Essays on Public Utility Pricing and Regulation

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Preface

Public utility pricing is a complex and at times frustrating subject for analysis and inquiry. In common with all prices, prices or rates in the electric, gas, water supply, and communications industries serve as an allocating and rationing mechanism. But the formulation and application of prices in these areas soon encounter unique and distinctive problems which justify special consideration.

To a degree, public utility pricing is distinctive because of the conditions under which service is typically supplied. Energy and communications are not readily storable for long periods, so peak and off-peak phases of production assume considerable importance. Further, the technology of supply involves capital-intensive operations, with characteristically large aggregates of overhead, common, and joint costs that are not readily assignable to particular services or to units of output. Also, public utilities serve a variety of markets and submarkets of differing demand elasticities. The presence or absence of substitutes vary greatly between such markets and the resultant potential for price discrimination is highly significant. Under these circumstances both demand and supply conditions interact to produce a series of potential obstacles that stand in the way of public utility pricing solutions that endeavor to promote greater efficiency.

The efficiency criterion, however, has seldom been the exclusive determinant of price in industries that are “affected with the public interest.” Equity considerations have always loomed large. Social and political values, no matter how disconcerting to the economist preoccupied with efficiency, play an extremely important part in all decisions pertaining to price. Management, investors, various classes of consumers, regulators, and politicians have strong convictions and special interests to promote as well as protect. Public utility
rate structures, cost allocations, and revenue contributions for individual services reflect these factors.

In recent years public utility pricing has come to assume added dimensions of importance as technology transforms the market structure of the regulated industries, and as the public becomes more concerned with matters of ecology, conservation, and the social responsibilities of business. Historically, the market structure of the electric, gas, and communications industries has received very little attention, except perhaps during the period of the holding company scandals in the 1930s. In the postwar years, however, technology has had a major impact on these industries and has created forces tending toward more concentration in some markets and more competition in others. While the result is far from a proxy for workable competition in the aggregate, it does raise the specter of cross-subsidization between particular services and markets. This tendency is reinforced by the cost structure and demand patterns characteristic of the public utility industries. In electricity and gas the evidence may be seen in promotional pricing practices and in promotional allowances, which are a form of selective price reduction. In communications selective price reductions have taken the form of new service offerings in the private line field designed to meet the threat of potential competition.

If increased emphasis on matters of ecology and environment as well as the social obligations of large-scale enterprise represents a shift in national goals, public utility pricing may take on new perspectives. For example, there appears to be a growing belief that the promotion of output, even under economies of scale, may yield results that are less than socially optimal, unless sufficient attention is given to the full range of attendant externalities. Significant externalities have always been implicitly associated with electricity, gas, water, and communications. Indeed, the early legal concern with the ramifications of the prices set for such services in terms of the consequences for the community, region, and nation was evidence of a recognition of broader social and third-party considerations. But now public utility pricing decisions must give explicit recognition to externalities. On balance, management, regulators, and politicians may choose to dismiss externalities in particular cases, but consumer groups, minority pressure groups, and environmentalists will not permit these social values and costs to pass unnoticed.

It is clear that the regulatory agencies themselves will face a host of new challenges in the coming years, and will have to come to grips with issues such as system optimization and performance, the appropriate role of selective competition, and, as noted, an assessment of externalities. Pricing is interwoven throughout all of these decisions, and ideally regulation should be able to control rate structures in a fashion that will maximize net social benefits. In practice, there are serious doubts that the institution of regulation is adequate for such a task if one accepts the increasing volume of criticism that has been directed toward administrative agencies since the mid-1950s. To obtain a better picture of the fashion in which price is treated or could be treated, it is important to perceive both how regulation handles the pricing process and what improvements, in turn, could be made in the thrust and direction of commission control.

Given each of these areas of importance, a collection dealing with public utility pricing could be developed from a number of viewpoints. One could focus on the simple statics of pricing theory, or be concerned with the institutional elements of pricing strategies. The subject could be considered at a high level of abstraction or at the behavioral and public policy levels. Rather than focus exclusively on one of these dimensions, this collection has sought to dip selectively into each strata. The results may be frustrating for those readers who are looking for an exhaustive series of papers dealing with one facet of public utility pricing. The only consolation for these readers may be that an exposure to a cross-sectional survey of pricing problems at all levels may give a better appreciation of the full range of variables involved.

The collection is organized around five major headings: pricing theory, applied pricing practices, pricing and market structure; regulatory policies and pricing practices; and the environmental and regulatory setting. In light of the preceding discussion, the rationale for selecting these headings should be apparent.

A word on the origin of these papers is appropriate. Some of the papers were presented at the 1969 conference of the Institute of Public Utilities, Michigan State University. The theme of that conference was "Public Utility Pricing Practices and Policies in a Dynamic Economy." The conference papers were subsequently augmented by a series of papers specially prepared at the invitation of the editor.

One area which has been omitted, but which does deserve recognition, is that of the historical development of public utility pricing, both in theory and in practice. At the present time there appears to be a renaissance of academic interest in the problems of regulation and public utilities. It would be particularly unfortunate if those who have been attracted to the field as relatively late arrivals were oblivious of the long heritage and body of literature which has grown up over the past seventy-five years. A review article should have been included in this collection dealing with this subject. For this omission the editor accepts full responsibility. It should be noted in passing that a preliminary step has been taken to correct this deficiency. A collection of essays is currently in preparation honoring the late Professor Martin G. Glazer of
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the University of Wisconsin, one of the pioneer scholars in the field of public utility economics. The collection is scheduled for publication under the auspices of Land Economics, University of Wisconsin.

The editor would like to express his appreciation to all of those who participated in the 1969 conference, as well as to those authors who contributed supplemental papers. In addition, the major contribution of those who assisted in the publication process should be acknowledged. Professor Charles E. Olson of the University of Maryland read portions of the manuscript and offered a number of constructive suggestions. Mrs. Diane Bourke provided the invaluable editorial skills that guided the book through its various stages of production, while at the same time taking responsibility for matters of artistic style and layout. Mrs. Cassandra Moore was particularly helpful in assisting with the translation of the paper by Mears, Uhermitte and Callé. Mrs. Virginia Michels and Mrs. Linda Stanley deserve considerable credit for handling various phases of the manuscript's preparation, related correspondence, and the numerous details of the pricing conference.

No set of papers can claim to be definitive, and certainly the number of topics for investigation in the field of public utility pricing can be expanded. If this collection serves to stimulate further inquiry and new thinking along any of these lines, it will have achieved its primary objective.

Harry M. Trebing
East Lansing
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Economic Theory and Public Utility Pricing

Over time, economic theorists have become increasingly aware of the general problems involved in public utility pricing. Beginning in the late 1930s, theorists paid more and more attention to the rationale and consequences of tariff structures and rate designs. Interest mounted with the nationalization of the electric and gas industries in England by the Labor Government at the close of World War II; for proper pricing in a government enterprise posed a significant challenge for welfare economics and efficiency maximization. By the late 1950s most of the immediate issues pertaining to demand and cost conditions had been delineated at the theoretical level. The economic literature reflected an increasing number of exchanges, such as those between the advocates of marginal cost pricing on the one hand, and those who accepted some variant of price discrimination on the other. Various aspects or facets of marginalism had been explored, and the literature reflected discussions of short-run marginal cost pricing, long-run marginal cost pricing, and the problems of subsidization and investment criteria. Most recently, attention has become centered on the problems of peak load pricing.

Marginal cost pricing has not been without its critics. At the theoretical level,
perhaps the most vigorous criticism has stemmed from those who question the contribution of marginalism to the general welfare when all of the explicit and implicit assumptions of marginal cost pricing are not satisfied. The attendant debate over the theory of the "second best" has, of course, transcended public utility pricing and encompassed the broader field of welfare economics. Nevertheless, the state of this debate is of considerable importance to the theoretical foundation underlying pricing principles in the regulated industries.

The papers in this section examine two areas of current interest: the peak load pricing problem and the implications of the second best critique. Peter O. Steiner was one of the original contributors, in the late 1950s, to the theoretical development of the problems associated with peak pricing. In his paper for this collection he examines the accomplishments since that time, and the state of the economist's contribution. Ralph Turvey comments on the Steiner paper, drawing upon reports in which he participated as Joint Deputy Chairman of the British National Board for Prices and Incomes.

In the second paper, Erik Furesbo and Thomas R. Saving examine the theory of the second best and the efficiency of marginal cost pricing. R. G. Lipsey, coauthor of the original essay on the theory of the second best, serves as the discussant for their paper.

Peak Load Pricing Revisited

Peter O. Steiner
University of Michigan

I accepted Professor Trebing's invitation to re-examine the peak load problem with both enthusiasm and concern. Having fired one of the opening shots in the current debate, I was curious to see what survived of my original suggestions. After one brief polemic, I had left the field to others who were referring to me sufficiently often that I suspected I would dissipate any reputation for competence in this area more by writing than by silence. My worry is that I have been right in my silence for these dozen years and wrong in breaking it.

Let me start with two disclaimers. First, I have no desire to defend in the small my "solution," which was merely to clear away some theoretical underbrush and deadwood that had been hamper-

ing a sensible discussion of how to price commodities subject to severe peak load demands. Second, I will not stress the distinctions between my solution and the similar, earlier (but unknown to me) solution of M. Boiteux. Among our differences, one that some may find intriguing is the totally different techniques of proof employed in attacking essentially the same theorem. Boiteux used a semi-intuitive calculus that I did not find persuasive until Jacques Drèze in 1964 published a brilliant paper that made the proof explicit. Benefitting from the aid of Robert Dorfman, I used what I now know to be the calculus of variations in a concise, if difficult proof.

The Boiteux-Steiner theorem, which I will summarize shortly, has proven the point of departure of an extended modern theoretical discussion. But it was no more the beginning than it was the end of discussions of the problem. I would date the early theoretical discussion of the problem back to papers by J. M. Clark in 1911, and G. P. Watkins in 1915. They treated the problem of differential rates as an interesting theoretical exercise in the allocation of overhead costs and were largely concerned with the short-run problem of covering total costs of a pre-specified capacity. The modern issue—determining the optimal capacity—was largely ignored in the overhead cost discussion, but it had been foreshadowed as Harold Demsetz points out by Alfred Marshall’s discussion of the joint productivity problem. His famous discussion of hides and carcasses of bullocks provides a loose analogy to the joint supply problem found in most peak load situations. (I will argue below that the analogy is too loose to be useful, and disagree with Demsetz’s contention that the Boiteux-Steiner solution is nothing more than Marshall’s.)


But the point is that up until World War I this problem, if it was discussed at all, was discussed in the mainstream of economics, in the leading journals, by the leaders of the profession. Rather abruptly, in the 1920s the whole discussion was incorporated into the great public utility discussion, and the highly practical question of how the state utilities commissions should permit electricity prices to be set. While the theorists of the 1920s worried about economies and diseconomies of scale and juggled their empty boxes, the institutionalists swarmed like locusts over the problems of price structure. For example, in the fifteen years between 1925 and 1939 a total of thirty-six articles on price structure are listed in the Index of Economic Journals, twenty-seven of them appearing in a single journal, Land Economics, six in what would be called the mainstream journals, two in the Harvard Business Review, and one in Social Research. In contrast in the period 1950–1965, of twenty-five articles, six appear in Land Economics, sixteen in theory-oriented journals, and three in odd places. I do not have post-1965 data, but clearly the theoretical debate has heated up, as the peak load problem becomes essentially a key topic in capital theory. This of course also reflects the re-absorption of problems of public utilities and other regulated industries back into the mainstream of economics.

1. The Boiteux-Steiner Solution

While both Boiteux and I, addressing general audiences, utilized verbal and geometrical constructions, we each presented and indeed manipulated formal mathematical models. I stress this because some of our critics have neglected the greater generality of the latter, and while here too I shall utilize the geometric technique I shall always be discussing the problem more generally.

The analysis is built around four limiting assumptions, each of which has been challenged or relaxed in the subsequent literature. Assumption I—Production of output requires some form of fixed capital which when available can be used to produce output in any or all of n equal length periods. A unit of such capital is designated as a unit of capacity. The cost of providing enough capacity to provide one unit of output in any or all of the n periods is ρ dollars, assumed not to vary with the number of units of capacity purchased.
Assumption II—It is possible to purchase capital in small enough units to increase the output in any period by as little as one unit without incurring diseconomies. Thus the capital cost per unit of producing \( m + 1 \) units of output is not larger than for \( m \) units, for all \( m \) greater than some minimum amount. In other words we assumed that capital was finely divisible.

Assumption III—The operating (that is, non-capital) costs are assumed constant at \( b \) dollars per unit per period.

Assumption IV—The pricing authority is constrained to charge a single price \( P_i \) for all units purchased in period \( i \). Thus, while prices might vary among periods, as \( i \) varies from 1 to \( n \), users in the same period, or units in the same period are subject to a single price.

A fifth assumption that is convenient for graphical analysis is that demands in the separate periods are independent of one another. This assumption is not vital, as was shown in my original paper, but will be used here without further discussion.

It is not sensible to reproduce much of the rationale of the original paper, but its flavor must be suggested. It sought to determine both the optimal amount of capacity and devices to achieve optimal utilization of that capacity. The optimizing criterion for determining amount of capacity was to provide any unit of capacity where the values consumers placed on the output it produced were at least equal to the total cost of producing it. Formally

\[
Z = \sum_{i} F_i(x_i) - b \sum_{i} x_i - \beta \max x_i
\]

where

\[
F_i(x_i) = \int_{x_i}^{x_i+\Delta x_i} f_i(x) \, dx,
\]

and the total cost is

\[
TC = b \sum x_i + \beta x_i,
\]

where \( x \) is the number of units of capacity in existence.

The now familiar solution to this problem for the three period case is shown as Figure 1.\(^{10}\) The individual demands in excess of \( b \) are viable demands for capacity. Their vertical sum \( D_i \) is the aggregate demand for capacity, and determines by its intercept of \( \beta \) that the optimal capacity is the amount \( x^* = x_1 \). The optimal utilization of this capacity is given by the quantities \( x_1 \), \( x_2 \), and \( x_3 \), and could be achieved via the market if the pricing authority changed the prices \( P_1, P_2, P_3 \) respectively.


\( x_1 \)
\( x_2 \)
\( x_3 \)

Three Period, Mixed Case

Figure 1

\( \beta \)
\( P_1 \)
\( P_2 \)
\( P_3 \)

10. This is Figure 2 of Steiner, “Peak Loads.” For graphic purposes here and elsewhere it is convenient to use \( b \) as the zero level of the vertical axis. This makes each individual demand curve the effective demand for capacity, and makes the intersection of \( D_i \) with \( \beta \) really \( \beta + mb \), where \( m \) is the number of periods whose combined demands justify the marginal unit of capacity. This is purely a graphic trick; there is no assumption involved that \( b = 0 \).
Because costs were assumed constant per unit, average costs equal marginal costs and thus the total receipts $P_1 x_1 + P_2 x_2 + P_3 x_3 = TC$. This “no profit—no loss” feature is however not a fundamental part of the solution, but a consequence of the assumption of constant costs. In a world of increasing costs there would be profits, and in a world of decreasing costs, losses at the optimal output.

This simple model, even when generalized to include $n$ periods and interdependent demands is no more than a point of departure. Its virtue perhaps was that it avoided some errors of intuitively plausible solutions.¹¹

Let me note with some regret that what originally seemed to be the most important unexplored questions continue to be largely unexplored. These are the extent to which this solution offers practical guidance for those regulating industries with peak load problems, and an answer to the question of whether the shifting peak situation is a practical reality, or merely a theorist’s nightmare.

The distinction between firm peak and shifting peak cases is illustrated in Figure 2. Suppose that at equal prices period 1 users demand more capacity than period 2 users and imagine charging prices $P_1 = b + \beta$ and $P_3 = \beta$. Call the outputs $x_1^*, x_3$. If $x_1^* > x_3^*$ this is a firm peak case; if $x_1^* \geq x_3^*$ it is a shifting period case.

Multi-period situations are not easily characterized. For example, in Figure 1, periods 1 and 2 exhibit shifting peak features vis-à-vis one another, period 3 is a firm peak vis-à-vis period 1, but shifting peak with respect to period 2 if period 1 is ignored.

II. Critiques and Extensions of the Theory

Other than debates about patentry, which I shall pass over with one brief statement below, the recent debate about the peak load problem has centered on several theoretical issues: (1) the correct criterion of optimality; (2) the consequences of eliminating the single price per period restriction; (3) the consequences of relaxing the assumption of divisibility; (4) the consequences of the assumption of $n$ equal periods; and (5) whether the optimal solution is discriminatory. Not all of the critics have confined themselves to a single issue, and I will therefore review the literature topically rather than author-by-author, although this approach tends to convey less than the full flavor of many of the individual contributions.

I have not attempted a comprehensive review of contributors, but instead try and identify the primary issues.

The one issue of precedence that deserves comment is that of Demsetz who offers this unkind thought: ‘The solution offered by Steiner is a correct solution, not to the peak load problem, but to a problem that had been solved long ago [by Marshall] under a different name—the joint product problem!’¹² Demsetz believes the essence of the peak load problem to be capital indivisibility, a view I discuss below. But in this context he continues: ‘Thus, if we call $D^*$ the demand curve for carcasses and $D^*$ the demand curve for hides, and if we let $\beta$ be the cost of slaughtering a steer and $\beta$ the cost of delivering either the hide or the meat, we have a pure and simple joint-product problem. The solution to this problem, of the same nature as that given by Steiner, is given by A. Marshall, Principles of Economics, pp. 388–89, in his discussion of joint-supply. Marshall writes in a footnote on page 322:

11. My original paper emerged from a reading of R. K. Davidson, Price Discrimination in Selling Gas and Electricity, Baltimore, 1955; and also H. Houthakker, “Electricity Tariffs in Theory and Practice,” Economic Journal 61 (1951): 1–25. Each of these offered other, erroneous solutions. These matters do not repay review. I must note that I have always been enormously grateful to Houthakker for his gracious acknowledgment of my correction of an error of his.

Let $SS'$ [in Figure 3] be the supply curve for bullocks which yield meat and leather in fixed quantities; $dd'$ the demand curve for their carcasses, that is, for the meat derived from them. $M$ being any point on $OX$ draw $MP$ vertically to cut $dd'$ in $p$, and produce it to $P$ so that $Pp$ represents the demand price for $OM$ hides.

Then $MP$ is the demand price for $OM$ bullocks, and $DD'$ the locus of $P$ is the demand curve for bullocks: it may be called the total demand curve. Let $DD'$ cut $SS'$ in $A$; and draw $AA'B$ as in the figure. Then in equilibrium $OB$ bullocks are produced and sold at the price $BA$ of which $Ba$ goes for the carcass and $aa'$ for the hide.

Let $MP$ cut $SS'$ in $Q$. From $QM$ cut off $Qq$ equal to $Pp$; then $q$ is a point of the derived supply curve for carcasses. For if we assume that the selling price of $OM$ hides is always equal to the corresponding demand price $Pp$, it follows that since it costs $QM$ to produce each of $OM$ there remains a price $QM-Pp$, that is $Qp$, to be borne by each of the $OM$ carcasses. Then $SS'$ the locus of $q$, and $dd'$ are the supply and demand curves for carcasses.

What is wrong with this analogy is simply that meat and leather are inherently and by assumption produced in fixed proportions. Thus the quantity of carcasses and hides is equal not as an implication of a maximizing equilibrium, but as a technological constraint. That the compelled solution to the joint-product problem turns out to be the optimal solution to the shifting-peak situation should not lead one to forget that other solutions are possible to the peak load problem: indeed the firm-peak case requires a different solution.

1. The Criterion of Optimality

Oliver Williamson makes the explication of a social welfare function his primary task.13 Believing that "the welfare motivation of the earlier analyses has been generally lacking" he then goes on to demonstrate again the theorem that under condition of Pareto-optimality the sum of producers' and consumers' surplus is maximized. This is then taken as the sensible optimizing criterion. I can hardly quarrel with that, since it is indeed the precise criterion implicit in equation (1) above, and was made explicit in the original paper.14

The optimality criterion used by Boiteux-Steiner, and further explicated by Williamson is thus a conventional output criterion. It aims to allocate resources in such a way as to provide a unit of output whenever the willingness to pay for a unit of output exceeds the marginal resource costs of provision. This output (given some second order conditions) is found where total viable demand equals total marginal cost. If now in some meaningful sense price charged equals marginal cost and if $MC = ATC$ then this solution implies total revenue equals total cost.

The if in the preceding sentence need not apply and the Pareto-optimal output defined above may lead to total revenues different from total costs in either of two circumstances. The first involves non-constant costs, leading to conditions such that $MC \neq ATC$.

14. See Steiner, "Peak Loads," fn. 6, p. 587: "The social objective is thus the maximization of the sum of the consumers' and producers' surpluses. This requires the output where the demand curve is cut from below by the marginal cost curve. The private (buyers) objective is the maximization of consumers' surplus. Taken together these conditions imply $p = MC$. Where the cost curve is in horizontal sections (our case) the problem is particularly simple since producers' surplus is zero (total costs equal total revenues) when $p = MC$. For the further conclusion of optimal resource allocation it is usually, but not universally, argued that price and marginal cost be equal in all sectors of the economy."
This familiar problem was treated at length in the earlier debate about the marginal cost controversy, and the interested reader is referred to the papers by R. H. Coase and by Nancy Ruggles. The consensus solution to that debate was to agree that the problem of optimal ways to absorb excess revenues or to supplement deficient ones should be left as a side distributive issue. Among the possibilities are, of course, taxes, subsidies, price discrimination, and public provision of the product.

Even if costs are constant, if multiple prices are charged revenues may exceed costs. For example, in Figure 1 if the producer can charge discriminatory prices to different period consumers or to consumption of different units he can sell the output $x$, at a higher total revenue than $\bar{P} \times x$. There may be a real (that is, output) consequence to this, as shall be discussed in the next section. Neglecting the output consequence, the distributive consequence is not different from that caused by increasing or decreasing costs, and discussed just above.

