicated that other forecasts of demand for electricity in Florida were greatly overstated. The results of the project were reported in a PURC working paper [3] and were presented before the Atlantic Economic Society in September 1974. Researchers at PURC later utilized the econometric model to evaluate forecasts derived by an independent consultant for the Gainesville/Alachua County Regional Utilities Board [9]. The analysis concluded that the extrapolation methods used by the consultant seriously overestimated the demand forecasts for the utility due to the implicit disregard for changes in price trends.

Another study emphasized the importance of going beyond aggregate data (average consumption per person in a city or state) to individual observations to determine the responsiveness of demand to changes in price structure [4]. Fuel adjustment clauses and changes in the old declining block price schedules will affect consumption, but studies using aggregated data will yield biased estimates of the effects of changes in the price structure. The composition of demand was found to affect estimates of price elasticity.

As an extension of this analytical line of research, another Masters thesis [26] and working paper [10] examined electricity consumption by income group. The studies emphasize the usefulness of micro-data in determining the differential impacts of various rate structures on consumption by high, medium, and low income consumers. Emphasized are the implications of proposed social rate restructuring programs such as the inclusion of "life-line" rates (low initial rates for electricity consumption) and the creation of fuel stamps (essentially a concept similar to the Federal Food Stamp Program). The research points to the need for utilities to gather and retain more data on individual customer consumption.

Another major area of economic research conducted by PURC concerns the pricing of utility services. The initial research in the area of utility rates concerned the motion of "rate spread" (the difference between the average and lowest price, given a declining block rate structure) in the investor-owned electric utility industry [21]. The results were consistent with the view that value-of-service pricing could lead to greater rate spread. A Gini index was developed to measure the concentration of revenue burdens among the four major customer classes (residential, commercial, industrial, and wholesale). This index of spread, when combined with specific cost or market demand data, may substantially improve our understanding of scale economies, cross-subsidization, and equity in rate design.

A third Masters thesis in the area of utility pricing and demand dealt with the major economic implications of electric rate structure inversions [17]. Environmental groups have advocated an inversion of the present declining block structure of rates such that the initial block of consumption corresponds to a relatively low price per kilowatt-hour, with the price rising as consumption increases into higher blocks. A computer simulation of hypothetical rate structures and individual demands facilitated the analysis of the impact of a

rate inversion on quantities demanded, individual welfare, and revenue sufficiency. Particular importance was given to the composition of demand in determining these impacts. The results of the project lead to some serious doubts concerning the validity of basically ad hoc proposals for rate restructuring, especially in regard to efficiency in the allocation of resources. Subsequently, the results of this research project were analyzed with particular attention being paid to the distributional effects of rate restructuring [7]. A major conclusion was that welfare is not easily judged by theoretical measures of rate spread nor by empirical measures such as a Gini coefficient.

A well accepted principle of economics is that when price equals marginal cost, resources are allocated efficiently. A consumer facing such a price may decide whether the marginal benefits derived from more consumption of a good are worth the additional expenditures. Substantial efforts have been made in recent years to base electricity prices on marginal or incremental costs. Opponents of such a pricing scheme are concerned with whether total revenues will cover total costs: substantial surpluses or deficits could occur on the part of the utility due to the use of marginal cost pricing. The first PURC research project which dealt directly with this problem was primarily an expository attempt to tie together the concepts of long-run incremental cost pricing and block pricing [19]. Block pricing and/or differential prices to different customer groups can result in recouping a deficit or reducing a surplus when used in conjunction with marginal cost pricing. The project surveys the work of the major economists in the area. A second study of marginal cost pricing of utility services analyzed several areas of controversy surrounding "real world" applications [18]. This effort addressed primarily the efficiency, equity, and practicality considerations associated with the application of marginal cost pricing in the utility sector.

During periods of rapidly rising input prices and increasing demand for utility services, utilities are considering the imposition of capital facilities charges for

all new customers; such charges would reflect the increase in input prices and attempt to reduce the burden on "old customers." One PURC research project stemming from a graduate course in Utility Economics examines various alternative means of utility pricing under conditions of rising input prices [5]. The study indicates that the imposition of a capital facilities charge solely on new residents can result in an inefficient allocation of resources. Alternatively, if priority property rights are to be recognized within our legal system, old customers could be compensated for losses they experience as electricity prices rise.