Is there any inherent welfare judgment involved in the number of prices charged, apart from either allocational or redistributive consequences? I would not argue for one, although there are those who regard discriminatory prices as odious per se, either because they imply unequal treatment or because they imply some discriminatory power. Certainly the competitive model which underlies so much of our price theory leads us to treat the single price situation as the normal kind of market behavior not only for competitive markets but also for monopolistic ones. Indeed much of the discussion of non-competitive markets has always seemed to me an unfortunate victim of that fact: most theory of oligopoly or monopoly assumes a single price, although in fact most monopoly power carries with it the ability to discriminate.


2. Relaxation of the Single Price Assumption

From the point of view of a seller, ability to substitute a multi-part price system for a single price system has the obvious appeal of permitting the seller to expropriate some of the consumers' surplus available under a one price system. From the point of view of a regulatory body a multi-part tariff—one lump sum for connection and a lower unit charge—may provide a convenient way to price near marginal costs for incremental output and yet cover the fixed costs that lead to declining ATC (and thus to MC less than ATC). Thus J. M. Buchanan and A. Gabor are clearly relevant in raising the question of what consequences emerge from abandoning the single price constraint. Let us look at the argument first in the context of a simple monopoly, absent any peak load problems. Assume both a linear demand curve and a horizontal marginal cost curve as in Figure 4. $P$ and $x$ represent the competitive price and output and $P_0$ and $x_0$, the single price monopoly price and output. Obviously the output between $x_0$ and $x$ would be attractive to the monopolist if he could capture it without having to lower the price on the $x_0$ units already salable at $P_0$. Thus, goes the familiar argument, a perfectly discriminatory monopolist would have incentive to increase output up to $x$, the competitive output, although at an average charge well in excess of $P_0$.

But the demand curve $D$ reflects the alternative purchases buyers would make for a given income. Suppose $D'$ is the demand curve for a somewhat lower set of incomes. Indeed suppose it represents the demand curve for buyers' incomes after the monopolist has extracted his discriminatory toll on consumers. Then even perfect discrimination would justify production only of quantity $x_0$ instead of $x$. Price discrimination involves income redistribution: income redistribution shifts demand curves; shifting demand curves change the actual (and optimal) level of output. Thus the optimal output depends upon the form of pricing used.

Applied to a peak load situation this point works out this way, following Buchanan. Suppose the pricing authority offers buyers in

each period a price structure wherein price varies with quantity purchased, perhaps giving quantity discounts to period 2 buyers and charging quantity premiums to period 1 buyers. Assume that these price offers (in excess of operating costs) are represented in Figure 5 as $M_1$ and $M_2$, for a two period case in which $D_1$ and $D_2$ are the demands for capacity. If

$$M_1(x_1) + M_2(x_2) = M(x) - \beta$$

(2)

and if $D_1$ and $D_2$ are the relevant demand curves, then the $x_0 = x_1 = x_2$ solution is no different than if the single prices $P_1$ and $P_2$ were charged. But $M_1$ and $M_2$ were perfectly arbitrary price structures. There are an indefinite number of price structures that satisfy equation (2)." One of them is shown as $M'$; $M_1$. Compared to $M_1$, $M_2$,

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20. Buchanan's analysis seems to imply equation (2) as a binding constraint. If costs are constant this amounts to a demand that total cost equals total revenue. Otherwise its welfare justification is more obscure: it assumes that equal consumption will occur in the two periods and that therefore the marginal capacity charge should equal the marginal capacity cost. I have no objection to these value judgments, but it is worth pointing out that they are not compelled: one may have optimal resource allocation without collecting revenues equal to total marginal costs. But the assumption serves well to illustrate Buchanan's basic point, and I accept it in this spirit. See Buchanan, "Efficient Pricing: Comment," pp. 463-71.

21. Ibid., p. 471.
Buchanan is quite right. As long as income effects are not negligible, optimal output is a function of price structure. But he appears to think this is in some ways peculiarly linked to the peak load problem. It is not. It applies in Figure 4 as well as Figure 5. Indeed it applies every time there is discretionary choice about price structure. Thus it applies everywhere except in the limiting case of perfect competition. If Buchanan and Gabor have identified flaws in price theory, they are very general flaws that apply whenever discretion can have an effect on income distribution.

Thus this interesting issue is far more general than peak load pricing. If there are a large number of cases where alternative pricing structures have redistributive effects and where the income effects lead to significantly different demands, we need more welfare judgments than we now have to reach any decisions. This is not particularly or peculiarly present in peak load problems. I share the view of Walter Oi, that the burden of proof lies with those who urge us to abandon the single price case as the point of departure.

3. The Consequence of Indivisibility

Demsetz and Williamson both raise a problem concerned with abandoning the assumption of divisible capacity. They are correct as can be simply illustrated in Figure 6. Instead of the continuous long-run supply curve represented by the horizontal line in Figure 1, suppose capacity can be only purchased in units that provide $K$ units of output ($K > 1$). Thus technologically it is possible to provide $mK$ units of output or $(m + 1)K$ units at a capital cost of $\beta$ per unit of output. But for intermediate amounts the only available technique is to build capacity of $(m + 1)K$ and underutilize it, thus raising capital costs per unit of output above $\beta$. If aggregate demand increases from $D_1$ to $D_2$, there is no problem, and the solution of Figure 1 applies. But if it increases by less, say to $D_1$, there is a problem. By our welfare function the additional unit of capacity (the $(m + 1)K$ should be built as soon as demand increases so that the area rzy exceeds sxy, for then the consumer satisfaction from the extra units of output exceeds the producer's loss in providing it at a capital cost of $\beta$ per unit of output. But private producers will not

22. Which is really $\beta + mb$. See footnote 10.

be motivated to provide the capacity $(m + 1)K$ (at the optimal prices) until demand increases to $D_2$. Thus there is a probable discontinuity lag, of the kind identified by Donald Wallace a long time ago.

![Figure 6](image)

Again I think this is right in principle, trivial in theory, and ultimately of importance only if shown to be empirically relevant. For example, by analogy, the ordinary long-run average cost function might be shown as a step function, instead of a continuous curve, as in Figure 7. Instead of providing marginal equalities, one needs, theoretically, sets of inequality conditions.

There is a temptation to say that as a practical matter, in electrical pricing, a steam turbine generator is indeed a lumpy item and that this criticism is thus particularly apt. But if one is talking

23. If the capital cost of producing $K$ or less incremental units of output is $A$, then $\beta = \frac{A}{K}$ if $K$ units are produced. But if the increase in output from $x$ is less than $K$, the amount $\beta \Delta x$ will be less than $A$, and private producers have no incentive to produce it. But for some $\Delta x$ less than $x$, the social criterion $F(x) - \beta$ exceeds $A$. Thus the pricing rules of the Boiteux-Steiner solution will fail to provide some socially desired capacity.

in equal periods, and the only confusion that arises is because Williamson uses my notation, \((b, \beta, \text{etc.})\) to refer to differently defined units. This hardly bears going into here. Using \(\hat{b}\) and \(\hat{\beta}\) to designate his concepts, \(b = \hat{b}; \hat{b}\) where \(b\) is the number of (equal) hours in period \(i\), and \(\hat{\beta} = K \hat{\beta}\) where \(K\) is the number of units of output a unit of capacity can provide.

5. Price Discrimination

I am reluctant to reopen this issue since J. Hirschleifer\(^{26}\) and I\(^{27}\) said about all that was sensible on the question in 1958. I have no doubt at all that I won that debate but the issue is essentially semantic. In Figure 8, suppose \(MC\) is at the level \(Ow\) up to output \(x_o\), and is infinite thereafter. If one regards the \(MC\) curve as \(wyz\) then the intersections of \(D_1\) and \(D_2\) with the vertical line \(x_2\) both represent \(P = MC\) intersections. If alternatively \(MC\) is defined as equal to \(Ow\) for outputs up to and including \(x_o\) and as not defined thereafter, then since this represents price discrimination the ratios \(OP_1\) \(Ow\) and \(OP_3\) \(Ow\) are clearly unequal, and unequal ratios imply price discrimination.

As H. Mohring has pointed out, in the Hirschleifer definition, "At system capacity in this case, 'short run marginal cost' is defined to equal whatever price is necessary to equate demand with capacity output..." I confess I agree, and find the definition thus unrevealing. Williamson says he agrees with Hirschleifer, but offers no support for this gratuitous assertion.\(^{28}\)

Defining price discrimination is always tricky because it depends on defining as essentially the same product, a product that buyers regard differently. If peak and off-peak demands are for different products then the issue of discrimination cannot arise. If they are

\(^{27}\) Steiner, "Peak Loads: Reply," pp. 485-68.
for the same product why should differential prices be nondiscriminatory? In any case I cannot see that the debate has led anywhere at all. I propose we forget it. We ought no longer be in the business, as Mrs. Robinson once put it, of taking in other people’s definitions for mangle.

III. Summary

In summary, it seems to me that the purely theoretical debate about a peak load pricing solution has gone on too long without a major infusion of new insights. Perhaps the multiple price (Buchanan, Gabor) and indivisibility (Demsset, Williamson) points will bear fruit if they lead to a general rethinking of microeconomic theory. I tend to doubt it. More promising, but awaiting its developer, is a genuinely dynamic attack on the problem. This promises to be hard, and I gladly leave the task to the young mathematicians among us.

I have neglected in this paper the literature on marginal cost pricing in practice in part because it has been surveyed by Ralph Turvey and by James Nelson, and in part because it takes me beyond the limits of my own interest in the problem. I cannot conclude, however, without mentioning an encouraging sign in a recently published paper by S. C. Littlechild. He explores the possibility of using programming techniques to discover the prices that lead to optimal outputs in a peak load situation. We badly need a link between theoretical solutions and empirical data and it is encouraging to find one being sought.

Comment

Ralph Turvey
National Board for Prices and Incomes

Since Professor Steiner's paper contains nothing with which I disagree, these comments will take up some of the matters which he merely mentions but does not investigate. Thus he lists as an unexplored question "the extent to which this solution offers practical guidance for those regulating industries with peak load problems." This involves two sub-problems. The first is the recommendation of a practical pricing policy for such an industry and the second is the task of getting the industry to implement the recommendation.

The nature of this second sub-problem depends on the structure of ownership and control, since the task of regulating a privately owned industry faced by a regulatory commission differs from the task faced by a government in controlling a nationalized enterprise. I propose to concentrate on the first sub-problem and examine how one gets from the Steiner-Boiteux theory to practical recommendations.

This transition involves four points. First, a proper cost analysis of the enterprise in question may be required. This inevitably brings in the complications of development through time and the multi-
dimensionality of outputs (and hence of the cost structure). Second, it has to be recognized that very little is or can be known about demand functions. Third, second-best considerations, though equally difficult to quantify, have to be taken into account. Fourth, the costs of complicated versus simple price structures and the costs of altering a price structure have to be weighed against any benefits from change.

It is immediately apparent from these four points that there is not much that can be said about these matters in purely general terms. Cost and demand structure, second-best problems, and tariff possibilities differ too much from one industry to another. Therefore, we can only make progress by the practical examination of particular industries. The role of theory is confined to the enunciation of a relevant concept of marginal costs and to the suggestions that peak pricing theory and second-best theory provide.

Since I have discussed the case of electricity in previous writings and do not wish to repeat what I have already written, I propose to illustrate my points by referring briefly to some of the reports of the National Board for Prices and Incomes, which are probably not widely known in the United States.

In at least two cases we have felt able to recommend peak pricing. One was the case of telephones where it already existed and where we merely recommended a widening of the differential and the introduction of a third, intermediate, level of call rates. Here several of the problems alluded to above did not exist, thus simplifying matters.

First, since there already was a differential, the question of how much it would cost to introduce it did not arise and we merely had to investigate the feasibility of introducing a third rate. Elaborate metering is, of course, far easier when meters are centrally located in a telephone exchange, than when they are located on consumers' premises, as they have to be at present in the cases of gas and electricity.

Second, we knew very little about telecommunications cost structure and indeed suggested that the Post Office should initiate a systems analysis investigation in partial replacement of their orthodox cost allocation procedures. But even while this ignorance prevented us from attempting to calculate optimal tariffs, it was clear that the peak/off-peak cost differential was so high that our recommendations represented a move in the right direction.

Third, we did not have (and could not undertake) econometric studies of demand elasticities and cross-elasticities. But it was clear that a priori that business calls are made during office hours, so that the only risk of shifting the peak was avoided was the generation of a sudden peak of non-business traffic at the onset of the cheap rate period. We endeavored to avoid this partly by choosing an appropriate timing for the change of rate and partly by proposing the new third and intermediate rate level.

Finally, our terms of reference constrained us to inquire how, rather than whether, more revenue should be raised. The initial proposal, from which we dissented, was to rely primarily upon an increase in telephone rentals. Here the argument might be thought to run in terms of Steiner's discussion of multi-part pricing as a means of getting a slice of consumers' surpluses. While this is undoubtedly relevant in principle, it was quite unquantifiable. On the other hand, a little reflection suggested that a telephone system supplies its subscribers with telephones as well as with telephone calls so that if the principles of marginal cost pricing applied as well, they could be applied to rentals as well as to call charges. Consequently, our opposition to a large increase in rentals was based upon arguments about the costs incurred by providing (and the costs saved by discontinuing) a telephone.

Another report where we recommended (seasonal) peak pricing related to freight charges between the mainland of Scotland and the Orkney and Shetland islands. Since charges in the peak period were intended "what the traffic will bear," this involved an actual reduction at other times. But this, taken alone, would have forced a loss upon the shipping company. The solution which we proposed—not yet accepted by the authorities—included a contract between

the company and the County Councils of the two island groups, whereby the latter would meet part of the former’s costs. We explained our idea as follows:

It is an essential feature of the scheme that the substantial contribution resulting from the proposed contracts should be financed by the islands’ ratepayers. The consequential increase in local rates coupled with the new charges structure would alter the way in which the islanders paid the North Company for their shipping services. The scheme would thus involve a mixture of collective and individual payments to replace the present system of exclusively individual payments by passengers and shippers of freight. The justification for this is that the shipping service does have some of the features of communal services such as, to name but two examples, road maintenance and refuse collection, which are provided by a single organisation and paid for by ratepayers. In view of their relative isolation, the provision of a regular and good shipping service has a utility and relevance to the islanders which is not adequately measured by the actual use which they and their suppliers make of it. There is thus a strong case for the islanders to act together, through their own elected local authorities, in determining the nature and cost of their shipping services. Since the independent fiscal resources of the County Councils are limited to local rates, there is no option but to use the rating system for this purpose.

If that increased local rates make up for reduced charges under our proposals, and hence for the loss of revenue to the North Company, the total amount paid by the islanders would be unchanged. But the better use of the carrying capacity provided by the shipping services would clearly benefit the islanders as a whole. Thus, in balance, the removal of the economic inefficiencies resulting from the present charges structure would improve the overall economic position of the islands. The incidence of the change on individuals, on the other hand, is impossible to assess since the prosperity of many islanders not only depends directly on the shipping charges they pay but also on the prosperity of their customers and suppliers in the islands. But given an overall improvement, few ratepayers could convincingly argue that the scheme would damage their interests.

In Chapter 4 we reviewed some of the medium and long term possibilities for the future of the shipping service. The choices that are made in the next few years, particularly those which will arise when ships have to be replaced, are vital to the social and economic future of the islands. It is therefore desirable that the islanders, who will have to help to pay the price, should also help to call the tune—that is, to have a say in the choices involved. Even on the narrowest economic grounds, investment decisions respecting island enterprises need to be co-ordinated with the North Company’s investment decisions which will determine the kind of shipping service provided in the future. There is at present no effective means whereby this co-ordination could be achieved. It is therefore an important feature of the scheme which we propose that it provides these means. The negotiations between the two County Councils and the North Company, leading up to the contracts would thus serve as a planning instrument integrating the islands’ agricultural and industrial development with that of transport between the Scottish mainland and the islands.

Another report on transport pricing, this time relating to a public enterprise, considered proposed increases in bus and underground fares in London. These increases included the innovation of charging higher fares in an Inner Zone than in the rest of London but did not include any element of peak pricing. We argued, on second-best grounds, that this was right. Thus we thought it probable that peak pricing would cause a substantial shift from public transport to the use of cars during the morning and evening rush hours. Although it was quite impossible to estimate how big the shift might be, we were able to show in a rough manner that its consequences could be very disadvantageous, as follows:

It is first necessary to calculate the marginal cost to London Transport of providing bus service per peak hour passenger mile. Extra passenger miles require extra buses only over those parts of the route and at those times when buses are full. The crucial distance on many routes is some 2 miles and the time taken over the whole route is usually such that each bus can traverse this crucial segment of the route only once during each peak period. Thus if 50 passengers constitute a full load, each extra 100 passenger miles in a peak period over the segment of the route in question will require the provision of one additional bus. With two peak periods per working day and 250 working days in the year an additional bus can thus provide some 50,000 peak passenger miles per annum. The corresponding addition to London Transport’s costs per annum is about 55,300. Thus its marginal cost per peak bus passenger mile is roughly 30d. This figure is no more than an order of magnitude, as are those which follow, but it serves for illustration.

The marginal cost to a car owner of using his or her car may be taken as 7·1/2d per mile, of which about 2·7d consists of petrol tax, leaving 4·8d per mile as the real resource cost. Since cars in the peak hours are observed to have, on average 1·3 occupants, this is equivalent to about 7·2d per passenger mile.

If the time of travellers in the peak period is valued at 3s. per hour for those travelling in their own time and 12s. for those travelling in working time, the congestion cost of a car can be estimated to be of the order of 10s. per mile. Since one bus causes about as much delay as 2·25 cars, the corresponding figure for a bus is of the order of 22·6d. With 1·3 occupants per

car and 50 per bus, the congestion cost per passenger mile comes out at 7½d for car travel and 5-1½d for bus travel.

Bringing these figures together, it appears that each passenger who shifts from peak hour travelling by bus to travelling by car:

<table>
<thead>
<tr>
<th>Cost</th>
<th>Value</th>
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<tbody>
<tr>
<td>Saves London Transport</td>
<td>29p</td>
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<tr>
<td>Saves bus congestion costs of</td>
<td>5.5p</td>
</tr>
<tr>
<td>incurs car costs (net of petrol tax) of</td>
<td>1.7p</td>
</tr>
<tr>
<td>imposes car congestion costs of</td>
<td>90p</td>
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giving a net addition to costs from the point of view of the community as a whole of 59.2p per mile.

In some of our other investigations of nationalized industries we have gone further into the analysis of cost structure than in the reports mentioned so far. The main example is our study of the gas industry, which included fairly substantial appendices on methods of long-term planning of the system, the appraisal of investment in distribution, and the principles of cost analysis.

In discussing tariffs for gas supply it is clear that the costs of installing and maintaining time-switched meters or meters which measure the maximum rate of flow as well as consumption over a period would be prohibitive for all except the largest consumers. Similarly, the provision of interruptible supplies is only feasible for large consumers. Since the seasonal peak in demand is a major argument in the cost function, this means that—for the great majority of consumers—the most obvious way of achieving a cost-reflecting tariff is closed. We were therefore led to the following two tentative proposals for experiment:

One possible solution as far as the commodity charge is concerned might be to introduce seasonally varying commodity rates and then weight them by the fraction of the meter-reading period to which each appliance, according to his meter-reading period, these weights would thus be used to derive the weighted average price at which to charge his consumption. Clearly this method would be less accurate than meter demands at each separate period of time when a different commodity rate was in force, but it would also be less expensive. It would also be an improvement on any tariff in which the commodity rate was assumed not to vary, for it would clearly encourage consumers to avoid consumption at times when the commodity rate was high.

There is no perfect solution to the problem of the capacity charge. However, a high commodity rate charged at the season of peak demand, as just suggested, provides a rough substitute for a capacity charge. Alternatively, there is a possible form of capacity charge for small consumers which avoids the costs of maximum demand metering and which is now proposed by the West Midlands Board for large consumers. It involves levying a charge proportional to the sum of the rated output capacities of a consumer's appliances, each appliance being multiplied by the average diversity factor for that type of appliance according to its use by itself or in combination with others. The diversity factor (the ratio of appliance consumption at the time of system peak to its own maximum) is ascertainable and, indeed, already partly known as a result of market research. Appliance ownership, on the other hand, automatically becomes known on the occasion of conversion to natural gas. The only problem, therefore, would be to keep the record up-to-date. So far as appliance disposals are concerned, it would be in the interest of consumers to notify the Area Board. Acquisitions, on the other hand, could be checked in several ways: for example, by compulsory notification of appliance sales, compulsory inspection of new installation work (desirable in any case for safety reasons) or even inspection by meter readers. The creation and maintenance of the necessary records and their integration into the billing system would, of course, have a cost. The question is whether this cost would not be worth incurring. Any improvement in tariff structure will have a cost and the imperfect reflection of costs under the present system is such that some new tariff structure seems to us to be necessary. Furthermore, the records would have great value in forecasting; indeed, some boards are already thinking about the desirability of keeping consumer appliance records solely for this reason.

The purpose of suggesting these two possible new tariff forms for small consumers is that either of them would offer consumers more opportunity than do present tariffs of tailoring their demands to the cost they impose on the system and at the same time saving money. This purpose would be lost if consumers were not in fact prepared to take advantage of the new tariff. Hence, the degree of consumer reaction to alternative tariff structures is relevant to the choice and there is a case for experimenting to discover the likely consumer response.

No proposal for a new tariff should be judged solely by the immediate costs and benefits that it might produce. Some benefits would not be felt until after consumers had completely adjusted themselves to the new tariff in their purchasing and disposal of appliances and the full benefits would not be experienced until after appliance manufacturers had also adjusted themselves to it by altering their appliance design to improve the consistency of the load taken by individual appliances. What pressure might be brought to bear on appliance makers so to change their appliances as to make the consistent load they could take is for the gas industry to consider. The benefits from an improved tariff structure, though slow to show themselves, could be substantial and too much capital is at stake for the novelty and

immediate inconvenience of change to count against it. The introduction of natural gas provides a particularly suitable opportunity to consider alternative and more cost related tariffs.

While not wishing to be dogmatic on any one course, we therefore recommend that the industry undertake experiments with alternative tariff structures for both large and small consumers, including those mooted above. This will require the calculation of the ideal tariff, an imaginative search for various approximations to it and a systematic analysis of possible alternatives.

Hopefully, the examples quoted above will serve to show that the application of peak pricing theory is less unexplored than Professor Steiner suggests. This is not to say that all the ideas surveyed were fully worked out, nor that they have all been accepted. Nevertheless, that (small) proportion of the work of the National Board for Prices and Incomes which lies within this field should be of interest to students of public utility pricing problems.

The Theory of the "Second Best" and the Efficiency of Marginal Cost Pricing

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Since the appearance of the classic paper by R. Lipsey and K. Lancaster on the general theory of second best, economists have been engaged in a process of clarifying and reappraising the work. In the process, many words have been written, but few conclusions reached. One thing, however, is certain; the initial far-reaching interpretations of the Lipsey-Lancaster paper were wrong. First, the question of the existence of a second-best solution was treated in a highly misleading way; there can be no general presumption that a second-best solution (even an interior solution) is unlikely to occur. If a first-best solution exists, then the imposition of an additional constraint that does not contradict the original constraint does not,

in general, result in no solution. Second, the generality of the conclusion that Paretian optimum conditions are not retained in a second-best solution was overstated. If one of the first-best optimum conditions cannot be met, the normal outcome is not that all other first-best equilibrium conditions are undesirable. In many types of optimization problems considered by economists, the inability to meet one or more specific first-best conditions does not imply that the second-best optimum will require violation of the remaining first-best conditions. Frequently, the second best will simply demand that the first-best conditions be met wherever feasible.

We find ourselves, then, in the position we occupied before the advent of the Lipsey-Lancaster paper. Optimization implies that some objective function is to be maximized (minimized) subject to a particular set of constraints that apply to the given problem. But each problem must be handled on its own terms; a general solution for all possible problems is unavailable.

1. The Relation of Second Best to Piecemeal Policy

The theory of second best, as originally discussed by Lipsey and Lancaster, is directed toward certain key policy questions. In effect, they ask: Is it always in the general interest of the community to force certain industries to behave in a competitive manner: when it is not possible to compel all other industries in the economy to behave similarly? If not, what circumstances have to hold to justify the regulation of the one set of industries while the other industries remain free to pursue their own policies?

It has long been known by welfare economists that, in general, the piecemeal policy of making one monopolist adhere to marginal cost pricing when other monopolists cannot be so controlled does not necessarily increase community welfare. Such selective policy does not, again in general, lead to an unambiguous improvement in the system’s output. What second-best theory is trying to do, or rather what it should be trying to do, is to determine the conditions under which such piecemeal action is appropriate. We believe that this is the understanding of most economists relative to the potential contribution of second best. In other words, the primary problem with which second-best theory is concerned is not to establish the policy that will turn a second-best optimum into a Paretian optimum, but rather the problem is to determine what policies will (necessarily) increase welfare in circumstances where a second-best situation is inevitable. In this light, second best involves nothing more than the basic need to maximize some welfare function subject to stipulated constraints.

2. The General Nature of Second Best

The general theorem for the second best as stated by Lipsey and Lancaster is:

... if there is introduced into a general equilibrium system a constraint which prevents the attainment of one of the Paretian conditions, the other Paretian conditions, although still attainable, are, in general, no longer desirable. In other words, given that one of the Paretian optimum conditions cannot be fulfilled, then an optimum situation can be achieved only by departing from all other Paretian conditions.

Subsequent to its publication, the “general theorem” has been interpreted by many to have shown, definitively, that any piecemeal policy, such as forcing public utilities to price at marginal cost, is antithetical to the public interest. The truth of the matter is, however, that the theorem shows something rather less than this. Lipsey and Lancaster merely demonstrate that if, in a general equi-


librium system, an additional constraint is introduced which prevents the attainment of one of the first-best conditions, then it is, in general, neither necessary nor sufficient for a maximum that the remaining first-best conditions hold. Note that this statement of the theorem implies nothing about the likelihood of a particular problem yielding results that require the remaining first-best conditions to be met (or violated). In fact, it would be entirely possible (that is, not in contradiction to the theorem) that in every economics problem in which an additional constraint is imposed that prevents the attainment of one of the first-best conditions, optimization will require the retention of all of the remaining first-best conditions. The moral here is simple: since economic problems are only a proper subset of all constrained maximization problems, general theorems of the type derived by Lipsey and Lancaster are of little use unless their relevance for economic models is clearly delineated.

At this point it will be desirable to present a summary mathematical statement of the second-best problem; the objective is to re-establish some of the preceding arguments with greater precision. Thus, consider the objective function:

$$z = \Phi(X_i), \quad i = 1, \ldots, n,$$

which is to be maximized subject to the following constraints:

$$\Gamma_i(X_i) = 0, \quad i = 1, \ldots, n.$$  \hspace{1em} (2.2)

The well-known first-order conditions are:

$$\phi_i = \lambda \Gamma_i, \quad i = 1, \ldots, n,$$  \hspace{1em} (2.3)

where $\phi_i$ and $\Gamma_i$ are partial derivatives of $\Phi$ and $\Gamma$ respectively and $\lambda$ is the Lagrangian multiplier. We now define the following relative

$\Psi_i$ as the Paretian conditions for the maximization of (2.1) subject to (2.2):

$$\frac{\phi_i}{\phi_*} = \frac{\Gamma_i}{\Gamma_*}, \quad i = 1, \ldots, n,$$  \hspace{1em} (2.4)

which comprise $(n-1)$ independent conditions ($i=n$ holds trivially).

Equations (2.4) represent the conditions for a first-best maximization of (2.1); that is, the maximization of (2.1) subject to the single constraint (2.2). Analysis of a second-best maximum requires a constraint in addition to (2.2) and, accordingly, we introduce the following second constraint:

$$\Psi_i(X_i) = 0, \quad i = 1, \ldots, n.$$  \hspace{1em} (2.5)

Then the new first-order conditions written in relative form are:

$$\frac{\phi_i}{\phi_*} = \frac{\lambda_i \Gamma_i + \lambda_* \Psi_i}{\lambda_i \Gamma_* + \lambda_* \Psi_*}, \quad i = 1, \ldots, n.$$  \hspace{1em} (2.6)

where the $\Psi_i$ are the partial derivatives of $\Psi_i$ and $\lambda_i$ and $\lambda_*$ are Lagrangian multipliers. Additionally, assume that there exists at least one $k$ such that:

$$\Gamma_k = \frac{\lambda_i \Gamma_i + \lambda_* \Psi_i}{\lambda_i \Gamma_* + \lambda_* \Psi_*}, \quad k \neq i.$$  \hspace{1em} (2.7)

The crucial question now is: what can be said about the remaining optimum conditions, given (2.6) and (2.7)? Specifically, does (2.7) imply that:

$$\frac{\Gamma_i}{\Gamma_*} \neq \frac{\lambda_i \Gamma_i + \lambda_* \Psi_i}{\lambda_i \Gamma_* + \lambda_* \Psi_*} \quad \text{for } i \neq k.$$  \hspace{1em} (2.8)

7. This has been ably demonstrated by Davis and Whinston, "Welfare Economics," pp. 1–14 and others.

8. We are assuming that all maxima occur at interior points. This assumption simplifies the notation and does not affect the generality of the argument presented since the corner solution conditions are well-known and not at issue here.

9. If no such $k$ exists, then in the neighborhood of the equilibrium point $\Gamma(X)$ and $\Psi(X)$ are linearly dependent and are really not separate constraints.
Clearly not, since as long as both $\Psi$ and $\Psi_i$ exist, it is both necessary and sufficient for equality in (2.8) that:

$$\frac{\Psi_i - \Gamma_i}{\Psi_i - \Gamma_i} - i \neq k,$$

(2.9)

which is not precluded by (2.7) and our previous assumptions about (2.5). In particular, the independence assumption requires that there exist at least one $k$ such that:

$$\frac{\Psi_k - \Gamma_k}{\Psi_k - \Gamma_k} = 1,$$

(2.10)

and our assumption in (2.7) assures us that this is the case. Thus, the general theorem for the second best may also be stated in the following form:

If there is introduced into a general equilibrium system a constraint which prevents the attainment of one of the Pareto conditions, nothing precludes, in general, the other Pareto condition from still being desirable.

Both the Lipton-Lancaster version and this version of the general theorem for the second best are correct statements of the mathematical result. But note the completely different emphasis and the different apparent meaning. We believe this points out the problem that has beset the whole second-best literature. Namely, there is no general theory of second best unless it is that you can, in general, say nothing.

Up to this point we have neglected the issue of the existence of second-best solutions. While the existence statements made by Lipton and Lancaster are vague, subsequent papers by M. McManus and C. C. Morrison have shown that if a first-best optimum exists then, under fairly general conditions, a second-best optimum will exist. The argument is essentially as follows: let $\Psi$, $\Gamma_i$, $\Psi_i$, be real valued functions on $R^*$ and assume that the set $Z$ com-

10. See Morrison, "Nature of Second Best," pp. 49-52, for a discussion and proof of result (2.9).

prised of elements $z = \Psi(X_i)$, for all $(X_i)$ such that $\Gamma_i(X_i) = 0$, is closed and bounded. Then $Z$ has a least upper bound $\bar{z} \in Z$ and $\bar{z}$ is the maximum. Introduce the additional constraint $\Psi(X_i)$ and construct the set $Z^*$ comprised of elements $z = \Psi(X_i)$ for all $(X_i)$ such that $\Gamma_i(X_i) = 0$ and $\Psi(X_i) = 0$. Since $\Psi(X_i)$ is independent of $\Gamma_i(X_i)$, $Z^* \subset Z$. But then $Z^*$ has a least upper bound $\bar{z}$, and if we assume that $Z^*$ is closed (that is, contains its boundary points) then $\bar{z} \in Z^*$, and $\bar{z}$ is the maximum of $Z^*$. Thus, if the first-best optimum exists, the second-best optimum must exist under the general conditions listed above, that is, that $Z$ and $Z^*$ are closed and bounded. Since we believe the latter presumption is reasonable for problems in economics, the case would seem secure.

3. A Simple Example of Second Best

Most of the issues involved in the second-best literature can be demonstrated with the use of a simple example from the theory of production. Thus, let us examine the firm’s short-run versus long-run output maximization for given total expenditures; this is, in reality, a second-best versus a first-best problem. In the standard presentation, the individual firm, facing perfectly competitive factor markets, is assumed to maximize output subject to a fixed total outlay relation. We have a conventional production function:

$$q = f(X_i), \quad i = 1, \ldots, n,$$

(3.1)

and an expenditure constraint:

$$\sum_{i} P_i X_i - C^* = 0.$$

(3.2)

In these relations, $q$ is the rate of output, $X_i$ is the rate of use of the $P_i$ input, and $C^*$ is the fixed level of total expenditures. Then, the
well known first-order conditions for a maximization of (3.1) subject to (3.2) emerge as:

\[ f_i - \lambda P_i = 0, \quad i = 1, \ldots, n, \]  

(3.3)

where \( f_i \) is the partial derivative of \( f \) with respect to \( X_i \), and \( \lambda \) is the Lagrangian multiplier. Equations (3.3) can be written in relative form, and in this form they are equivalent to the usual Pareto optimality conditions:

\[ \frac{f_i}{f} - \frac{P_i}{P}, \quad i = 1, \ldots, n, \]  

(3.4)

where (3.4) contains \((n - 1)\) independent conditions (again \( i = n \) holds trivially).

Now consider the short-run case which appears with the addition of a constraint:

\[ X_i - \gamma_i = 0, \]  

(3.5)

where \( \gamma_i \) is a constant. For convenience, we assume that all factors have positive expenditure elasticities (that is, we assume no factor is inferior),\(^{16}\) and that the fixed level of total expenditures \((C^n)\) is sufficiently large so that \( X_i = \gamma_i \) is not the optimal rate of use of factor \( k \). Under these circumstances it follows that:\(^{17}\)

\[ \frac{f_i}{f} > \frac{P_i}{P}, \]  

(3.6)

Thus, our problem fits the starting conditions of the general theorem for the second best.

At this point the Lipsey and Lancaster approach\(^ {18} \) is to introduce as the second constraint:

\[ \frac{f_i}{f} - k \frac{P_i}{P} = 0 \quad k \neq 1, \]  

(3.6a)

where \( k \) is a constant not equal to 1 (in our case \( k > 1 \)). Relative to this procedure, Lipsey and Lancaster add the following statement: "It is not necessary that \( k \) be constant, but it is assumed to be so in the present analysis."\(^ {19} \) This passage is mentioned because the assumption of the constancy of \( k \) seems innocuous enough at first glance but, as it turns out, the assumption is extremely crucial and it is not, in general, consistent with the economic problem being analyzed.

Proceeding with the second-best optimization as formulated above, we now maximize (3.1) subject to (3.2) and (3.6a) and secure the first-order conditions:

\[ f_i - \lambda_i P_i - \lambda_j (f_j f_i - f_i f_j) = 0, \quad i = 1, \ldots, n, \]  

(3.7)

or in relative terms:

\[ \frac{f_i}{f} - \lambda_i \frac{P_i}{P} - \lambda_j (\frac{f_j f_i - f_i f_j}{f^2}) = 0, \quad i = 1, \ldots, n. \]  

(3.8)

It is necessary and sufficient that:

\[ \frac{f_i}{f} f_i - f_j f_i - \frac{P_i}{P} = 0, \quad i = 1, \ldots, n. \]  

(3.9)

If (3.8) is to be equivalent to (3.4). But nothing in our model requires the equality (3.9) to obtain; and this fact, by itself, seems to imply that in a situation where the existence of a fixed factor prevents the attainment of one of the Pareto optimal conditions [see

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16. The expenditure elasticity \((e_n)\) for the \( i^{th} \) factor is defined as \( \frac{\delta X_i C}{\delta C X_i} \) and is greater than or less than zero as the factor is normal or inferior. See: C. E. Ferguson and T. R. Saving, "Long-Run Scale Adjustments of a Perfectly Competitive Firm and Industry," American Economic Review, December 1969, pp. 774–83.

17. The proof of (3.6) can be accomplished easily by defining \( h_i = f_i - f - \lambda P_i \) and totally differentiating (3.3) with \( h_i \) replacing \( f_i - \lambda P_i = 0 \) and solving for \( \frac{\delta h_i}{\delta C} \), which is greater than zero. Thus, it follows that \( f_i > \lambda P_i \) and since \( f_i = \lambda P_i \), (3.6) follows.


(3.6a), the remaining conditions need not hold. For this particular problem, however, the result suggested by (3.8) is in direct contradic-
tion with the accepted doctrine of the theory of the firm—
namely, that the Pareto optimal conditions should hold for all vari-
able factors. Actually, the orthodox result would have been ob-
tained had we imposed constraint (3.5) directly instead of the
special transformation of (3.5) in the form of Lipsey and Lancas-
ter’s expression (3.6a). In other words, the maximization of (3.1)
subject to (3.2) and (3.5) yields the following first-order conditions
expressed in relative form:
\[ \frac{f_i}{f} - \frac{P_i}{P}, \quad i \neq k. \]  
(3.10)

But it is immediately apparent that (3.10) and (3.8) are in con-
tradiction to one another and something must be amiss. Indeed,
something is amiss. The seemingly innocuous assumption that the
(variable) \( k \) in (3.6a) is a constant has come back to haunt us.
Strictly speaking, the \( k \) in (3.6a) is a function of the remaining
arguments of the production function; and what (3.6a) reduces to
ultimately is a definition of \( k \).\(^{20}\) Hence the differential of (3.6a):

\[ d[3.6a] = \frac{f_i \Sigma f_{j,} + f_i \Sigma f_{j,}}{f_i} - \frac{P_i}{P} \frac{d\lambda_i}{d\lambda} \]

is necessarily zero. But, then, the term in (3.7) associated with \( \lambda_i \)
should be (3.11), and a correctly derived set of equations (3.8)
would be identical to (3.10) and our contradiction disappears.

The preceding exercise in production theory has pointed up two
significant difficulties encountered in applications of the general
theorem for the second best. We find that: (1) the addition of a con-
straint which prevents the attainment of the Pareto optimal con-

\(^{20}\) The truth of this statement is apparent when we recall that, by
assumption, (3.6a) follows from (3.5) and the subsequent maximization
process.

tions does not necessarily imply (or even make it likely) that the
remaining Pareto optimal conditions are undesirable; and (2) the
form in which the second constraint is considered exercises a not
insignificant effect on the results obtained. The latter problem was
certainly evidenced in our example of the competitive firm, but the
principle involved transcends that particular case. We can say, as a
general proposition, that if a second constraint exists, it should be
introduced directly rather than through the device of introducing
the result of the constraint. In this connection, consider the Lipsey-
Lancaster model. Their additional constraint (3.6a) arises because
one of the products in the system is being produced by a monop-
olist. But if such is the case, it is inappropriate to stipulate a con-
stant \( k \)—which implies that the monopolist’s price is always greater
than marginal cost by a constant percentage. A constant \( k \) is simply
inconsistent with the profit maximizing behavior usually ascribed
to a monopolist. The conclusion seems to be this. Unless a con-
straint is handled directly, so that its economic significance can be
grasped with relative ease, we increase the danger of formulating a
sterile model.

In the end, we are back to the rather uncomfortable position we
held before the Lipsey-Lancaster attempt at a general theorem for
the second best; but, hopefully we are considerably the wiser for the
experience. Originally, it was thought that each second-best prob-
lem was more or less unique and deserved treatment on its own
merits (or demerits). What Lipsey and Lancaster have demon-
strated is the fallacy of assuming that any Pareto condition that
is attainable should be attained, no matter what the nature of the
constraints imposed.\(^{21}\) While this emphasis was useful, the pendu-
lum has clearly swung too far the other way.

4. Toward Some General Statements Concerning Second Best

In an illuminating paper, O. A. Davis and A. B. Whinston de-

July 1967, pp. 315–16.
Erik G. Furubotn and Thomas R. Saving

where \( \pi \) is a constant different from the first best optimal ratio of \( \left( \frac{X_k}{X_L} \right) \).

Constraint (4.1) makes the deviant behavior of factor \( k \) a function of the rate of use of factor \( L \). Thus, we should expect, in the light of Davis and Whinston's result, that the maximization of (3.1) subject to (3.2) and (4.1) will result in the Pareto optimal conditions for each factor \( i \neq k, L \) still being desirable and, indeed, this is the case. These Pareto optimal conditions are:

\[
\frac{f_i}{f_k} = \frac{P_i}{P_k}, \quad i \neq k, L
\]

\[
f_k = \frac{P_i}{\lambda_i \theta_i} + \frac{\lambda_k}{\lambda_i \theta_i}
\]

\[
f_L = \frac{P_i}{\lambda_i \theta_i} - \frac{\lambda_k}{\lambda_i \theta_i}
\]

where \( \lambda_i \) and \( \lambda_k \) are Lagrangian multipliers.

Equations (4.2) provide us with an opportunity of illustrating the policy problem posed by second best. Assume that an entrepreneur is granted one wish. Should he be made the Pareto optimal condition for factor \( L \) hold? In this case clearly not—for example as long as (4.1) holds, (4.2) is the best that can be done. On the other hand, assume that in addition to (4.1) the entrepreneur is forced to violate one of the other Pareto optimal conditions. That is:

\[
f_k \neq \frac{P_i}{P_k}, \quad \phi \neq k, L
\]

Is it now in the entrepreneur's interest to bring (4.3) into equality? Clearly, yes. And the outcome underscores the lack of generality in the so-called general theorem of the second best.

We can generalize our example by assuming that the use of factor

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\( k \) is made dependent on the rate of use of more than one other factor. Thus:

\[
X_k = \gamma (X_j) = 0 \quad j \neq k; \quad j - 1, \ldots, m < n - 1. \tag{4.4}
\]

The Pareto optimal conditions for the maximization of (3.1) subject (3.2) and (4.4) are:

\[
\frac{f_j}{f_k} = \frac{P_j}{P_k}, \quad n, \; i \neq j; \; i \neq k
\]

\[
\frac{f_j}{f_k} = \frac{P_j}{P_k} = \frac{\lambda_3 y_j}{\lambda_3 y_k}, \quad j = 1, \ldots, m \tag{4.5}
\]

\[
\frac{f_j}{f_k} = \frac{P_j}{P_k} + \frac{\lambda_3}{\lambda_3}.
\]

Equations (3.10) bring out the Davis and Whinston argument clearly. We see that as long as the behavior of the deviant \( X_k \) is independent of the remaining actors \( X_j \), the second-best equilibrium for the remaining actors will be the Pareto optimal conditions. For those actors whose behavior affects the deviant’s behavior and for the deviant, the second-best optimal conditions will differ from the Pareto optimal conditions.

Now, if our entrepreneur was offered the chance to reform the behavior of a single deviant, he should reject the offer unless the behavior of that deviant were independent of the remaining actors. If such independence exists then he should, of course, accept the offer and engage in piecemeal policy.

5. Social Welfare and the Case for Marginal Cost Pricing

The preceding discussion was concerned essentially with the formal problem of constrained optimization. To apply the results to theoretical welfare economics, we need only give functions (2.1) and (2.2) the proper interpretation. Broadly, this means that (2.1) should be viewed as a welfare function and (2.2) as a transformation function defining the production possibilities for the system. It will be desirable, however, to proceed more slowly and show, in systematic fashion, how decentralized decision making by consumers and producers leads to a Pareto optimal configuration.

Let us assume, first, that the community consists of \( \Pi \) individuals with utility functions:

\[
U^* = U^* (X_i), \quad i = 1, \ldots, m; \quad \tau = 1, \ldots, \Pi, \tag{5.1}
\]

which are strictly concave-contoured and where \( X_i \) is the rate of consumption of the \( i^{th} \) good by the \( i^{th} \) consumer.