One of the most fundamental studies published in the area of public utility economics was by Harvey Averch and Leland Johnson (better known simply as A-J). They concluded that a firm subject to rate of return regulation will become overly capital intensive for the purpose of padding the rate base. Others have criticized, tested, and extended the A-J analysis. A PURC-sponsored dissertation made theoretical contributions to debate surrounding the A-J hypothesis [24]. Both input and output distortions potentially resulting from regulation were integrated through geometric analysis. The dissertation was subsequently published as a book by Lexington Books.

Another set of economic studies address more general problems of pollution standards [11] and policies for conservation and pollution control [22,23]. While these studies stemmed from PURC research, the theories developed here apply to other industries as well. An explicit analysis of utilities along this line of research is planned for the future.

A number of PURC projects have been in the area of public utility finance and accounting. In the area of depreciation policy, PURC sponsored a project which analyzed the relative impacts of normalization versus flow through for utilities using liberalized depreciation methods [15]. A firm using normalization will utilize accelerated depreciation for tax purposes but straight line will be carried on the books. In anticipation of higher taxes in the future, a reserve fund for deferred taxes will be set up by the normalized firm. A company using flow through

will pass on the effect of liberalized depreciation to current income but compensates for the increase in income by reducing utility service rates. Although the flow through versus normalization question has been addressed quite extensively, none of the studies expressly considered the effects of such factors as regulatory lag, price elasticity, and differential costs of capital. The PURC project utilized a computer simulation which incorporated these factors. One of the conclusions of the study was that the consideration of lags, elasticity, and cost of capital strengthen the case for normalization.

Another PURC project addressed the problem of depreciation and financing under inflation [28, 29]. The combination of high capital intensity and regulation causes serious difficulties for utilities during inflation. As long as utilities are required to price their products on a historical cost of assets basis, their services will be underpriced during inflation. The problems associated with utilizing replacement cost, trended original cost or price-level depreciation are examined. An alternative is presented, whereby utilities are permitted to include in their rates the before-tax equivalent of the increment between historical cost and price-level depreciation. This amount would be accumulated in a restricted surplus account, and prices, although initially rising, would subsequently level off as the need for new funds decreased.

In the area of finance, one PURC project considered the modifications which must be made in the capital budgeting process when applied to public utilities [16]. Both the rate adjustment process and the mandatory investment requirement are shown to have contributed to the use of a modified discounted cash flow (DCF) criterion whereby utilities attempt to minimize the present value of future revenue requirements. The results of a questionnaire survey indicate that public utilities utilize DCF techniques in their capital budgeting process to a greater extent than

industrial firms. The results of the study suggest that utilities should consider using the net present value method of budgeting because such a method would provide data relating to the impacts of expansion on profitability and revenue requirements.

A related study examined the problems inherent in financing utilities under conditions of inflation, rising costs of capital and regulatory lag [12]. It is demonstrated that, in combination, these situations bring about a serious inequality between the cost of capital and the actual rate of return. Both long- and short-run solutions to the problem of financing technological change are offered. In the long-run, a joint program of research and development is advocated encompassing utilities, suppliers, and government. The short-run solution entails large government outlays of funds.

Utility rate case cost of capital studies have relied heavily upon the traditional comparative earnings approach and, to some extent, the discounted cash flow techniques. A PURC-sponsored project examined a newer approach to estimating risk and relating risk to the cost of equity capital: the capital asset pricing model (CAPM) [13]. Essentially, the correlation of returns on a particular stock with the market return is calculated through regression analysis. A beta coefficient (the coefficient of correlation) thus gives a measure of the volatility of returns vis-a-vis market returns. Given some generally accepted riskless rate of return, the beta for a particular stock may be used to arrive at the required rate of return on that stock. Although CAPM has been used in only a few cost of capital studies, this technique might be viewed today as being where DCF was a few years ago. The study concludes that CAPM will probably be utilized more and more in the future as a general understanding of the model progresses.

Another PURC dissertation analyzed the potential for using CAPM to determine the cost of equity capital to public utility holding companies [27]. Generally, it has been assumed that the cost of capital to a subsidiary is the same as that of the

holding company. Discounted cash flow techniques are limited, and it was found that they cannot be used to detect any differences in the cost of capital among holding company subsidiaries. The study begins with the contention that any differentials in risk among holding company subsidiaries should be reflected in differentials in rate of return. Due to the non-existence of market data at the subsidiary level, direct utilization of CAPM was not possible, although it may become more applicable in ascertaining rate of return differentials among holding company subsidiaries in the future as the model becomes further developed.