Now define:

\[
\Omega = \sum_{i=1}^{\Pi} u^*.
\]

where the \( \alpha_i \) are positive constants, and replace (2.1) with (5.2).

Note here that for any vector \( (X_i) \) that maximizes \( \Omega \) no other vector \( (X_i) \) exists such that \( U^* (X_i) \geq U^* (X_j) \) for all \( \tau \) and \( U^* (X_i) > U^* (X_j) \) for at least one \( k \in \Pi. \) Thus, any vector \( X_i \) that maximizes (5.2) is a Pareto optimal point since no one can be made better without making at least one other individual worse.\( ^{25} \)

Second, assume that the goods \( X_i \) are produced under production conditions:

\[
X_i = g^* (V_i), \quad i = 1, \ldots, m; \quad f = 1, \ldots, F, \tag{5.3}
\]

where \( X_i \) is the community's output of the \( i^{th} \) good and \( V_i \) is the rate of use of the \( f^{th} \) factor.\( ^{26} \) Note that if leisure is the \( \gamma^* \) consumption good and labor is the \( k^* \) factor then (5.3) implies:

\[
X_i = \Pi t - V_i, \tag{5.3a}
\]

where \( t \) is the length of the time period under consideration. Now, use (5.3) to form the transformation function (7) for the community.

\( ^{25} \) Davis and Whinston, "Welfare Economics," pp. 3-4.

\( ^{26} \) The production functions in (5.3) are already aggregates of the production functions for individual producers. Thus, they represent the maximum \( X_i \) for any given set \( (V_i) \) so that the marginal product of \( V_i \) in the production of \( X_i \) must be the same for all producers of \( X_i \).
such that everywhere along \( t \) the output of any \( X_i \) is a maximum given the levels of the other outputs \( X_j, j \neq i \). Thus, 
\[
\tau (X_i; V) = 0 ,
\]
(5.4)
replaces (2.2) as the constraint on the community, and the inclusion of \( V \) after the semicolon indicates that the total amounts of resources available are fixed.

The maximization of (5.2) subject to (5.4) and the condition that the total output of each good be consumed requires the existence of product prices \( P_i \) and factor prices \( w_k \) such that the following Pareto optimal conditions are met:
\[
\frac{U_i}{U_j} = \frac{\tau_i}{\tau_j} , \quad \text{for all } i \text{ and } j ,
\]
(5.5)
where \( (U_i/U_j) \) is the common marginal rate of substitution for all consuming individuals and \( (\tau_i/\tau_j) \) is the common marginal rate of transformation for all producing individuals. By construction of the transformation function \( \tau \), it is necessary that:
\[
\tau_i = \frac{MC_i}{MC} ,
\]
(5.6)
where \( (MC/MC_i) \) is the common ratio of marginal costs for all producing individuals.

Finally, since for these individuals producing good \( X \), its price is \( P^*_i = MC_i \), \( i = \Pi \), (5.5) requires that:
\[
P_i = MC_i \quad \text{for all } i .
\]
(5.7)

Thus, if a Pareto optimal configuration is to be attained in the market system, marginal cost must equal price for each good. It is well known, of course, that competition in all commodity and factor markets will result in the equality of price and marginal cost for every good and, hence, will yield a Pareto optimal solution. Then, the marginal cost pricing rule follows immediately. That is, in an economy where at least some industries are not competitive, it is urged that the noncompetitive industries be required, wherever possible, to set price equal to marginal cost. Naturally, in the case of those industries that are subject to government regulation (for example, public utilities), it is possible to require marginal cost pricing; and the argument proceeds that since the Pareto optimum demands prices equal to marginal cost for all goods, these regulated industries should be forced to marginal cost price.

Justification of marginal cost pricing can be accomplished by another, less exact, line of reasoning. If possible divergencies between private and social valuations are ignored, marginal cost may be viewed as a measure of the cost to society of producing an additional unit of a commodity. On the other side, commodity price represents a measure of the marginal social utility offered up by an additional unit of the good in question. Given these interpretations, the community’s net benefit will be increased by production as long as price is greater than marginal cost (or marginal social utility is greater than marginal social cost). Of course, when price just equals marginal cost in any industry, the optimum output is attained.27

It is a short step from this conception of ideal output to the analysis of social net benefit in terms of consumer surplus. And, in recent years, concern with the problem of public utility pricing has led to some revival of interest in just such net benefit measures.28 For the simplest case, where uncertainly is absent and the firm’s cost function is assumed to be linear,29 the decision model takes the following form. First, a demand function is posited to summarize the demand conditions facing the utility firm; the function is assumed to possess orthodox properties and to be fixed for the period of analysis. Taking the inverse of the demand equation, price \( (P) \) can be expressed as a continuous, single-valued function of quantity \( (X) \):

29. The net benefit approach can be used in cases where the cost function is non-linear, but the analysis becomes substantially more complex (and questionable).
Next, if the social welfare (or objective) function is defined as:

\[ P = \phi (X) \],

(5.8)

the problem of determining the optimal output is straightforward. Specifically, we have:

\[ W = \int_1^c \phi (X) \, dx - C(X), \]

(5.9)

where \( W \) represents welfare and \( C(X) \) is the linear total cost function. Then, all that is required is to differentiate (5.9) with respect to \( X \) in order to find the volume of production for which welfare (\( W \)) is a maximum. The result is:

\[ P = C' (X) = MC, \]

(5.10)

and the marginal cost pricing rule reasserts itself.

Apart from questions concerning the legitimacy of using consumer surplus as a surrogate measure of community welfare,\(^{31}\) models like the one described in (5.8)-(5.10) can be criticized because of the partial equilibrium nature of the analysis employed. A valid accounting of welfare effects requires the tracing out of all ramifications of production in the one sector on the other sectors of the economy. But once a general equilibrium approach is adopted, attention is inevitably drawn to second-best problems. The existence of varying degrees of imperfect competition in the system as a whole, together with other possible types of constraints, means that, contrary to (5.10), marginal cost pricing will not necessarily insure the best pattern of resource allocation. The switch to a welfare function involving consumer surplus does nothing to avoid the fundamental difficulties suggested by second-best theory. While the net benefit model may be defended on grounds that it provides a rough and ready operational method for determining price-output policy

in public utilities, we should not be blind to its basic limitations for general equilibrium welfare analysis.

The main results of the preceding theoretical discussion can be illustrated with a simple graphical device.\(^{32}\) Thus, in Figure 1, the curve \( BA \) represents the transformation function for a two commodity-two factor-two person system. The quantity of commodity \( X_1 \) is measured on the horizontal axis and the quantity of \( X_2 \) on the vertical axis. Curve \( BA \), which may be viewed as an efficiency frontier, shows the maximum quantity of \( X_1 \) that can be produced for each given quantity of \( X_2 \), assuming that the resources available to the community are fixed and factor allocation is efficient. Each point on \( BA \) (for example, \( M_1 \), \( M_2 \), \( M_3 \)) indicates a particular commodity mix which, if produced, would be available for distribution between the two individuals forming the community. It follows that a "contract curve" can be associated with each point on \( BA \) and along any such (exchange) contract curve (for example, \( OM_1 \), \( OM_2 \)), the marginal rates of substitution for the two individuals must be equal. Then, starting at any arbitrary production point \( M_1 \) and assuming some initial distribution of welfare \( b \), we are able to construct a community indifference curve \( I_{M_1} \). Each point on such a curve represents the minimum amount of \( X_2 \) necessary to keep both individuals at their predetermined levels of welfare, given various amounts of \( X_1 \); and for curve \( I_{M_1} \), the consumers maintain the respective levels of welfare enjoyed at point \( b \) on the contract curve \( OM_1 \).

At point \( M_1 \), the indifference curve \( I_{M_1} \) has a slope equal to the common marginal rate of substitution at \( b \) and, thus, \( I_{M_1} \) intersects the transformation curve \( BA \). This means \( I_{M_1} \) lies below \( BA \) for some range of output combinations; for example, in the diagram the range is \( M_1 \) to \( M_2 \). Under these circumstances, however, welfare improvement is feasible for both individuals. Accepting the general pattern of welfare apportionment suggested at point \( b \), a family of community indifference curves comparable to \( I_{M_1} \) can be constructed. Movement from \( I_{M_1} \) to any higher curve implies a situation where at least one individual is better off and no individual is worse off. Of course, with the production possibilities specified by \( BA \), the ideal operating position for the system is found at \( M_1 \) or the


equal to the marginal rate of product transformation,\(^{33}\) that is, that (5.5) above holds. Since for those individuals producing good \(X_2\), its effective price is \(P_2 = MC_2\), this requires \(P_2 = MC_2\) for all purchasers. But then \(P_2 = MC_2\) is required for (5.5) to hold, and marginal cost pricing is again the result.\(^{34}\)

We may ask how, at this level of abstraction, the theory of second best can affect the case for marginal cost pricing. The answer, of course, turns on the analysis of the additional constraints placed on the system. In particular, if one good, say \(X_n\), is produced by a monopolist, certain restrictions are imposed on the relation between the competitively produced goods \(X_i\) and the monopolistically produced good \(X_n\). Assume that these restrictions are summarized in the relation:

\[
M(X_n) = 0, \quad (5.11)
\]

so that our optimality conditions are:

\[
\begin{align*}
U_i &= \lambda_i MC_i + \lambda_n M_i, \\
\bar{U}_j &= \lambda_j MC_j + \lambda_n M_j, \\
\end{align*}
\]

(5.12)

Here \(\lambda_i\) and \(\lambda_n\) are the relevant Lagrangian multipliers and the \(M_i\) are the partial derivatives of function (5.11). We know that \(MC_i \neq M_n\) for all \(j \neq m\) since otherwise the monopolist would be marginal cost pricing.\(^{35}\) The crucial element for

\(^{33}\) Note that with the distribution of welfare implied at point \(a\) on \(OM_1\), the corresponding community indifference curve would be \(I_1\), and an optimal plan would exist at point \(M_1\). Point \(c\) on \(OM_2\) has an analogous interpretation and indicates the welfare gain open to the community when movement is made from production point \(M_1\) to \(M_2\) (with distribution comparable to that at point \(b\)).

\(^{34}\) If it is assumed that the factors are supplied in fixed total amounts and that no one produces for his own consumption, then it is only required that price be proportional to marginal cost.

\(^{35}\) If \(\frac{MC_n}{MC_i} = \frac{M_n}{M_i}\) then \(\frac{U_n}{U_i} = \frac{P_n}{P_i}\) so that in spite of the additional constraint it is possible for \(MC_n = P_n\). Essentially, in this case, the additional constraint is not binding.
policy is the relation between \( MC_i \) and \( M_i \) for \( i, j \neq m \). As we have pointed out above, Davis and Whinston have shown\(^{36}\) that if the monopolist’s decisions do not depend on the decisions taken by any other producer then:

\[
\frac{MC_i}{M_i} = \frac{MC_j}{M_j}, \quad \text{for all } i \neq j \neq m. \quad (5.13)
\]

Equation (5.13) implies that \( M_i \) may be written as \( \alpha MC_i \) (a constant) for all \( i \neq m \) so that (5.12) becomes:

\[
\frac{U_i}{U_j} = \frac{\lambda_i MC_i + \lambda_i \alpha MC_i}{\lambda_j MC_j + \lambda_j \alpha MC_j} = \left( \frac{MC_i}{MC_j} \right)^{\lambda_i \lambda_j} \quad \text{for all } i, j \neq m \quad (5.14)
\]

Appealing, again, to our argument that for those individuals who produce \( X \), the price is \( P_i = MC_i \), it follows that \( P_i = MC_i \) is required for all \( X, i \neq m \). Moreover, Davis and Whinston\(^{37}\) go a step further by showing that if the monopolist’s output decision depends on a subset (\( S \)) of the remaining decision making units, then:

\[
\frac{MC_i}{M_i} = \frac{MC_j}{M_j}, \quad \text{for all } i, j \in S. \quad (5.15)
\]

so that (5.14) holds for all \( i, j \in S \). Therefore, marginal cost pricing should be followed provided the monopolist does not give direct consideration to the output decision of the competitive industry in question when making his own output decisions.

6. The Principles of Resource Allocation Reconsidered

As was shown above, the perfectly competitive model yields simple marginal rules for Pareto optimality; and a central implication is that price must equal marginal cost in all sectors. When any movement is made toward greater realism in the model, however, these rules come into question. Second-best theory is designed to show the effect on the simple rules of imposing additional constraints on the system. These constraints are most easily interpreted as stipulations concerning entrepreneurial behavior (for example, monopoly), institutional characteristics, and so forth which differ from those of the competitive model; they act to change the equilibrium position of the economy, but presumably, their removal would permit the system to return to a Pareto optimum.

Although clear cut distinction is not always possible, it is convenient to contrast these constraints with the model’s basic structural assumptions. The latter, of course, determine the potentialities of the economic system; and depending on whether we introduce such complications as commodity indivisibilities, increasing returns to scale, and interdependent preferences, competitive markets may or may not yield a Pareto optimal solution. Welfare economics has given attention to this class of problems for some time and the results to be anticipated from alternate sets of structural assumptions are well established.\(^{38}\) The point to note, however, is that when practical policy is at issue, the combined effects of any special “constraints” and the model’s basic assumptions must be studied. Thus the total analytical system, including both structural assumptions and the added constraints, should reflect the salient features of the real world if policy is to be decided scientifically.

All this is obvious enough; the trouble is that the recommended procedure amounts to a counsel of perfection. When we seek an unexceptionable welfare foundation for microeconomic policy, the analytical and empirical problems are overwhelming; disappointment is inevitable. It is recognition of these difficulties, and the ultimate need for value judgments, that has led Graaff and other writers to urge looser policy guidelines—as in the suggestion of the “just” price for public utilities. Graaff says:

\[\ldots\] the only price a public enterprise or nationalized industry can be expected to set is what we may as well call a just price—a price which is set


\(^{37}\) Ibid., pp. 7–8.

with some regard for its effect on the distribution of wealth as well as for its effect on the allocation of resources. Definite value judgments are naturally required for its determination—and a good deal of positive knowledge.\(^2\)

Apparently, then, the issue of the distribution of welfare must take its place alongside the allocation problem if the issue of marginal cost pricing is to be resolved. Allocative efficiency can only be defined relative to a particular distribution of resources. In fact, if a specific value judgment concerning distribution is not made, no point on the transformation curve can be regarded as unambiguously superior to any other,\(^3\) and the case for marginal cost pricing is open to question.

Following E. J. Mishan,\(^4\) the nature of the efficiency dilemma can be shown by simple geometric means. Thus, in Figure 2, we assume a transformation curve BA and depict alternate production points \(M_1, M_2\). An economic "plan" is defined as any price-cost-output situation that can exist in the economy; in the figure, a plan is represented by the intersection or tangency of a community indifference curve with BA. When tangency occurs, as in the case of curve \(I_1\) at production point \(M_1\), the implication is that marginal cost equals price in each sector and an optimum plan is said to be in effect. When intersection occurs (for example, with curve \(I_2\) at \(M_3\)), a non-optimum plan must hold because the common marginal rate of substitution \((P_1/P_2)\) is either greater or less than the marginal rate of transformation \((MC_1/MC_2)\) and, of course, marginal cost pricing is violated. We know the so called optimum plan at \(M_1\) is ideal relative to the distribution of welfare summarised by indifference curve \(I_1\), but is it superior to the non-optimum plan at \(M_2\)?

Sensible comparison of the two plans requires that the respective points \((M_1, M_2)\) be evaluated by community indifference curves which are mutually comparable. Thus, if the set of comparable curves is to be based on the properties of curve \(I_1\), it is necessary to conceive of hypothetical compensation being paid to consumers in such manner as to change income distribution and the orientation of curve \(I_1\) from its original position to \(I_2\). The difficulty with this procedure is that the distributional change alters price-cost relationships at \(M_1\) (that is, \(P_1/P_2 > MC_1/MC_2\)) and destroys the optimum characteristics of the plan at \(M_1\). Moreover, a switch in the basis of comparison provides no help; a comparison based on indifference curve \(I_1\) would require a change in the orientation of \(I_1\) to \(I_2\) and, hence, would alter the price-cost characteristics of the non-optimum

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\(^{40}\) An operating position \(A\) represents an unambiguous potential improvement over another position \(B\) if, for all conceivable distributions of welfare, \(A\) shows itself to be superior to \(B\).

\(^{41}\) Mishan, "Resources Allocation," pp. 333-35.
plan at $M_2$. The conclusion is clear. In general, the attempt to secure comparability of plans by way of income redistribution results in the destruction of the unique characteristics of at least one of the plans and, therefore, renders meaningful comparison impossible. The significance of this finding for marginal cost pricing follows directly:

Granted that the exchange and production optima are achieved, the "top layer" optimum, reached by equalizing the ratio of prices to marginal costs, is in general no improvement actual or potential as compared with a non-optimum position. Failing interpersonal comparisons, no optimum at this level is necessarily superior to a non-optimum.\(^{42}\)

From this critique, it appears that the distribution problem has moved from a position of relative neglect to a position of eminence in discussions of allocative efficiency. By its essential nature, the question of distribution is hard to treat with scientific objectivity; nevertheless, the literature has been forced to deal with distributional effects. One approach is essentially technical; it avoids difficulties by assuming that all utility functions in the system are homogeneous and identical.\(^{43}\) This treatment is satisfactory at a certain level of abstraction, but ignores completely the social character of the economy and yields little guidance for policy. Another strategy is to define a social welfare function—$W = G(U_1, U_2)$—which links the welfare of society to the satisfaction levels attained by the respective individuals in the system. If a proposed welfare function can be accepted as valid, it becomes possible, in theory, to secure the ideal or equilibrium values for the prices of inputs, the prices of outputs, the distribution of income, and so forth. Geometrically, the optimum optimum is found at the point on the transformation curve $BA$ which lies on the highest attainable Bergson contour—$W^* = \Psi (X_1, X_2)$. Assuming the model has appropriate curvature properties and is otherwise well-behaved, the equilibrium position reached is a Pareto optimal configuration. Thus, marginal cost pricing emerges once again as an essential require-

\(^{42}\) Ibid., p. 340.  
non-optimal points (that is, points not on the efficiency frontier); and marginal cost pricing can be undesirable. Ultimately, it appears that any static and deterministic welfare theory will be deficient; perhaps what is needed is deeper study of the process by which society draws on experience to evolve goals, and modifies existing economic structures in the light of newly perceived values.

7. Some Concluding Remarks

In theory, a perfectly competitive market economy reaches an equilibrium position where the Pareto conditions hold. If additional constraints are imposed on the system, the second-best solution that emerges will require a larger or smaller number of the original Pareto conditions to be violated. But it is also true that if a different set of structural assumptions is introduced into the model, the resulting solution will call for the rejection of a larger or smaller number of the Pareto conditions.

All this makes for some difficulty in applying second-best theory to practical policy problems. Since the significance of any given set of constraints will vary with the structure of the economic model to which the set is applied, we can never gauge the effects of constraints accurately unless fairly detailed information on the structure of the total system is available. Yet, even assuming the basic structural conditions for the second-best problem are met, second-best theory need not be particularly useful. For example, in the case of industrial pricing policy, the general theorem merely tells us that, depending on the nature and pattern of the constraints extant, optimal adjustment may involve marginal cost pricing by some or none of the individual sectors in the economy.

Finally, there is a question of whether static optimization theory, of the type discussed by Lipton and Lancaster, is well adapted to treat welfare problems in a world where goals are, to some extent, open-ended and difficult to define. Modern welfare theory has cast doubt on the traditional arguments for efficient allocation of resources by asserting that the scientific position must be one of strict neutrality toward alternative welfare distributions. In other words, because of the interdependence between the distribution of income and the valuation of any aggregate commodity mix, allocative efficiency is a relativistic concept. Efficiency can be defined only relative to a particular distribution of income; if a specific value judgment is not made, no point on the transformation function can be regarded as unambiguously potentially superior to any other. Complete acceptance of this logic means that the case for marginal cost pricing is stripped of its former authority. Yet insofar as the ideal distribution of welfare is unknown (and possibly unknowable), it can be urged that the best policy is to accept some plausible distribution provisionally and optimize with respect to it. Resolution of the basic policy dilemma here may well await the development of a more comprehensive theory of social processes, but such speculation carries us a long way from the existing theory of second best.
Comment

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The paper by Furubotn and Saving (F&S) correctly emphasizes the current unsatisfactory state of second-best theory. It is, of course, unnecessary to waste time in discussing whether or not various criticisms of the original second-best article are justified in terms of what Lipsey and Lancaster (L&L) originally wrote. It is, however, possibly worth recording that much of the counterattack against the nihilistic position taken by L&L seems to have mainly recaptured ground that L&L never intended to occupy. Just as the early supporters of the second best were misled by L&L’s admitted vagueness on many key issues into claiming too much, it now seems that the interpreters of the counterattack against the basic second-best position are claiming to have recaptured far more ground than is justified by their underlying analysis. Indeed, it seems to me that they have recaptured about as much as was mistakenly claimed in the first instance, and that the present defensible lines are just about where L&L intended to place them in the first place—
although L&L were often far too vague in their verbal description of their results. In the course of the battle, the issues have been greatly sharpened and clarified, and, in this sense, a real gain has been achieved.

To justify this view in detail would require a treatment too extensive for the present comment. This must be postponed to a longer article now in preparation, and here I can only try to indicate the general reasons for believing that the counterattackers have claimed too much. For brevity, I shall confine these remarks solely to the analysis of F&S.

F&S correctly state the second-best problem as being one of finding necessary conditions for an increase in welfare “. . . in circumstances where a second-best situation is inevitable.” They restate the second-best result as follows:

[If one of the first-best conditions cannot be achieved] then it is, in general, neither necessary nor sufficient for a maximum that the remaining first-best conditions hold. Note that this implies nothing about the likelihood . . . that the remaining first-best conditions be met (or violated). In fact it would be entirely possible that in every economic problem . . . optimization will require the retention of all the remaining first-best conditions.

Hence we are back where we were before L&L wrote their article. It must be granted that, as an empirical statement, this is possible. But is it likely? It was L&L’s original position, and this still seems to be unsuited, given the interrelationships normally made in economic theory, the possibility referred to by F&S is an extremely unlikely one. Be that as it may, the F&S quotation poses two basic questions that need to be answered within the context of second-best theory: (1) can we say anything about the general likelihood that the inability to obtain at least one first-best optimum condition (FBOC) will make it necessary to depart from all (or most of) the other FBOCs’ and (2) can we say anything in general about the conditions under which the second-best optimum conditions (SBOC) will differ from (or be the same as) the FBOC’s?

F&S state the general problem of the second best in a way that can be used to illustrate the difficulties of interpreting the formal analysis of the counterattackers. They give an objective function to be maximized subject to two constraints and show that the first order conditions for a maximum are (their 2.4):

\[
\begin{align*}
\Phi_i &= \lambda_i \Gamma_i + \lambda_0 \Psi_i \\
\Phi_a &= \lambda_i \Gamma_a + \lambda_0 \Psi_a 
\end{align*}
\]

They then show that this gives the FBOC’s

\[
\begin{align*}
\Phi_i &= \Gamma_i \\
\Phi_a &= \Gamma_a 
\end{align*}
\]

if and only if

\[
\begin{align*}
\Gamma_i &= \Phi_i \\
\Gamma_a &= \Phi_a 
\end{align*}
\]

and, since this cannot, in general, be ruled out, the FBOC’s may still be desired. In particular, if the constraint that creates the second-best situation is defined as a violation of (3) for one good k, there is nothing to suggest that (3) should not be satisfied for all goods i = 1, . . . , n, i \neq k. At this level of abstraction there can be no quarrel with the proposition. But what is the economic meaning of (3) being satisfied for some goods i \neq k?

In the spirit of F&S’s statement that “general theorems of the type derived by Lipsey and Lancaster are of little use unless their relevance for economic models is clearly delineated,” let us consider an example of the general case that they describe.

Assume that a consumer is maximizing a utility function (their 2.1) subject to a budget constraint (their 2.2) with the standard first order conditions for a maximum (their 2.3). Call this the FBO. Now assume that a point-rationalizing scheme is introduced yielding a second constraint (their 2.5). Now find the second-best optimum (SBO). To make the argument simple, assume that the rationing constraint lies everywhere inside the budget constraint, so that the best the consumer can do is to optimize with respect to the single point rationing constraint. Now ask: “Should the consumer continue to satisfy any of the FBOC’s?” The answer is, of course, that whenever the relative point prices conform to the relative market prices that satisfy the FBOC’s, then satisfying the FBOC’s will also satisfy the SBOC’s, but whenever relative point prices differ from relative market prices the ratio of marginal utilities should be equated to relative point prices, not relative market prices.

If the point prices are chosen by the central authorities by cri-
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FBOC’s in B should be departed from. This is the same thing as saying that monopolies on earth do not make it necessary to depart from a perfectly competitive optimum on the planet which is in no way linked to the earth. Again true, but not overly surprising.

Two facts still remain. When behavior in the ‘deviant sector, ’ j, affects, and is affected by, behavior in other sectors, inability to fulfill the FBOC’s in j establishes a presumption that, except by coincidence, the FBOC’s should be departed from in all the other sectors. Thus F&S would seem to be wrong when, at the crucial point in their paper, they assert that “... in an economy where at least some industries are not competitive, it is urged that the non-competitive industries should be required, whenever possible, to set price equal to marginal cost,” (unless, of course, all sectors can do so, thus establishing a first-best optimum).

To see this, consider two counter examples. First, assume a sector of the economy with three industries, 1, 2, and 3 in which Cournot-style, marginal costs are zero. The FBOC’s require that $P = MC = 0$ to maximize consumer’s utility. Now assume industry 1 is monopolized so that $p > MR = 0$. Should industries 2 and 3 continue to adopt the marginal cost pricing rule, as they would if they were perfectly competitive? The answer is “no,” except in the special case in which $\frac{\partial x_2}{\partial p_1} = \frac{\partial x_1}{\partial p_0} = 0$, in which case what happens in sectors 2 and 3 has no effect on sector 1. If, to take a particular example, 1 and 2 produce goods that are gross substitutes, while 1 and 3 produce goods that are gross complements, then the second-best optimum requires a positive price for $x_1$ and a negative price for $x_2$.

2. Since part of the problem of understanding second-best theory lies in the correct interpretation of very general constraints, it may be better to produce a numerical example (for the provision of which I am indebted to Dr. Curtis Etnon).

Consider a subsector of the economy containing three goods with demand curves

$P_1 = 15 - Q_1 + .15 Q_2 - .30 Q_3$

$P_2 = 5 + .15 Q_1 - Q_2$

$P_3 = 10 - .30 Q_2 - Q_3$

where $z$ is a constant different from the first-best optimal ratio, $X_1^*$. This, in effect, renders the two factors a single composite factor, and, if this then upsets the optimal conditions with respect to the other factors, we would have to rework, for example, all of Marshall’s pure theory of international trade where extensive use is made of composite factors.

What all of this establishes is that, if the economy can be separated into two non-interacting subsectors A & B, upsetting optimum conditions in A does not create a second-best situation in which the

1. It is surprising that anyone ever thought differently, but the original verbal statement of the second-best theorem by L&L was clearly too vague here. The statement “in a general equilibrium system” was intended to imply a situation in which $\frac{\partial x}{\partial x} \neq 0$, where $x$ was the variable subject to the first-best-destroying constraint and $x$ the variable that could be influenced by some second-best-optimizing policy.
The second example was given in section 4 of the original L&L article. In that case, one good was produced and sold untaxed at home, while two were imported at given terms of trade from abroad. One of the imports was subject to a fixed rate of tariff and the question was “what is the second-best optimum tariff on the second import?” It was shown that the optimum tariff on the second import differed from zero, except in the special case in which consumption of the first import was independent of the price of the second import. As long as the sector subject to the second-best-creating constraint (the first import) responded in any way whatsoever to what happened in the second sector (the second import), the FBOC should be departed from in the second sector.¹

which are consistent with goods 1 and 2 being complements and goods 1 and 3 being substitutes.

Define a social welfare function as

\[ W = 15 Q_1 - 0.5 Q_1^2 + 5 Q_2 - 0.5 Q_2^2 + 10 Q_3 - 0.5 Q_3^2 + 15 Q_1 Q_3 - 30 Q_2 Q_3 \]

Let \[ MC = 0 \] for all 3 sectors and \[ P_1 = P_2 = P_3 = 0 \]. The quantities produced are \[ Q_1 = 14.4, Q_2 = 7.3, \] and \[ Q_3 = 5.1 \] and \[ W = 157.5 \].

Now let \[ Q_1 \] be monopolized and the other two sectors remain with \[ P_1 = P_2 = P_3 = 0 \]. The monopolist's output is \[ Q_1 = 6.7 \] and \[ W = 127.6 \].

Finally maximize \[ W \] subject to the constraint \[ M R = 0 \], and the outputs are \[ Q_1 = 7.0, Q_2 = 6.6, Q_3 = 6.9 \] and \[ W = 129.1 \]. This requires \[ p_1 < 0 < p_2 \].

Thus the second-best optimum requires that neither 2 nor 3 adopt a marginal cost pricing rule and that price be less than marginal cost with the complementary good and greater than marginal cost with the substitute good.

3. This example was in fact a quite general one for cases in which it is taxes, tariffs, or subsidies that upset some of the FBOC’s. Perhaps the general applicability of the example was overlooked because L&L did not use constrained maximization techniques to solve it, but used a simpler method instead. Stated as a constrained maximization problem it is as follows:

\[ U = u(X, Y, Z) \]  

(1)

is the welfare function for a three good world.

\[ X + p_Y Y + p_Z Z - C = 0 \]  

(2)

is the production constraint where \( p_Y \) and \( p_Z \) are the fixed international prices of \( Y \) and \( Z \) relative to the price of \( X \). Consumers, however, respond to tariff-distorted prices and their apparent budget constraint is:

\[ X + T_Y p_Y + T_Z p_Z - D = 0 \]  

(3)

The reason for this general result has been stated verbally many years ago by Professor Meade both in his Theory of Customs Unions and in Trade and Welfare. Let us restate it very briefly: Suppose there is 'deviant behavior' in some sector, \( j \), such that \( x' < x \) where \( x \) is the actual quantity in that sector and \( x' \) is the FBOC quantity. Suppose that for all other sectors, \( i \neq j \), \( x' = x \). (Actually, if there were a production constraint, these would only be approximately equal, but we can assume that sector \( j \) is "small." ) Now a marginal departure from the FBOC’s in the sectors \( i \neq j \) will cause (1) a marginal reallocation of expenditure between the sectors \( i \neq j \) on which there is neither gain nor loss since the FBOC’s are fulfilled, and (2) a marginal reallocation between all the \( i \)'s \( \neq j \) on which there is a gain if it causes an increase in \( x \) at the expense of the \( x_i 's \), and a loss if it causes a decrease in \( x_i \) (and an increase in the \( x_i 's \)). Thus, if \( p > MC \) in sector \( j \) and \( p = MC \) for all sectors \( i \neq j \), then a system of taxes and subsidies that raises prices for all \( i \)'s that are gross substitutes for \( j \) and decreases prices for all \( i \)'s that the gross complements for \( j \) will raise welfare toward a second-best optimum. Only for those goods where \( \frac{dY_i}{dP} \neq 0 \) should price be left equal to marginal cost. Thus if we assume that in one of the \( i \)'s \( p = MC \), then forcing it to adopt the marginal cost pricing rule may just as well lower welfare as raise it.

What we seem to be left with is the following. If the FBOC can-

where \( T_Y \) and \( T_Z \) are one plus the rates of tariff and where \( D > C \) because tariff revenue is returned to consumers as a lump-sum subsidy. Since consumers respond to (3) not (2), they will, in equilibrium, insist on satisfying the following 'optimum conditions'

\[ \frac{U_J}{U_i} = T_Y, P_Y \]  

(4)

\[ \frac{U_J}{U_i} = T_Z, P_Z \]  

(5)

Now to find the second-best \( T \), for a given \( T \), we must maximize (1) subject to three constraints, (2), (4), and (5). In general, \( T_{opt} = 0 \) unless \( \frac{\partial Y}{\partial T} = 0 \). Thus, in general, we must depart from the FBOC \( \frac{U_J}{U_i} = P \).
not be achieved in one sector \( j \), the SBOC will require that the FBOC’s be departed from in all sectors the behavior of which influences, directly or indirectly, the behavior in sector \( j \). This rules out the case where the behavior in sector \( j \) is a constant but includes all cases of monopoly in goods and factor markets. In both cases, except by an accidental coincidence, price in any sector will influence demand for goods or factors in the monopolized sector.

What the theory of second best still requires is the specification of economic situations in which we are interested, a translation of these into relevant constraints, and a study of the relation between the FBOC’s and the SBOC’s in the particular cases so defined. It also needs additional empirical information about situations in which the behavior of a sector that can be influenced by policy does or does not influence behavior in sectors in which the FBOC’s cannot be fulfilled. Until we can narrow the range of possible cases empirically we still seem to be left with the original conclusion of L&L that

as long as everything may depend on everything else as in a fully general equilibrium model, the violation of some FBOC’s means that there can be no presumption in favour of establishing the FBOC’s in some sectors (as long as behaviour in the sectors in which the FBOC is necessarily violated is influenced by the behaviour of the sectors in which the FBOC’s could be established).

II

Applied Pricing Practices and Problems

Moving from a high level of theoretical abstraction to the formulation and application of pricing principles introduces a host of complicating factors. The transition involves matters of philosophy as well as normative judgments. In addition, it involves a consideration of the mechanics of implementation, revenue contributions by particular services, and the design of price structures.

In the first essay in this section, Frank S. Walters sets forth the general procedures and rationale which have come to guide public utility management and professional rate designers in the United States. Milton Kofoght comments on this approach, giving particular attention to the problems which it poses for the economist concerned with resource allocation and efficiency.

The French Green Tariff represented a significant change in emphasis and logic in the design of public utility prices. P. Lhermitte and P. Caillé describe the logic of the Green Tariff and review recent modifications and changes in that tariff. Because of their association with Electricité de France, they provide a valuable insight into this departure from conventional pricing. Eli W. Clemens compares French, English, and American tariffs for residential electric service and evaluates supposed differences. James R. Nelson, one of the first
economists in the United States to analyze the Green Tariff, comments on the Thérèse-Cailleté and Clemens papers.

A relatively recent development in public utility pricing focuses on cross-subsidization between particular services. In the Domestic Telegraph Investigation (Docket 14650), the Federal Communications Commission was confronted with Western Union's allegation that the Bell System used its monopoly services (message toll telephone) to subsidize its more competitive offerings in the private-line field. Subsequently, in Phase 1b of the AT&T case (Docket 16258), the Bell System sought to present a pricing proposal that would constrain unreasonable cross-subsidization while at the same time incorporating marginalist principles. William J. Baumol explains the incremental costing concept embodied in that proposal and its relationship to cross-subsidization; A. M. Friggat describes AT&T's efforts to implement such incremental costing. William H. Melody, on the other hand, provides an exhaustive critique of the Bell System's proposal as presented in the AT&T case.

Rate Concepts in Today's Economy

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Several years ago, a prominent economist published a paper in which he reflected that for many years rate making in the United States had been largely in the hands of the professional engineers instead of the professional economists. I read, perhaps imaginatively, into his words a note of some regret that this had been the case. Later on, in talking with him, I assured him that at least he had accomplished his purpose insofar as I was concerned; he had piqued my curiosity as an engineer and I read his paper from cover to cover with avid interest—trying to find out what chaos had been wrought under the stewardship of engineers, despite the fact that during this period our utilities did experience growth unequalled anywhere in the world.

I did not find the answer to that question, but I did learn much from his written words and found a great deal of food for thought on the subject of utility economics.

Rate making in the years immediately ahead is almost certain to draw deeply on the resources of both the economist and engineer if real progress is to continue in a changing marketplace. The current
trend toward increased use by economists of advanced mathematical approaches to economic problems is significant in its ultimate relationship to rate formulation and to pricing policy in the utilities. Rate makers generally regard this as a welcome step toward establishing better tariff provisions for future loads.

As the market for electric service grows, the interconnected utility systems become vastly more complex, not only in the technical advancement in equipment but in operational procedures. These are being guided more and more by sophisticated computer control. In the operation of large systems serving widespread populated areas, the electrical loading and switching operations are carried out by computer decisions, which at the same time consider the optimum economic choice of generating equipment. In other words, the available generating unit with the lowest running-cost characteristic is selected for the job. Development of computers for simultaneous decisions on operating problems and on economic choice represents a significant joint contribution of the engineering and economic disciplines to the industry.

Much has been said and written about today’s “new competition” in the utility business and about the application of cost theory in the determination of the ultimate price tag placed upon the service furnished to the consumer. Progressively, the designer of utility rate structures is confronted with greater problems of economic choice through the need for rates for new uses of electricity as the market grows at an almost unbelievable exponential pace. Competitive forces are present to such a degree that they completely overshadow the concepts of competition which were accepted as representative of the industry’s position not many years ago.

To be more specific, the acceptance of electric space heating on a nationwide basis has injected a new growth element of literally tremendous potential in the utility sales market. Not only has this required a re-evaluation of growth targets, but it has meant that utility system plans for handling the new loads had to be extensively altered and capital additions to plant had to be budgeted accordingly.

In the marketplace competitive forms of energy have pushed aggressively forward with such a basic countermeasure as the “total energy concept” wherein all energy utilization within a project would stem from the combustion of a single fuel regardless of the ultimate end use of the service.

The real importance of these developments is that each of these segments of the energy market is quite capable of making serious inroads into the established domain of the competing fuel. Because of this potential, a new awareness of competitive factors in the utility field has been brought forward. Inherently, this is good in that it does press utility management for top performance and the results inure to the ultimate benefit of the consumer. However, such competition in the marketplace has raised a vast array of new problems both for the regulator and the regulated.

In functioning under these conditions, the regulator must apply the traditional restraints ascribed to regulation as a substitute for competition, yet he must not unduly restrain the intensity of the competitive sector of the market. Otherwise, the value-seeking aspect of competition will not be given full play as the final determinant of value of the product.

To some degree the regulator is in the dilemma of needing to move in opposite directions at the same time. The utility, fully aware of the potential of its competition, takes an aggressive marketing position not only to obtain new business in the face of this competition, but also to protect the vested interests of its existing customers.

A general public long given to mentally disassociating from its concept of the utility field such economic forces as competition and aggressive sales effort now has before it much visible evidence of their new emergence. Admittedly, some of these manifestations are controversial and unresolved as in the case of pressures to place electric lines underground. However, from the economic point of view, it is simply significant that extremely large commitments of capital may be involved in the ultimate solution and such abnormal pressures on the traditional balance between plant investment and operating revenue can have a profound effect on future rate levels.

In this connection, it seems particularly significant that a major role in this controversy has been taken by competitive fuel industries in seemingly sympathetic assistance to the general public objective of environmental improvement.

The end result of any rate making process from a customer’s point of view is putting the price tag on the utility’s product. Because of the non-storable nature of the electricity, the consumer’s mode of use of service shapes the actual technical specification of the product he buys. The manner in which the product is used by
different consumers constitutes a specialized field of study which is termed load research or the study of load characteristics. It is these that give it a multi-dimensional quality not only in terms of kilowatt-hours, but in terms of kilowatts, kilovolt amperes, diversity, and time. Interpretive problems as to the validity of allocated costs arise from the fact that the important parameters in this specification vary with the passage of time, some with cyclical repetition and others on long-term bases. Simple analyses are made on the bases of assumed static conditions, but the more minute the economic penetration, the more apparent it becomes that many underlying factors are variables and are functionally dependent on time as growth takes place.

The greatest obstacle to analysis and meaningful cost determination arises from the real inability to describe the end product in sufficiently rigid economic terms, but this is a matter of communication. In day-to-day discussion of the business, a simple term is needed for the product. We think of cost per kilowatt-hour without always considering that a large part of the unit cost is not directly related to the kilowatt-hour, but is related to the other dimensions of the product combined only for statistical convenience.

Putting the price tag on the utility's product is an eminently practical process because the decisions of the rate designer determine the degrees of compromise with theoretical concepts that will be reflected in actual practice.

The rate maker must certainly consider the cost of his product, but he must be no less concerned with its saleability. The presence of strong competitive forces in the energy markets today attest to this fact. The designer's appraisal of market factors must run the gamut from price-demand elasticity to the political impact and the public reaction to proposed changes. Accordingly, I shall direct my remarks in three channels, first from the viewpoint of the cost analyst, second from the viewpoint of the practical rate maker, and third from the point of view of an observer of the process.

First, some thoughts on the cost approach. The classical methods of cost allocation on utilities described in most texts evolve from the familiar separation of cost elements into three components, those related to capacity, commodity, and customer functions. Because electric utilities are a heavy capital industry with more than four dollars invested in plant for every dollar of annual revenue, the problem of allocating the investment in capacity becomes the principal factor of importance in the methodology and without question becomes the major point of controversy.

Technical difficulty in determining load characteristics, or in other words, the significant values of electrical demand, energy, and diversity on which an allocation must be based has an important bearing on the extent to which such studies are employed in practice. For example, determination of the coincident need for capacity of a utility's residential class of customers obviously cannot be measured by a single large watt-meter. Service is furnished to such customers through substations and feeders which may also be furnishing electricity to other categories of consumers. Therefore, the class of electrical demand for the residential category must be determined by selecting sample groups of individual homes where special metering equipment may be installed for load research purposes. The important point is that the final result, the kilowatts of demand used in allocating costs to a particular class of customer, must be synthesized from the test data by statistical methods and is, therefore, subject to review by others as to the propriety of the methods used.

A great deal of work has been done in this field by members of the Rate Research Committee of the Edison Electric Institute and by members of the Load Research Committee of the Association of Edison Illuminating Companies. Much investigative work is under way at the present time. Along with this research in the field goes a considerable amount of study of the underlying statistical methods of interpretation of these findings.

As a direct by-product of these industry efforts, special recording instruments were designed to measure electrical loads on magnetic tape. This was done in such a way that it became practicable to obtain and process by computer the literally thousands of measurements needed for statistical stability. This was a landmark in load research technique because it placed more effective tools in the hands of the rate designer.

Despite such improvements in technology, the final determination of load parameters, as well as the establishment of a basic rationale for utilizing them in cost allocation, must reflect the judgment of the person making the study. No matter how excellent such judgments may be, they can be questioned as a matter of opinion by intervenors in formal rate proceedings resulting in undesirable delays in the regulatory process.
Allocation studies assigning costs to different classes of customers have been vulnerable instruments for this reason and it is quite understandable that most large utilities in the United States have been reluctant to introduce them at regulatory hearings. For somewhat the same reasons, regulatory authorities may at times have been less than enthusiastic about cost allocations relative to retail rate making because of the probability of reaching a stalemate between opposing expert opinions and because of the need to correlate the cost of service with the many non-cost related factors involved in practical pricing.

There is some difference in the attainable precision when the allocation is between similar or dissimilar sectors of the market. Consider, for example, an allocation of costs between municipalities, counties, or other geographic subdivisions where the mix of ultimate consumers is roughly the same although size may be different. It follows that the overall load curve or time distribution of load for the aggregate of customers in each sector will be similar in contour. Under these conditions, error in the allocation philosophy used tends to be distributed proportionately and the effect is minimized. This is the general case in ratemaking at wholesale for resale.

When costs are allocated between dissimilar segments of a single market area, such as an allocation between residential, commercial, and industrial classes of customers, the characteristic load contours of each segment may be quite different. Under these conditions, any inadequacy in allocation method may be distributed on a disproportionate basis which could affect some classes of business more than others. Although this consideration is of vital importance, it does emphasize the high degree of care that must be embedded in a meaningful allocation study by classes of business. It also suggests that allocation methods developed for the separation of costs at the wholesale for resale level are not necessarily directly translatable for the allocation of costs to retail customer classes.