In recent years the market prices of many utility stocks have been far below book value. When coupled with the need for heavy capital expenditures, the sale of new equity issues below book value erodes the position of existing stockholders. A PURC-sponsored dissertation [1] and working paper [14] report on the relationship between market price and book value for public utilities. A model was developed which indicates the effect of changes in rate of return, growth in assets, and other factors on the market value/book value ratio. Empirical tests were carried out in order to determine the extent to which relationships among variables are consistent with theory. Under ideal conditions of perfect competition, no flotation costs, instantaneous regulation, and no inflation, a market/book ratio of 1.0 will obtain if the utility earns a fair return. In a more realistic setting, the study concludes that a market/book ratio in excess of 1.0 is required to enable the firm to attract and maintain capital in the long-run.

The question of how utilities should account for construction work in progress (CWIP) is addressed in another dissertation [25]. Since CWIP does not represent "used and useful" capital, current customers should not be required to provide a return on this unused plant. On the other hand, investors have provided funds for construction and should be allowed a return on their investment. The impact of several construction accounting methods were analyzed in this dissertation which used as two polar extremes the inclusion of construction work in-process in the

rate base (RB) and the use of an imputed credit which is added to the cost of the asset and eventually recovered through depreciation (IDC). A computer simulation examined various alternatives over a wide range of assumptions and conditions. Among the conclusions of the study, it was determined that it is to a utility's disadvantage to capitalize IDC, given the particular assumptions regarding the staging of new construction. Thus, the use of IDC could make it more difficult for a utility to obtain funds needed for continued construction.

In 1974-75, the Public Utility Research Center assisted the Joint Select Committee on Utility Rate Structures (comprised of Senators and Representatives) in keeping abreast of current issues in the area of electric utility rate structures. A glossary [8] was prepared wherein the major technical terms and policy issues concerning rate structure were defined and discussed. In addition, PURC provided the Committee with a detailed analysis of the Florida Public Service Commission Rate Department's recommendations regarding rate structures [6]. Presentations were made before the Florida Energy Committee and the Joint Select Committee. There also were discussions with the staff of the Public Service Commission. The exchanges were facilitated by PURC's being an independent source of expertise in the state. The credibility of recommendations stemming from PURC research is not compromised by affiliation with only one part of the regulatory system. As such, PURC can examine issues posed by regulators, firms, or consumers on neutral ground.

#### Conferences and Workshops

Reflecting the above points, PURC sponsors a major conference each winter entitled "Issues in the Regulation and Management of Public Utility Companies." Attendance has grown substantially each year. Major speakers have included Florida Public Service Commissioners William Mayo, Paula Hawkins, and William Bevis; the Commission's Executive Director Jay B. Kennedy; New York Public Service Commission Chairman Alfred E. Kahn; National Economic Research Associates President Irwin M. Stelzer; investment banker John Childs; Standard and Poor's Vice President

H. Russell Fraser; Institute for Public Policy Alternatives Chairman Joseph Swidler; Southeast Electric Exchange Rate Committee Chairman Samuel Behrends; and Florida State Senate President Dempsey Barron. Topics covered at the conferences have included "The Theory of Rate Making," "Ways to Overcome the Problem of Regulatory Lags," "Rate Structures: Theory and Practice," and "Cooperation and Coordination Between Investor-Owned Utilities, Municipals and Cooperatives." The conferences have provided a useful forum at which utility executives, regulators, representatives of the public, and academicians may meet to share ideas and discuss differences in view.

In response to requests, the Center sponsored a specialized workshop in 1974 dealing with forecasting demand for utility services. A number of executives, regulators, and educators met in a one-day workshop to discuss the use of such tools as econometric analysis to predict trends in demand. Topics being considered for future workshops include capital facilities charges, capital budgeting by utilities, and incremental cost pricing.

#### Instruction and Future Directions

To make students aware of job opportunities in the area of public utility economics and finance, the Center has provided research awards to students enrolled in the College's regulated industries courses. The awards are based on originality and technical competence of research carried out by the students. Many in-class research projects have, as a result, been carried over to provide a basis for student theses and dissertations. Students have also attended the annual Conferences and specialized workshops; the exposure to real-world problems reinforces their understanding of how classroom tools and concepts can be applied in concrete situations. The success of PURC's instructional efforts is evidenced by the employment of many students in career positions with utilities and regulatory commissions.

Given the pressing problems of utilities and regulation, PURC will not soon lose its reason for existence. Academic research should be useful to decision-makers in the area. A mutual learning process is facilitated by the Public Utility Research Center; this process should continue.

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