The classical methods with which economic philosophy has been most concerned are those directed to the resolution of the peak load pricing problem. They have their most appropriate application in costs related to power supply, or in other words, production and bulk transmission costs. As analysis proceeds along the electric system toward the point of delivery to the consumer, these methods become progressively less appropriate. To illustrate this point, in considering costs of lines, transformers, services, and meters, such distribution plant facilities may be associated with clusters of customers or with individual installations. Methods of cost apportionment are different at these levels; finite physical quantities become more significant in a cost accounting sense.

The facilities required to furnish electric service at wholesale for resale or for large industrial customers will consist largely of production and bulk transmission facilities. Service to residential and commercial users requires that, in addition to these facilities, a substantial part of the total investment be in distribution plant items not necessarily allocated under the basic broad rationale. Such items may constitute the greater portion of the total cost. As a consequence, the basic allocation philosophy is applicable to a much smaller portion of the total service cost for the residential and commercial customer classes than for the wholesale and industrial groups.

Reference to the inherent error in allocation method simply means the degree of compromise that accompanies each of the classical methods or approaches. Such philosophies as non-coincident class peak, average-excess demand, complete peak, phantom customer and the many other methods of apportioning costs which have been developed are all compromises. They attempt to assess the dynamic characteristic of the electric load cycle on a basis that is assumed to be relatively static during the period of analysis. Since each embodies some degree of departure from the complex ideal each has some inherent limitation.

These are the methods normally used in the development of studies involving "fully distributed costs." However, analyses of this kind are being subordinated by the intensive focus of recent economic thinking on the marginal cost approach. Marginal cost pricing is currently taking a more prominent position, undoubtedly because of its appropriateness to the competitive marketing problem.

The fundamental concept of incremental or marginal cost, referring to its simplest meaning to costs associated with an additional unit of output, is at least as old as the utility industry and there is a natural tendency to look upon recent economic theories in this complex realm as really nothing new. However, there is a vast difference between the simplest meaning of the term "marginal cost" and the type of complex "in depth" analyses that are the products of modern economic research.
While I do not believe that all of the theoretical output of this research is directly translatable into the rate structure, many valuable applications of these principles are now being made and they will certainly be used in the development of future utility tariffs. Progress itself is not a static concept and full consideration must be given to new approaches to rate problems if we are to successfully pursue the market potentials of future years. These lie somewhat obscured now but they are just over the horizon in the highly competitive market of tomorrow.

One aspect of the marginal cost approach to pricing tends to collide with a formidable stumbling block before it really has demonstrated its worth. That is, the school of economic thinking that considers the optimum distribution of resources through marginal pricing of all services when the social welfare function is given full weight in the equation. In the utility business, with its decreasing unit cost characteristic, establishment of the price of all services at a marginal cost level would not produce enough revenue within the utility to cover costs and a revenue deficit would be realized. It is suggested by theory, at least, that such a deficit could properly be made up by a tax subsidy in consideration of the external welfare benefit to society achieved through the optimum distribution of resources. Although this is only theory and should be considered as such, it is disturbing to contemplate in a free economy and it tends to dampen the enthusiasm of the non-economist for the marginal pricing philosophy. Even in theory it collides with the concept of free enterprise utility services and suggests a differently oriented approach waiting for some future advocate to pursue.

A solution to this problem is suggested by Irwin Steltzer, who says:

...some economically appropriate resolution of the conflict is necessary. And this resolution is possible by designating rates which reflect, even in very rough fashion, the differing demand elasticities of the various service-users.

Recognition of the elastic and inelastic sectors of the utility customers' use of service has been an economic principle in rate design for many years. However, the designer is faced with an extremely difficult problem in assessing this quality and quantifying it in numerical terms. Perhaps the phrase "even in very rough fashion" is the key to the practical approach as a guiding principle, as Steltzer suggests.

Outside of the United States much of the work of economists and rate makers has been addressed to pricing policies directly reflective of marginal cost economics. Broadly speaking, the thrust of most of this endeavor has been to propose rate schedules which are based on a very close relationship between rates and costs. Such a relationship is at variance with many practical considerations on which rates are based today in the United States.

This sharp contrast is apparent in the following comment by Russell E. Caywood:

Costs have a place in rate development, but only in a limited way. The practical requirements which must be met in rate design make it necessary to strike a compromise between costs and prices to get a workable price structure. Strict adherence to costs would put such limitations on rate development as to make it impossible to serve properly the many customers of various classifications. Thus, the end result would be very unsatisfactory. 1

Let me make my own position clear on this point. Rates are not and should not be based purely on cost concepts. I offer what Professor Bonbright terms "the usual reasons," namely, that many other factors are involved, but I think that in the final analysis it is simply a question of considering all of the factors that produce economic value and saleability in any product that is successfully sold in the marketplace.

This concept is extremely well stated by Paul Garfield and Wallace Lovejoy:

Public utility services are produced because they are valuable. However, utility services are not valuable because companies incur costs in producing them. Rather, their value derives primarily from the fact that they can satisfy consumers' needs and wants so effectively that consumers are willing to pay a price to acquire them. It is this want-satisfying or value-giving characteristic which provides economic justification for incurring the costs of supply. Accordingly, in the matter of pricing utility services, it would be erroneous to look solely to the results of cost analyses for they

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function of utility service. In all probability, they will be deeply involved with urban development, real estate, housing problems, consumer orientation, and an array of politically and socially related subjects that have not been previously associated with utility service.

Economic research and the resultant design of utility rates in other parts of the world is always a matter of intense interest to the rate maker. His professional curiosity is aroused by the ways in which others have solved common problems. There are, however, substantial differences in rate philosophy and in the actual methods of implementing these concepts.

One of the developments that has been observed with great interest throughout the world has been the formulation of the Green Tariff or Tariff Vert by the nationalized electric utility industry of France, the EDF or Electricité de France. This has been a laboratory application of marginal cost pricing having been developed by outstanding French economists and having been put into effect through the convenient mechanism of a nationalized utility industry.

One of the most interested observers of the French procedure in this country, Eli Clemens, commented on this development:

The question is presented as to the difference between these French rates and the rates commonly in effect among American utilities. The question is made more significant in that the Green Tariff was presumably designed in accordance with 'sound' economic theory and by implication, American tariffs were not.1

As a matter of personal experience, I had the opportunity to discuss this point with officials of Electricité de France a few years ago when they visited this country. They were naturally quite proud of their accomplishment in the marginal pricing approach. They felt it was the most advanced form of rate making in the world. However, they were extremely interested in finding out why American utilities had not taken the same approach. My basic answer was to point out the fundamental differences in business

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philosophy and to emphasize our concept of abundance with an un-
restricted supply of power.

Much economic research on marginal pricing in the utility field is based upon the concept of time of use as the key factor and the principle that production cost is different at different hours of the day. Some researchers have divided the day into twenty-four-hour sub-periods for analysis while others have used fewer sub-periods of greater length or of different lengths.

The Green Tariff provides five pricing periods which distinguish between day and night, winter and summer, and a special period for peak hours. Prices per kilowatt-hour are quoted for service taken during each period and these prices are adjusted at frequent intervals as system costs change. The tariff also includes a demand discount which varies in a similar pattern depending on the pricing period. One of the expressed objectives at the time of implementation of the Green Tariff was to provide motivation to reduce peak loads by reduction in charges for service taken at other hours.

In the United States the interest aroused by the Green Tariff and by other “time rate” concepts prompted manufacturers of metering equipment to canvass American utilities as to their plans for the installation of multiple register meters which would be required if a similar rate approach were used.

Eli Clemens’ analysis of experience of the EDF while operating under the Green Tariff indicated two important differences in the observed end result as compared with American practice. Demand charges were higher, but total charges to large customers were lower in the United States. It was noted that the EDF tariff does not appreciably decrease the charge for large users but tends to treat both small and large customers uniformly. This practice, it is suggested, may have been motivated by social considerations and if so tends to violate the purity of the marginal price concept. The same is true of their relatively large tax on electric sales in its relation to pricing. However, these are simply two factors of a non-
cost nature which are part of the practical problem of rate making.

In his summary, Clemens states that a customer would fare much the same under both systems in terms of total charge and in terms of marginal charge. The only area of real difference would result from expansion of use into the so-called “empty hours” where EDF rates are definitely lower.

Another interesting form of time rate is the subscribed load rate

tariff used in the Scandinavian countries. Under this rate the cus-
tomer selects a probable electrical demand in kilowatts and pays a demand charge on this basis. Kilowatt-hours of energy used when the customer’s load is less than the predetermined level are charged at one price scale, but energy used when the load is above that level carries a higher price tag. Continued use of “overload” kilowatt-hours makes it desirable for the customer to subscribe to a higher demand and pay a higher demand charge to avoid an inordinate number of kilowatt-hours at the overload price.

The load rate form of tariff is reported to produce a flatter load curve in a 24-hour period. This is also a load managing approach in relation to the customer’s activity and as such is a restrictive mechanism.

The subscribed demand tariff used in France for domestic cus-
tomers is of a similar nature except that the charge is based on the capacity of a circuit breaker which opens without warning when the load exceeds the predetermined setting. This is also a load manag-
ing approach and the customer is persuaded to subscribe to a higher demand level when the service is interrupted too frequently.

Investor-owned utilities in the United States do not concur in the restrictive approach to the problem although in the early history of the industry concepts of this kind were introduced. Generally speaking, this was when loads were much smaller and the addition of large increments was often an engineering problem of consider-
sable proportions. However, the American utility industry is well beyond that stage primarily because the basic philosophy of abun-
dance prevails. It is the consumer who sets the pace on an uninhibited basis and it is the utility’s responsibility to provide whatever service he wants.

One basic problem in customer relations is to explain to a con-
tSUMER that his higher bill this year is largely the result of increased use of service over last year. Great care is taken to make that ex-
planation in the context of the benefit he received from the use of the additional kilowatt-hours, so that the consumer will not curtail his usage in the future and growth in the marketplace will continue.

The use of electricity per capita in the United States is approxi-
mately 2-1/2 times that in France and domestic usage per customer is 6 times as great. Therefore, the same tariff is not appropriate for both because the ground rules are very different.

Shaping of the load curve through selective pricing does not have
a great deal of direct effect in the United States market except for some specialized industrial applications. The present Hopkinson type rate used by most American utilities offers an inducement for off-peak energy use as long as the billing demand, usually established in the daytime, is not exceeded. If it is possible for a portion of a customer's load to be shifted to off-peak hours, the billing demand itself would automatically be reduced. Despite these possibilities there are few takers of these options. Obviously, the controlling factors lie in business considerations other than the cost of electricity.

The rate maker is concerned to a substantial degree with less scholarly but extremely important aspects of the practical conduct of the utility business. In changing a rate schedule, for example, there are no more difficult problems than those of transition. The problem is really how best to move toward the objective.

A change in the price of any single block of a rate schedule will have a greater relative effect on some customers than on others, depending on their particular level of use of service. If major price structure changes are indicated, the question arises as to how great a percentage change in individual bills can be reasonably tolerated and how many customers will be affected and to what degree. The prudent answer to these questions often may be at variance with the theoretical objective for the class of customers as a whole, yet a decision must be made. Public opinion and public reaction to rate change are always of deep concern to utility management because the utility is a major force in the economic life of the community it serves and good relations between the producer and the user are a must.

Utilities in the United States have made outstanding progress under the free enterprise system and under regulation as we know it today. It serves the greatest industrial complex in the world and has contributed the value of electric power to a gigantic scale of endeavor. At the same time, there has been achieved a domestic standard of usage unequalled anywhere else; electricity as we know it has made a major contribution to the American standard of living. Perceptive management looks backward for only two reasons, first to learn from past experience, and second to draw meaningfully from that experience in the solution of new problems. Its real preoccupation must be with its future function in an economy in which both the social and economic orientation of the utility with respect to the community will be very different from that of the past.

Growth in utility service will take place at an even higher level than experienced today if pricing policies and marketing efforts are directed to take full advantage of the real opportunities that the future potentially holds. With a full realization that pricing policy must be matched to the dynamic nature of the future marketplace, there can be no question but that utilities will need the best economic and engineering thought obtainable. Nevertheless, I am confident rate making in the future, though it be in the hands of either engineers or economists, will continue to be the art of judicious compromise.
Comment

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For over thirty years practitioners and theorists have debated the merits of marginal cost pricing. Traditionally, the issues have been framed in terms of "theoretical versus practical," "measurable versus nonmeasurable," "realistic versus unrealistic." Walters's paper suggests that this phase of the debate, though probably still unresolved, may have run its course. Looking at essentially the same rate problem, Walters develops a different and more significant set of issues and establishes contrasts in terms of abundance versus restriction, uninhibited consumption versus load management, and growth versus stagnation. These contrasts suggest that economics is, indeed, a dismal science concerned with allocating an inexorably fixed supply of resources among yesterday's alternative uses in the light of last year's technology. Rejecting this dismal view, Walters sets forth an optimistic philosophy of abundance based on the well-founded faith that technology and growth will overcome static resource restrictions, diminishing returns, and other inhibiting phenomena which continue to play an important role in economic theory. The failure of economic analysis to come to grips
with technology and dynamic change may lie at the heart of these sharp contrasts. However, if we admit this failure of economic theory we must also admit that resources are scarce, that they have alternative uses, and that restrictions and inhibitions are a necessary part of life. Though economic theorists may err in the direction of restriction and conservation, it is possible that the industry may err in the direction of promotion and waste.

The Issue

At the practical level the issue relates to "value-of-service" or demand oriented rate making (implemented through customer classification and block rate structures) versus rate making which more closely conforms to the marginal cost criterion. Value-of-service is an attractive criterion because it is consistent with maximum growth and the assimilation of the economies associated with scale and technology while maintaining an adequate level of corporate profits. However, marginal cost also is an attractive criterion because it emphasizes efficient utilization of the existing plant and economy in the provision of future plant. We are searching for a criterion flexible enough to allow for growth and the assimilation of scale and technology but not so flexible as to encourage "empire-building" at the expense of consumers and competitors.

Before considering this question in greater detail, I should note the general agreement that the usual cost allocation is arbitrary, gives inadequate weight to demand factors and is useful only as a device for organizing information which may be useful, but not determining, in the rate making process. Thus, one may agree with Walters "that rates are not and should not be based on purely cost concepts." However, marginal cost pricing is not a "purely cost concept" in the sense Walters implies. Unlike "purely cost" or "purely demand" rate making, marginal cost pricing requires a balancing of demand and cost and makes the necessary compromise between opposing forces. I emphasize this point because marginal cost pricing is frequently described as "cost" oriented leaving the impression that rates are determined independently of demand. We do not set a price equal to marginal cost; rather, we find the price which equates the marginal benefit to consumers and the marginal cost of producers in a calculation that simultaneously considers demand and cost.

Nevertheless, it is true that marginal cost pricing in its pure and simple form does not allow rate variations in response to variations in demand elasticities—that is, rate discrimination. But only purists maintain that rate discrimination of value-of-service should be avoided altogether. Indeed, James M. Buchanan has recently shown that consumers themselves would select a rate structure incorporating many of the features that characterize typical value-of-service rate structures. An increased scope for rate discrimination has also been found when scale economies and external economies characterize the service. The real issue, then, is not whether demand elasticity is to be a factor in rate making, but the degree of discrimination to be incorporated in the rate structure. A managerial philosophy of growth and abundance combined with a green light on value-of-service may have an undesirable effect on the efficiency of resource use, thereby being undue and may work to the disadvantage of particular classes of customers, thereby being unjust. A simple model will aid in the development of these points.

The Model

Let us assume that the design of rate structures is a "managerial prerogative" and that the regulatory agency is concerned only with the general level of earnings—a position taken by most utility firms and many regulatory commissions. Thus, the firm may do anything it pleases insofar as rate design is concerned provided it does not report excessive profit. For analytical simplicity, we assume constant cost, homogeneous product, and absence of external economies; these simplifications create a situation which, in theory at least, requires uniform prices equal to marginal cost.

These simplified (and simple-minded) relationships are summarized in Figure 1 in which \( TR^* \) is a total revenue schedule drawn

2. We may also assume that the regulatory commission exercises some control over nonproduction expense—advertising, managerial fringes, and the like.
on the assumption of uniform prices in all markets and $TC$ is a total cost schedule which includes the allowable return. Assuming no regulatory lag, the equilibrium imposed by the regulatory commission will be characterized by $TC - TR$. Under a nondiscriminatory pricing arrangement, output will be at the efficient level, $Q^*$. This amount of output can be sold at a uniform price which equates marginal cost and demand while satisfying the regulatory restraint which requires $TC - TR$. In this static setting, the output solution at $Q^*$ appears neither restrictive nor promotional. However, to a growth-minded management it may appear restrictive.

If the management is permitted to develop the rate structure without restraint, there is little reason to believe that it will select the uniform rate structure represented by $TR^*$. The same output may be sold to different customers at different prices and the output sold to any given customer may be sold a block at a time at declining prices. Thus, rate schedule, $TR^*$, may represent the maximum revenue available for any given customer subject to customer classifications and rate schedules designed to fully extract “what the traffic will bear.” Revenue structure $TR$, one of the infinite possibilities which lie between minimum schedule $TR^*$ and maximum schedule $TR^*$, is one of the infinite possibilities which lie between minimum schedule $TR^*$ and maximum schedule $TR^*$, Rightward movements along any particular $TR$ schedule are accomplished by price reductions, but only in the case of $TR^*$ do the price reductions apply to all units and all markets. Movements along the other revenue schedules are accomplished by price reductions in the last blocks or by reductions which apply only to particular markets. The general level of revenue represented by $TR$, or $TR^*$ is above the level represented by $TR^*$ over all outputs. However, this does not mean that all rates are higher. Alteration of the rate structure from $TR^*$ to say, $TR_1$, involves reducing rates where demand is relatively elastic and increasing rates where demand is relatively inelastic. The manipulation of these revenue schedules to achieve managerial objectives is the bread and butter work of the practitioner but has received little attention from academics, especially at the empirical level.

The regulatory condition, $TC - TR$, can be fulfilled at an infinite number of outputs—however feasible $TR$ schedules intersect the $TC$ schedule. If the utility is able to develop the highly discriminatory schedule $TR_2$, it will be able to produce the abundant quantity, $Q_2$, and still earn no more than a fair return. Though the output and rate base are too large, there is no obvious idle capacity. Moreover, the firm may be well-managed and may combine the resources at its disposal quite efficiently. However, since average price ($TR/Q$) is equal to average cost ($TC/Q$) and since some rates are above average price while others are below, some rates must be below average cost. On our assumption of constant cost, it necessarily follows that some rates will be below marginal cost. Relaxation of the assumption that average cost and marginal cost are equal does not alter the conclusion: if at least one rate is above average cost, the discriminating firm whose profits are restrained can fulfill the condition $TC - TR$, with all other rates below marginal cost. Abundance prevails at $Q_2$, but some output is being sold at a loss and resources are being siphoned from other sectors which might be able to put them to more profitable uses in both a business and a social sense. This indicates, in an extreme fashion to be sure, the implications of value-of-service in the hands of a growth-minded management with the prerogative to design its own rates.

If earnings in excess of a fair return begin to appear, traditional regulation calls for general rate reductions. But, rather than accept a general rate reduction, the utility may wish to make selective or competitive rate reductions where demands are elastic thus promoting its service. This will lead to a revenue schedule that is above $TR^*$ and to some prices which are below marginal cost. This managerial policy will serve many purposes. It will get rid of unseemly profits even before they appear in the accounting statements; it will
expand output and encourage industrial development; and it will meet and beat competition and will make it possible to meet targets and establish new records in output, sales revenue, and growth. However, it also spells misallocation coupled with a rate structure of dubious equity. It means that those with inelastic demand—the captive portion of the market—may be denied rate reductions while the management introduces special rates for space heating, air-conditioning, industrial development, and the like. I suggest this only as a tendency which may be observed in some utilities—especially among those municipally owned utilities whose retail rates are exempt from state regulation. Though the model of Figure 1 is based on a set of highly simplified structural and behavioral assumptions, it suggests the possibility of achieving growth through sales at prices below marginal cost and has implications for competitive relationships, the distribution of income, and regulatory policy.

Impact on Competition

Competition and technological progress may ensure that a highly discriminatory rate structure becomes self-defeating. The loss of high-rated business by the railroads to the trucking industry is perhaps the most dramatic historical example. And, even though a market like electricity for home lighting may seem secure from competition, technology has a way of upsetting things. These forces may ameliorate rate discrimination. On the other hand, these same forces may develop conditions which increase rate discrimination. Some markets are relatively more secure than others and firms compete for parts and segments of the market. Thus, technology and competition do not alter Figure 1 which assumes only that some demands are less elastic than others.

An important implication of Figure 1 is that the firm with the largest captive market and the greatest power to segment and classify its market will win the greatest share of the competitive market because it has the greatest potential for selling in particular markets at a loss while still fulfilling the TC = TR regulatory constraint. The "energy package" controlled by electricity would appear to be a potent competitive weapon capable of winning markets that may not be efficiently served by electricity. The three-way competition between gas, oil, and electricity for the space-heating market is a case in point. Assuming for the moment that service characteristics and costs are identical and that no rate discrimination is practiced, each industry will sell Q* (Figure 1). But if electric utilities, which have the greatest power to classify and segment, can develop schedules TR by selectively reducing rates in the space-heating market, electricity output will expand from Q* to Q. This will, in turn, erode the TR schedules for oil and gas shifting them say to TR, which will lead to reductions in oil and gas output to Q. Market shares Q and Q, are, on our assumptions, not optimal. Other things being equal, the firm with the ability to develop the highest TR schedule will garner the largest share of the market. Thus, references to "new competition" and "total energy concepts" have important implications to the traditional problem of regulating the relations between competing segments of the industry. Conclusions similar to those drawn by our model have also been drawn by Averch and Johnson. Though both analyses point to similar problems and tend to strengthen one another, the rationale and regulatory implications are different. Averch and Johnson suggest improved earnings control via reduced rates of return whereas our model suggests careful regulation of the rate structure.

Regulatory authorities frequently establish a rule preventing sales at rates below "out-of-pocket" cost and this serves to check promotional expansion financed by rate discrimination of the sort described here. Such a rule is usually laid down when one utility attempts to undercut in the market of a competitive utility and when the utilities are under the jurisdiction of the same commission. The historical control of minimum rates by the Interstate Commerce Commission is a case in point. However, where competition does not exist or where different regulatory jurisdictions are involved, the "out-of-pocket" criterion is not likely to be employed. Moreover, there are shortcomings in the application of the "out-of-pocket" criterion in cases where the motivation for the low rate is to expand the size rather than the profits of the firm. The marginal costs of an expanding firm will exceed "out-of-pocket" (average variable) cost as it is usually calculated. It would appear that selective rate reductions on the basis of the low marginal cost argument should be scrutinized very carefully in the case of a rapidly growing industry that has a huge captive market and is achieving an increased market share through promotional and selective rate cutting practices.
The argument to this point has been made too strongly. Situations characterized by scale economies, externalities, and a long-run outlook for rapid and differential technological progress (as might appear to be the case with respect to electricity) may call for output in excess of \( Q^* \). Provided the captive market is, in some sense, treated justly, rate discrimination may represent a reasonable response in view of these dynamic considerations. The thrust of technology is to lower marginal cost curves and the firm which establishes below marginal cost rates today in the light of a clearly differential technological thrust may not be too far off the mark. It could even turn out that when all factors are considered output \( Q \) and revenue schedule \( TR_w \) with which I have associated (perhaps erroneously) the “industry position” may represent a reasonable general solution. At the same time, there are tendencies in the complex of value-of-service, growthmanship, and managerial prerogatives which call for careful scrutiny of the rate structure by the regulatory agency.

A number of writers have suggested that the most serious violation of marginal cost pricing arises because of the failure to develop peak load prices. It is at this point that Walters finds marginal cost pricing excessively restrictive because it inhibits the freedom of consumers to consume freely. Since one of the major purposes of the price system is to inhibit our consumption of some things so that we can have other things as well, this argument is not convincing.

The evaluation of the practical consequences of peak load pricing are sketchy and inconclusive. However, to electricity is associated with the idea that does introduce pricing irrationality during the peak. For example, in the case of water utilities, we find the lowest average rate per gallon charged during the August peak when the plant is overloaded and water pressures are declining. Thus, the most expensive water to produce is sold at the year’s lowest rate for well-heeled suburbanites for lawn sprinkling. The simple, obvious, and efficient business practice of charging more when demand is brisk and less when it is lax seems totally to have escaped municipal water authorities and is frowned on by many public utility officials. Yet, the same officials who object to on-peak rates do not object to rate reductions designed to fill the off-peak trough. Thus, there exists a paradoxical philosophy which encourages efficient utilization of the existing plant provided it does not economize in future plant. It seems illogical, even under a philosophy of abundance, to deliberately pro-

mote a service which is in short supply. There are practical reasons for wondering about the efficiency of peak load pricing and, hopefully, increased coordination and interconnection will reduce the cyclic and ameliorate the problem in the electric industry. However, failure to consider peak load in the establishment of rates introduces another form of discrimination which may lead to subsidized peak load uses.

The Distributional Question

When promotional rates and practices are employed, the effect, in some instances, may be to take from one class of customers and to give to another. Thus, there are redistributive consequences in the philosophy of abundance. Abundance, in other words, for whom? Though little is known about the redistributive consequences of complex rate structures, public utility commissions frequently point with pride to low rates in rural and other classifications. Low rates based on the objective of maximum or widespread use of the service create little conflict—they are shrewd politically, conform to notions of social justice, and fit well into the growth plans of the firm. Rate structures may also be designed to encourage new industry, minimize the complaints of individuals and institutions which have bargaining power or political effectiveness or, in the case of publicly-owned utilities, to raise general revenue. In these, or in many other ways, the rate structure may have an effect on the distribution of income. Ordinarily, the income redistributions will run from those who have inelastic demands, no alternative sources of supply, and bargaining weakness to those who have elastic demands, alternative sources of supply, and bargaining strength. Of particular significance is the relation between small users who typically have inelastic demands and large users who may have elastic demands. In recent years, for example, electric utilities have instituted incremental rate reductions to encourage air-conditioning and space heating. Unless front-end reductions are anticipated and forthcoming within a few years, the small user may not receive a fair share of the technological and scale economies that are offered in support of these selective and incremental rate reductions. Thus, small users with inelastic demands may well wonder about All-Gas and Gold Medallion bargains, industrial rate bar-
gains, and suburban underground cables financed through the same old rate structure except with a lower rate in the last block—a rate which sometimes is below short-run marginal cost and which may bring in a demand at the peak requiring a new capital expansion program and delays in general rate reduction.

Commissions sometimes, but not often enough, object to low rates for one class of customers if these rates threaten to burden other classes. However, this limited type of rate structure regulation may not be pursued vigorously at the initiative of the commission. If the low rate is justified in terms of scale economies, technology or more efficient utilization of plant, it should (on both distributional and efficiency grounds) carry a commitment to reduce as quickly as possible the rates of those who have been denied their round. A test of “no burden” to other classes of customers seems inadequate. I suggest that the test be the willingness of the management to commit to a front-end or general rate reduction within a reasonable period of time. Such a policy also would reduce the possibility of the capture of a competitive market simply because of the ability to develop a sophisticated system of price discrimination.

Rate reductions, particularly of the front-end variety, for those who have inelastic demands seem pointless to a growth-minded management committed to a philosophy of abundance because they drastically reduce revenue without significantly expanding output. To make matters worse, a costly front-end adjustment, of say half a cent in the front block, may be dismissed by the public as a mere token and might even lead to a deterioration in public relations. Understandably, some managers see no worse way to reduce excess profits. The lack of attention given to the poor man’s block on the part of economists is not as easy to understand. Whether or not I have suggested a real problem can be determined by analyzing the historical trend in the spread of rate structures and by examining the degree of symmetry in the placement of rate increases and decreases. Sooner or later, regulatory agencies will insist on across-the-board rate reductions, but the situation suggests it will be later rather than sooner.

The fact that rate structures have distributive consequences does not, of course, imply that redistribution via rate structures is desirable public policy. Though regulatory statutes contain words like fair, just, and reasonable, they do not contemplate redistributions of income or wealth. Public utility rate making, even under the careful guidance of public agencies, which embarks along the path of deliberate redistribution is likely to create more problems than it would resolve. My concern is that the pursuit of a policy of abundance will place the burden on those who receive an inadequate share of the abundant things produced.

Conclusion

Regulatory agencies which adhere primarily to a fair rate of return criterion may fail in their responsibility to scrutinize the values which may be imposed through selection of the rate structure. The power to discriminate, even when profits are controlled, is akin to the power to tax, giving to some and taking from others. This power should be used with extreme caution and I am reluctant to see it defined as a “managerial prerogative.”

The most obvious check, of course, is to require the utility to reduce front-end rates either simultaneously or within a reasonable period after it makes selective rate reductions to meet competition or promote its service. This may lead to somewhat less abundance, but what we have may be more fairly distributed.
Marginal Cost Pricing in a Random Future as Applied to the Tariff for Electrical Energy by Electricité de France

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Electricité de France

with an introduction by P. Lhermitte, Electricité de France

Introduction

The tariff for electrical energy sold by Electricité de France to customers supplied with high and very high voltage is founded on the principle of marginal cost pricing. The first practical application of this principle to electrical energy was carried through in 1957 in the so-called Green Tariff, now as familiar to our customers as to pricing theorists. The Green Tariff was based on the analyses of MM. Dessau, Boiteux, and Stasi.¹

As a result of these efforts, it has been possible to resolve the main paradoxes which hindered the application of the theory of marginal cost pricing to the concrete case of pricing by a major public utility enterprise. The introduction of the notion of marginal cost as an "adapted structure" clarified the link between the choice of plant and facilities and the calculation of marginal cost, especially when installations are "inelastic." The analysis of periodical demand patterns provided a solution to the delicate problem of pricing peak period supplies. Last but not least, M. Boiteux developed a definition of marginal cost in a random future for the case in which the adaptation of production facilities to random demand is implemented by pre-selection of an acceptable risk of curtailment.

Since then, considerable progress has been made in setting criteria for investment decisions, while the introduction of non-linear programming has made possible in particular an explicit accounting of the cost of the kilowatt hour that has not been supplied, that is, the cost of curtailment. This cost had formerly been measured only implicitly.

For these reasons it seemed desirable to review the analysis of pricing problems in a random future and to keep full compatibility with the approach used in our investment models. This led to a re-examination of the definition of marginal costing in a random future and thus to expressing in a new language the theory first stated in 1957.

The work could only be done by someone who had mastered not only the underlying logic of the earlier work, but also the contribution of random theory to the construction of investment decision models. We owe this to M. Caillé, whose own account follows.

The Development of the Green Tariff

Since its introduction in 1957, the Green Tariff has been modified only in a very limited way in order to adapt it to changes in the economic environment; its basic structure has not been questioned. The relative values of marginal costs, however, have undergone drastic changes in one decade as a result of certain technical and economic phenomena. In particular:

1) Demand has doubled, with noticeable changes in its geographi-
conclusions may be stated as follows:

"Under the set of assumptions describing an ideal economy (or the perfectly competitive model), it is shown that, if income distribution is optimal and all enterprises but one are optimally managed, the collective utility function is optimized if that enterprise satisfies the two following conditions:

1) minimization of costs; and
2) selling at marginal cost, defined as the cost of production of the last unit produced."

This theory has been criticized in various ways, which there is little point in repeating here. In contrast, the problems raised by its practical application to the concrete case of the EDF must be examined.

From a rigorous standpoint, the concepts of a tariff structure and marginal cost pricing are contradictory. By definition, a tariff is to remain stable, at least as regards its basic structure, for a fairly long period of time, such as a decade or so in practice. There is no necessary reason for marginal cost to remain stable.

Since the objective was to develop a new tariff to be applicable from 1970 to 1980, this first contradiction was resolved by selecting as target date the median year of the period, that is, fiscal 1975 (July 1, 1975, to June 30, 1976). Provision was made for correcting certain results to allow for foreseeable trends in the latter part of the decade. At this point a second difficulty appeared: as seen in 1968 or 1969, marginal costs in fiscal 1975 are an uncertain or, at best, random quantity; but the published tariff must be a fixed one.

This is of course the problem of marginal cost pricing in a random future. Since its solution can be approached in various ways, the following method was chosen.

Having made the most reasonable assumption as to the values of the strictly uncertain parameters, the variables characterizing fiscal 1975 are stochastic (random). Consider a marginal customer i, whose random consumption is Ci. We assumed that the determinate
distance at which his consumption should be invoiced is given by the equality

\[ q_i C_i = \mu C_i \]

where \( \mu \) designates marginal cost.

Two factors dictated this choice. To invoice at a price of \( q_i \) involves (1) the equality in expected value for each marginal customer between revenues and expenditures, and (2) the expected value of the total receipts equal to \( \mu C \). This result is also obtained if, instead of selling at a pre-established price, sales are made at marginal cost as determined at each moment of time. This, furthermore, is the only sales policy consistent with the theory on which Electricité de France bases its activity.

It should be noted in particular that invoicing at the mathematical expected value marginal cost, \( \mu \), however natural it may seem, would lead to systematically lower total revenues by reason of the correlation between \( \mu \) and \( C \) (or \( C_i \)).

In concluding this brief theoretical statement, it should also be observed that an analysis of the problems pertaining to randomness has been set forth by M. Boiteux. At first glance it may appear different from the approach outlined above; but as will be shown later, this difference is not fundamental.

The prices \( q_i \) at each level of voltage remain to be calculated.

\[ \text{ii. The 220 KV Supply Voltage} \]

The calculation of marginal cost as it has been previously defined makes sense only if the margin is that of an "adapted" structure, that is, a structure minimizing the total outlays for energy production and bulk transmission lines. In actual circumstances, most organization and management decisions are taken with reference to an uncertain future. Minimization no longer concerns real expenditures, but is an indicator which represents them as accurately as possible. For example, their mathematical expected value if they can be expressed in probabilistic terms would be such an indicator.

The models used by EDF for selecting investment projects relate equipment requirements to a five-year advance demand forecast, this being the period currently required for the highest yielding
projects to come on stream. Hence a forecast of consumption is essential. For this purpose, various statistical models are used which allow the entire range of consumption to be expressed in probability notation in the form of a normal curve. Hydroelectric output is expressed using a log-normal function.

As a result of this method, at any given volume of equipment there is a non-zero probability of curtailment, during certain hours at least. Selection of a program therefore involves acceptance of a certain degree of risk, and consequently the implicit or explicit assignment of a cost to each kilowatt-hour not supplied: this will be referred to throughout as the curtailment cost. In a situation of curtailment, this cost is also that of the last kwh supplied. In situations of this kind, demand is not met in part, and each kwh actually consumed can be considered as responsible for an equivalent cut.

This provides a more accurate definition of marginal cost. Where marginal production capacity is available, it is the cost of the additional kwh. In the opposite case, it is the curtailment cost. The latter will be designated by \( D \). It is assumed to be independent of time and place, and also of the intensity of the curtailment. The latter represents a very strong assumption, but it is not an essential one. It will be retained, however, since at certain points it greatly simplifies the exposition.

The symbol \( p \) will be used to denote the probability of curtailment (at a given time and place). The theoretical mathematical expected values introduced above can then be rewritten as follows:

\[
\bar{C} = (1 - p) \bar{C} + p D = \bar{C} + p (D - \bar{C})
\]

\[
\mu \bar{C} = (1 - p) \mu \bar{C} + p D \bar{C};
\]

where \( \bar{C} \) designates the mathematical expected value of marginal cost in an operating situation, and \( \bar{C} \) and \( \bar{C} \) are the mathematical expected values of \( C \) in operating and failure situations respectively.

It will be seen later that, in an operating situation, \( \mu \) varies little around its average. As the same is generally true of \( C \), it is possible to write

\[
\mu \bar{C} = \bar{C} \quad \text{or}
\]

\[
\mu \bar{C} = (1 - p) \bar{C} + p D \bar{C}.
\]

It is then straightforward to derive

\[
\mu \bar{C} = \bar{C} + p (D - \bar{C}) (\bar{C} - \bar{C})
\]

\[
\mu \bar{C} = \bar{C} + p (D - \bar{C}) \left( \frac{\bar{C} - \bar{C}}{\bar{C}} \right).
\]

The cost to be evaluated is then composed of the sum of three terms:

\[
\mu \bar{C} + p (D - \bar{C}) + p (D - \bar{C}) \left( \frac{\bar{C} - \bar{C}}{\bar{C}} \right).
\]

The method of calculation has consisted of evaluating each separately, after first developing an accurate specification of the investments that would be adapted to meet 1975 requirements, and their optimal operation in a certain number of cases.

1. Specifications of Adapted Investments—The parameters used to describe 1975 were demand for and costs of primary energy. For demand, assumptions were made about the mean and standard deviation of the normal curve used to represent demand in 1970, as well as about certain parameters governing the load curve. Forecasting errors on these points are of little importance: marginal costs are not very responsive to the volume of facilities if the latter are well adapted to the pattern of consumption.

Non-probabilistic assumptions were made regarding energy costs,

\[
\text{If } r \text{ denotes the coefficient of correlation between } C \text{ and } x, \mu (x) = \bar{x}, \quad C = \bar{C} + r x + \epsilon; \text{ and since } \sigma_\epsilon \text{ and } \epsilon \text{ are small by comparison with } \mu \text{ and } \bar{C}, \text{ the second term can be neglected.}
\]

5. This property, which holds only over a narrow range of variation, seems to be inconsistent with the constant decline in electricity prices over time. The latter, however, is not principally an effect of economies of scale, but is attributable to other causes—technical progress, lower costs of certain inputs, productivity gains, and so forth.
specifying both the general price level and the extent of regional differentiation.

Selection of the appropriate investment pattern then entails simultaneous use of an overall model, the "Note Bleue" model, and a marginal approach. "Program Adjustments." The latter provides a detailed listing of the equipment most apt to meet requirements, with its geographical location. The optimal interconnection system can be calculated from it: consideration has been restricted to a grid with 100 substations, more than adequate for the purposes of the study.6

2. Optimal Operation and the Calculation of O'—Non-curtailment operating situations correspond to a set of values of the couple: demand—hydraulic conditions. For the present problem, it was possible to specify this set, with sufficient accuracy, as the limited number of points determined by combining three levels of demand C, namely, the median, and one standard deviation above and below it, with three levels of hydraulic conditions H, determined in similar fashion. Weighing coefficients α and β can be associated with C and H, satisfying the conditions

\[ \sum_{i=1}^{3} \alpha_i C_i = \bar{C} \]
\[ \sum_{i=1}^{3} \beta_i H_i = \bar{H} \]

These coefficients are easily calculated once the frequency densities of C and H are known. Nine situations are determined in this way, of which only eight are operating situations. The values of \( \mu \) were calculated for each of these eight cases, and it was assumed that \( \bar{\mu} \) would not be significantly different from

\[ \bar{\mu} = \sum_{i=1}^{3} \alpha_i \sum_{i=1}^{3} \beta_i \mu (C_i, H_i). \]

Since optimal operation of the system depends on other parameters which involve "finer tuning" than the choice of investments, further assumptions were required before the eight series of calculations could be undertaken.

Some of these concerned the spatial and temporal distribution of demand. Evidence derived from extrapolation of past trends and forecasting surveys was used to calculate coefficients of the allocation of consumption among substations on the grid. In addition, important ongoing statistical research at EDF provided good forecasts of the form of the load diagrams characterizing each month. These included data for the average working day, Saturday, Sunday, and Monday.8

Other assumptions concerned the distribution of usable hydro resources among the various hydraulic basins in France. It was enough merely to apply the correlation coefficients relating each basin to all of France as derived from past series. Several steps are then required to reach the desired results. First, optimization of certain variables leads to use of the year as the basic time period. This is particularly true in regard to the timing of preventive maintenance of thermal power installations and the associated policy concerning filling levels of storage hydro plants. Studies on both topics have been made and provide monthly outage rates for overhaul of thermal facilities and running drawdown of stored reserves. Second, the other operation problems involve a time unit of a week. For each value of the (demand—hydro conditions) vector studied, the production target, the available hydro potential, and the available thermal capacity are known for each substation for the average week of each month, the last two items being determined on the basis of the rates emerging from the previous stage.

At this point, use is made of two models developed by the Energy Movements Service of EDF in connection with their own operating requirements. The first of these identifies modulatable hydraulic energy. The criterion applied is that the marginal cost of thermal production should be constant as nearly as possible for the week as a whole. But while hydro power production is geographically localized, thermal production is not. The effect is as though thermal output were positioned intermittently on the national load curve.

6. The author acknowledges the contribution made in this section by M. Bernard Montfort, formerly an economist at EDF.
7. Summed over operating situations only.
8. These coefficients are referred to internally as the \( \mu_{ij} \). They are used to derive the demand for energy at hour \( h \) of day \( i \) of month \( j \) from a figure for average daily power demanded.
Hydro production for each hour of the week can thus be derived for each substation. The thermal installations to be started up to provide the necessary supplementary production are specified on a daily basis using a model known as economic dispatching. This model, based on the Kuhn-Tucker theorem, minimizes total operating expenses, subject to constraints which, for each substation, translate the demand to be met and the limits set by production and transmission capacity. The marginal costs of active and reactive energy then appear as duals of certain constraints. The solution to the problem is reached through a process of successive approximations; it corresponds to relations between certain variables, such as voltage and dephasing, and marginal costs. A numerical estimate of marginal costs at optimum is thus calculated by the model itself for each hour of the day studied and at each substation on the grid. In practice, for active energy, this is equivalent to identification by the model of a marginal power plant, whose marginal fuel costs determine marginal cost at the substation to which it is connected. At all other substations, the required value is found by algebraic addition of marginal losses on the transmission system. This is why marginal costs in operating situations are often called fuel costs.

Figure 1 gives the full layout of the calculations. In practice, steps were taken to keep them within bounds. Tests based on the present time segmentation of the Green Tariff showed that December could be used to represent the period October to March, and June the rest of the year. Again, only average working days were studied in detail. Saturday and Monday are fairly similar to weekdays while Sunday is of little interest.

The results indicate that marginal costs are not very sensitive to changes in either demand or hydraulic conditions; in both cases, they vary by 10 to 15 percent as between extreme values at either end of the range. This is also the order of magnitude of the extreme movements in \( \gamma \) in the course of a given day. As will be seen, this accounts for the decision not to use fuel costs in choosing the tariff brackets.

3. Definition of Hourly Brackets and Calculation of the Terms: \( p (D - \gamma) \) —Investment-choice models produce information on the nature of the investments offering the highest return and the volume of facilities to be put into service. They also identify the technique of development, or mix of techniques, that should be called upon if it is decided to increase marginally the capacity available.
The requirement that production facilities be in line with the consumption forecast then leads to the following property: advancing the introduction from July 1, 1976, to July 1, 1975, of an increase in capacity of one kilowatt, by the type of facility then being used to augment generating capacity, produces a balance in the budget. On the other hand, the advancement is associated with a fixed cost which includes financial charges, depreciation for the first year of existence, and fixed operating costs. In addition, fuel costs must be taken into account for use of an up-to-date kilowatt of capacity. The counterpart of this extra kilowatt of capacity is a saving, during each hour it is drawn on, as determined by the load diagram, of the marginal cost of fuel in an operating situation, and of the curtailment cost in the alternative case.

This equilibrium can be written

\[ i = \sum_j \left[ (\bar{\gamma}_j - \gamma) + p_j (D - \bar{\gamma}_j) \right] \]  

(1)

in which \( i \) denotes the fixed cost of advancing a kilowatt of capacity growth by one year, \( \gamma \) denotes the associated variable operating costs, \( j \) is the set of annual hours during which this extra capacity is available, and \( \bar{\gamma} \) and \( p_j \) are marginal costs in operating situations, and the probability of curtailment, respectively, in each of these hours.

In the case of Electricité de France, the technique applicable for capacity increases in 1975 will be conventional thermal production using 600 MW generating facilities. The precommissioning expenditures before such facilities come on stream are well known, as are the fixed and variable operating costs. The terms \( i \) and \( \gamma \) can consequently be calculated, the present value of financial charges being assessed by using the opportunity cost of capital adopted in equation (1). Economic depreciation is derived from the results of an existing study on trends in the net present value of generating facilities undertaken in another connection. \( \bar{\gamma} \) has already been estimated, and \( (D - \bar{\gamma}) \) can be considered as a constant, since \( \bar{\gamma} \), and, a fortiori, changes in it from hour to hour are of negligible dimensions by comparison with \( D \). It follows that, once the ranking of the probability of curtailment over different hours of the day is known, equation (1) can be used to deduce all the values of \( p_j (D - \bar{\gamma}) \).

The necessary information can be secured by using the “Note Bleue” in association with the model for timing of thermal plant maintenance. Together they establish three different levels of the probability of curtailment: these relate to the critical winter and summer hours, covering some fourteen hours per working day, and the peak, a small number of hours in December or January. These elements were not used in unadjusted form. Allowance had to be made for a factor that has not been mentioned until now—the influence of the pricing system on the load diagram.

The problems met in forecasting demand have been set forth above; implicit in this approach, however, is that the forecast is valid only for a given tariff structure. To be complete, the present study must start from an assumption concerning load diagrams, deduce marginal costs from it, and introduce a new demand forecast, for example, by applying an estimate of price elasticity; then, if necessary, it must introduce another estimate of costs, and so on until a situation of equilibrium has been reached. This process, in practice, was not followed rigorously, but qualitative allowance was made for the interaction between the tariffs and the load diagram.

This leads, in particular, to an extension of the definition of the peak. If the appropriate price were charged for the three or four hours of heaviest annual load, this extreme peak would collapse, only to reappear at some other time. As in 1958, it seemed efficient to set the peak-rate bracket as covering roughly four hundred hours. The critical hours were compared with the full use demand bracket in the Green Tariff. There are more hours in the latter since it corresponds to sixteen hours per working day. Here again, it is probable that any lessening of its duration would necessitate tempering with the peak hours bracket, which is fairly sensitive to the load diagram. In particular, it would lead to significant growth in use for accumulation of thermal energy. On balance, it seems that the equilibrium position corresponds to the hourly brackets that are presently utilized.

The previous equation therefore becomes

\[ i = \sum_j (\bar{\gamma}_j - \gamma) \cong [h_1 p_1 + h_2 p_2 + h_3 p_3] (D - \bar{\gamma}) \]

where \( h_1, h_2, \) and \( h_3 \) are the number of hours in each of the three brackets defined earlier: peak hours, winter full-use demand hours, and summer full-use demand hours, and \( p_1, p_2, \) and \( p_3 \) are the cor-
responding probabilities of curtailment whose values are known from other sources.

An ambiguity still has to be resolved. The term \( \sum (C_f - \gamma_j) \), which will be referred to as the fuel-saving term, depends a priori on the grid substation to which the capacity-increasing facility is connected. This would not be the case if the location of power plants was determined solely by the desire to minimize fuel costs. This would imply a transmission network of infinite capacity. The optimum in this instance would be determined by equalization of fuel savings among the substations to which each new plant was connected. Furthermore, in this same example, the fixed costs associated with the expansion of the interconnecting network would be amortized by the difference between the cost of average losses and the returns found by valuing these losses at their marginal price.

In reality, the capacity of the transmission network is limited, and the choice of generating sites is intended in part to improve the reliability of local supply. The second member of equation (1) should, in principle, include a further term for each region \( r: \sum \gamma_j \), in which \( \gamma_j \) represents the \( j \)th hour, the probability that a curtailment will be experienced in region \( r \), even though overall capacity is adequate to meet demand.

Consider the simplified diagram below, involving only two substations, in which flows are always from A toward B.

![Diagram](image)

It can be shown that the optimal transmission of power from A to B satisfies the equation

\[
i_1 = \text{savings on losses} + \sum_{j} \gamma_j \cdot B_j
\]

in which \( i_1 \) denotes the expected cost, per kw dispatched, of bringing forward the connection between A and B. This reasoning can be extended to the actual network. The global value of local curtailment can then be obtained for each substation by subtracting from an excess supply zone and calculating, by successive steps in the direction in which transmission takes place, the cost of advancing construction of an interconnecting network which is assumed to be perfectly adapted to requirements. The distribution of this cost among the various hours of the day is based on the knowledge available as to the ranking of the probabilities \( \gamma_j \), and on the feedback effects of the tariffs on the load diagram. Two tests are available to verify the internal consistency of the whole set of calculations. The same results should be obtained for a given substation, whichever substation one starts from, and whatever the path taken to move from one to the other. In the areas in which new capacity is installed, the local curtailment should balance equation (1).

4. Calculation of the term

\[
p (D - \bar{Y}) \left( \frac{C_i - \bar{C}_i}{C_i} \right)
\]

Qualitatively the term

\[
p (D - \bar{Y}) \left( \frac{C_i - \bar{C}}{C_i} \right)
\]

for a given client \( i \) is a direct function of his irregular consumption pattern and of his total consumption.

The analysis can be carried further in particular cases. Assume, for example, that individual demand \( \gamma_i \) and collective demand \( Y \) are normally distributed with means \( \bar{\gamma}_i \) and \( \bar{Y} \), and standard deviations \((\gamma_i, \sigma_i)\) and \((\bar{Y}, \sigma)\); that production \( P \) is also normally distributed \((\bar{P}, \sigma_P)\); that curtailments, when necessary, affect each client in proportion to his excess demand, that is, the excess over his average demand.

It is then possible to prove the relation

\[
C_i - \bar{C}_i = \rho_i \frac{\gamma_i}{\sigma_i} (P - \bar{Y}) = \gamma_i + \rho_i \frac{\gamma_i}{\sigma_i} (C_i - \bar{C}_i)
\]

in which \( C_i \) and \( C \) denote consumption actually supplied \( \rho \) is the coefficient of correlation between \( \gamma_i \) and \( Y \), and the sign \( \wedge \), the mathematical expected value in a curtailment situation.

The calculations are based on this relation. It is known that the proportional irregularity \( \frac{\gamma_i}{\sigma_i} \) varies with the duration of use of the power contracted for or of the maximum capacity reached. Therefore, the random features taken into account relate to forecasts and
not to random fluctuations around a mean that is certain. But clearly, for a given level of uncertainty as to consumption, forecasting the power used by a customer at a given hour is the more difficult the more irregular the time distribution of his requirements.

The irreversibility term was therefore estimated for three groups of customers with utilization periods of 8,760, 5,000, and 2,000 hours. In an hourly bracket covering \( H \) hours, it can be shown that the relative irregularity of a customer whose utilization period is \( U \) varies roughly as the quantity \( \frac{H}{U} - 1 \). This property made it possible to set up a hierarchy of representative customers. Overall it must be true that

\[
\frac{\sum \left( \frac{C_i - C_i'}{C_i'} \right)}{\sum \frac{C_i}{C_i'}} = \frac{C - C'}{C'}.
\]

Since the order of magnitude of \( \frac{C - C'}{C} \) is known, by taking into account the rules for adjusting programs, it is possible to determine roughly the various values of

\[
\left( \frac{C_i - C_i'}{C_i'} \right).
\]

The three terms composing the marginal cost imputable to client \( i \) have thus been established. There remains the task of translating them into the simplest possible schedule of charges. Since cost decreases with extension of the utilization period of the capacity stipulated in the supply contract, two-part tariffs are indicated. A part of the curtailment term is invoiced as a fixed rate of premium per kilowatt contracted for. In order to reflect the results obtained as closely as possible, it was necessary to maintain several variants of the tariff, these being nearly identical with those existing at present. A tariff with a high fixed component covers long utilization periods, while another, a general tariff, matches the first for utilisations on the order of 4,000 hours. A special tariff for extremely short utilisations.

tion periods will no doubt also be necessary. Finally, to facilitate comparison with the Green Tariff, the substations were regrouped into a limited number of zones, in each of which prices are identical.

A review follows of the main features of the method used by M. Boiteux in 1957. The marginal cost for 220 kv supply is assumed to be composed of fuel costs and a fixed charge whose main function is to cover the peak. Fuel costs are defined in exactly the same way as costs in an operating situation in the present paper, and the calculating technique used, allowing for the less powerful means then available, is also essentially the same. Optimal management, on the other hand, is defined more schematically, since start-up sequence is determined merely by beginning with the lowest plant in the cost hierarchy and proceeding by order of rank. This was a valid approximation in an area where cost difference between obsolete installations and the most modern units were very substantial. For the same reason, fuel prices were sufficiently differentiated at one time to justify, on this count alone, separate tariff brackets.

According to Boiteux, the fixed charge appears equal to the cost of bringing forward a kilowatt in a modern facility, less an allowance for fuel savings, and further diminished by a coefficient referred to as the “coefficient covering responsibility for peaks.” The effect therefore is to impute a value to what has been referred to here as the “curtailment term.” This presentation constitutes an application of the analysis made by Boiteux of marginal cost selling in a random future, which has been referred to earlier. Boiteux envisaged a normal demand of \( Y \) and \( y \) with a fixed production capacity of \( a \). Designating the cost of advancing investment in plant in time as \( u \), he shows that for constant quality of service, demand \( y \) calls for receipts of \( uy \), with

\[
y_i = \frac{Y}{\sigma} + \rho_i \sigma, \quad \frac{a - Y}{\sigma}.
\]

It should be noted that in these circumstances, introduction of the cost of curtailment involves billing demand at a price of \( pDC' \), and that, at the optimum, \( PD \) is exactly equal to \( \omega \), and \( C \) to \( Y \), according to the above equation; the two approaches lead to identical results. Originally \( y \) was taken in conjunction with capacity \( FS \).


10. See Boiteux in Marginal Cost Pricing in Practice.
assumed to be of the form $PS_i = \bar{Y} + ma_i$, and it followed that fixed charges for growth of facilities should be imputed by pro-rating according to the capacity contracted for by the customer. However, this position postulates equality of the coefficients ($a_i/PS_i$), and it was rejected since it led to an excessive equalization of charges among customers. The three variants of the Green Tariff resulted from this process. As an immediate consequence, the fixed charge loses its original purity of definition, since some costs considered as fixed are carried into the price per kilowatt-hour. Two two-part tariff thus reached is intended not so much to separate the charges for "power" and "energy" as to offer a decrease in the average price per kw consumed in line with that indicated by the calculations. The convergence between the two theoretical approaches to the problems posed by a random future is therefore perfect.

Finally, it should be mentioned that the 1957 research necessitated an important verification: the tariff was supposed to ensure that capacity-increasing facilities provided an economic return. It is clear that the present method, due to the introduction of the notion of the costs of local curtailment and their proper assessment, makes such verification pointless.

III. Calculation of Marginal Costs of Supply at Subtransmission and Primary Distribution Levels

The previous discussion has dealt with the setting of prices for customers directly connected to the grid. There remains the case of the far greater number of customers who are connected to the 220 kv substations by transmission lines of varying length. Only the subtransmission network (90 and 63 kv) will be studied here. The methods of calculation can be transposed without difficulty to the primary distribution network (6 to 30 kv).

Consider a customer $i$, connected at 60 kv, as in the diagram below. The aim is to determine the marginal cost of the energy supplied this customer at a given hour.

Three possibilities arise: (a) Curtailment at $A$. Supply of a kilowatt to customer $i$ results in a curtailment of $(1 + \eta)$ kilowatts at $A$, where $\eta$ is the average rate of loss on the network between $A$ and $B$. The marginal cost is $(1 + \eta)D$. (b) No failure at $A$, but the capacity of the system between $A$ and $B$ is inadequate to meet demand fully. Marginal cost is $D$. (c) No failure. The marginal cost can be calculated at $A$ and increased at $B$ to allow for the average rate of loss between the two points.

Let $p$, $\eta$, and $1 - p - \eta$ be the probabilities of each of the three series of events; $C_i$, $C_j$, and $C_k$, the corresponding conditional mathematical expected values of $C_i$; and $m$, marginal cost at $B$. It will be assumed that in cases (b) and (c) the conditional expectation of $\mu$ is $\bar{\mu}$ as defined in Section II, and that the average rate of loss on the $A$–$B$ network is identical between cases (a) and (c). It is then possible to write

$$\bar{C}_i = (1 - p - \eta) \bar{C}_i + p C_i + \theta \bar{C}_k$$

$$m \bar{C}_i = (1 - p - \eta) \bar{\mu}(1 + \eta) \bar{C}_i + p D (1 + \eta) \bar{C}_i + \theta D \bar{C}_k$$

and the sale price $q_i$ is

$$q_i = m \frac{\bar{C}_i}{\bar{C}_j} = (1 + \eta) \left[ \bar{\mu} + p (D - \bar{\mu}) \left( \frac{C_i - \bar{C}_j}{\bar{C}_j} \right) \right] +$$

$$\theta \left[ D - \bar{\mu}(1 + \eta) \right] \left[ 1 + \frac{C_i - \bar{C}_j}{\bar{C}_j} \right].$$

In other words, $q_i$ can be expressed as the sum of two terms.

The first of these is equal to the selling price for supplies at 220 kv, as increased to allow for losses. However, the results of the previous stage cannot be taken as a starting point since the term $\frac{C_i - \bar{C}_j}{\bar{C}_j}$ for a 60 kv customer is not identical to that calculated in Section II. There are more customers at this level than at the higher voltage level, so there is a lower coefficient of correlation $\mu$, between the average customer and the clienteles in general. This is
the phenomenon involved in the concepts of collective and semi-
individualized networks introduced by Boiteux. In the 1957 presen-
tation, fixed charges for the collective network were factored into
the kwh price of certain hourly brackets; in other words, the cor-
responding average price did not vary in line with the relative de-
gree of irregularity of the individual demand pattern. Research into
certain groups of clients indicated that the degree of equalization
involved was generally excessive. The component of the price paid
by 60 kV customers to allow for production and main-line trans-
mission should vary with the period of utilization of contracted-for
capacity, and so include a small but not negligible share in the form
of a fixed charge.

The methods used to estimate \( \theta (D - T (1 + n)) \) and \( \left( \frac{C_0 - C_1}{C_1} \right) \)
are similar to those already described.

As in 1957, supply networks have been considered as "inelastic
installations." The country was divided into zones of supply den-
sities which were roughly homogeneous. It was assumed that the
network in each could be summarily represented by a transformer
station and an average length of feeder line, the capacity of the
whole having a limit which coincides with its optimal operating
capacity. For a certain future, Boiteux has derived the optimal
adaptation of this kind of installation to sporadic demand and the
consequent marginal costs.\(^{11}\)

In a random future, the adapted structure of the network shown
can be described by an equation of the form

\[
\omega = \sum \theta [D - T (1 + n)]
\]

where \( \omega \) denotes the cost of advancing investment expressed per
kilowatt of limit capacity. This equation takes no account of the
savings on losses arising from marginal reinforcement of the lines;
therefore, the value that has been taken for \( \theta \) is the average rate
of loss (the value used), rather than the marginal rate.

The procedure then consists of estimating in successive steps the
cost of advancing investment, \( \omega \), the rates of loss, \( n \), the hierarchy of

1. Calculation of \( \omega \) and \( \theta \)—In view of the assumption of the inelas-
ticity of the installations, limit capacity is in principle a function of
the peak demand serviced.

Research was therefore undertaken to describe network growth
over the last ten years by fitting simple statistical models correlat-
ing the growth of peak demand to the growth of transformer capac-
ity and the length of supply lines of a given capacity for each region.

By postulating that the policy followed during the period was opti-
mal from a theoretical economic standpoint and that the descriptive
models would remain valid until 1975, it was possible to specify
what installations would be necessary at that date to service the
marginal kilowatt; calculation of the cost of bringing them forward,
\( \omega \), was then a simple matter.

Rates of loss were deduced from a simplified forecast of the struc-
ture of the various networks in 1970 and the physical characteristics
of their components.

2. Values of \( \theta \)—It was assumed that the probability of curtailment
was constant within the hourly brackets identified at the level of
production. The brackets were classified by comparing the average
power forecast for each with a capacity involving a reasonable risk
of curtailment at peak. The values finally retained, furthermore,
take into account the "tariff-load" diagram interaction already
examined.

3. Estimation of \( \left( \frac{C_0 - C_1}{C_1} \right) \)—Section II has presented the main
guidelines for this type of calculation. Since network costs are de-
termined solely by the highest peak demand, the coefficients of
responsibility for peak demand, which have been estimated with
acceptable accuracy for certain groups of customers, can be used to
check the results.

In practice, the fixed charges for network growth are allocated
between fixed charges and the cost per kwh in order to follow as
closely as possible the change in marginal cost as a function of the
utilization period.\(^{12}\)

11. This capacity allows for safety margins necessary to meet equipment
failures.
12. See Boiteux in Marginal Cost Pricing in Practice.
Knowledge of costs at each voltage level of supply is still not enough to develop a workable pricing tariff. EDF must balance its budget, and marginal cost pricing, as is known, does not automatically affect a balance.

On the production side, simple models confirm that charging the \( q \) prices as defined above leads theoretically to equilibrium, apart from the very low costs for central administration; this property is further confirmed as broadly accurate by EDF financial records.

Overall, however, a systematic deficit emerges, stemming mainly from the phenomena of increasing returns to scale on the networks and the greater cost of certain administrative and commercial expenditures, not taken directly into account in the calculations. Financial equilibrium therefore requires an upward correction factor to be applied to the results. The allocation of this correction to the various categories of customers is largely based on the analysis by Boiteux.

Conclusion

The results of this study are similar in form to the existing Green Tariff. The rating structure consists of a fixed charge and a kWh price differentiated among five hourly brackets. There are three basic variants of the tariff: long use, general, and short use, set up so that the interests of the users and of the EDF will coincide, with the result that each customer is left free to decide which variant best meets his particular requirements.

Comparison with the present tariff structure is therefore simple. It shows the need for three important changes. The first of these relates to trends in load diagrams; although the total number of hours in the bracket concerned remains unchanged, the peak and standard hours must be shifted toward the evening.

The major difference between the theoretical approach adopted in 1987 and that now adopted concerns the problem of irregular demand; it has led to a significant structural alteration. Whereas presently the fixed charge is the same whatever the supply voltage, the new General Tariff will provide for a higher fixed charge for medium voltage than for a high-voltage connection. The higher charge results in a greater sensitivity of the average price per kWh as a function of the utilization period of the power contracted for. It is interesting that a recent survey of European members of the UNIPED shows that at this voltage level, the current French tariff is among those which decrease the least sharply.

Finally, the most important changes are related to trends in relative input prices and certain features such as supply densities. The collapse of fuel prices has led to a significant decline in the relative costs of slack hours and in the average cost of very high voltage supplies, where fuel accounts for roughly half of total costs. This trend is further reinforced by the regular decline in total precommissioning expenditures on capacity-raising facilities over recent years. By contrast, the increase in supply densities, which lowers the marginal cost of supply and distribution, offsets this in part, but only partially. Overall, the adjusted tariffs result in lower prices for 220 kV supply, roughly the same prices at the 60 kV and 90 kV levels, and some increase for medium voltage supplies. Here again, this trend is moving France more into line with the main foreign countries. As regards regional variations in prices, it has proved feasible to keep the existing tariff zones practically unchanged, but the relative price relationships between them have been modified considerably. As noted in the introduction, the port regions benefit more. This change is carried down to the medium voltage subscribers, with modulations resulting from differences in trends in supply densities.

In practice, these adjustments will take effect through a series of detailed alterations of the existing tariffs; it is hoped that these will result in improved decisions by consumers over the course of the coming decade. In some instances, of course, non-economic considerations may keep us from putting the results of our calculations fully into practice, but these calculations will nonetheless provide a benchmark for measuring the amplitude of the distortions or equalizations which may from time to time be granted.

There are several aspects of the tariff calculations which call for further investigation. One is the approximate nature of the allowance made for irregularity and for the impact of the price structure on the structure of demand. It is to be expected that substantial progress will have been made on these questions by the time of the next tariff revision. For this reason, we, like our predecessors in 1987, would reject any claim that we have "made it possible henceforth to forego making studies of this kind."
A Comparison of English, French, and American Electric Residential Rates and Their Significance for Large Scale Integration of American Utilities

Eli W. Clemens

University of Maryland

Electric utility rates have been the subject of much discussion in recent years. In retrospect, the controversy goes back to M. Be-

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*The writer acknowledges the help of Mr. Daniel Charles Lefebvre, Sr., and Mr. Dominique Allard of Electricité de France; of Mr. Frank S. Walters of Potomac Electric Power Co. for valuable information he gave to him on electric heating; Mr. J. A. Burchmall of the Electricity Council of London, England; Dr. Haskell P. Wald, chief economist of the Federal Power Commission and Mr. P. J. McCarthy of the Federal Power Commission who worked long and hard in explaining some of the intricacies of American tariffs to him. Most of all, he is indebted to Mrs. Lucienne C. Clemens who translated many pieces of French literature to him and who aided him immeasurably in correcting proof. Any errors of fact or interpretation are the sole responsibility of the writer.
teux, J. Hirschleifer, P. O. Steiner, H. S. Houthaker, and others who have maintained that utility rates should be based on demand at the time of system peak, while American utility rate men have held that rates should be based on individual class peaks, whatever their time of occurrence in relation to the system peak, and the need to promote usage.

This paper will compare and evaluate the residential rates charged customers under typical American rate structures with those charged customers of the North Eastern Electricity Board (NEEB) and the London Electricity Board (LEB) of England. The pricing policies of the NEEB gained prominence through an article by Ralph Turvey who pointed out that electricity consumers could gain exceptionally low rates merely by taking advantage of the off-peak restricted hour rates. Certain comparisons will also be made for Paris, New York, Chicago, and Nashville, as well as for selected Indiana cities.

Sources of Information

The NEEB operates in the various counties surrounding Newcastle in northeastern England. Approximately 8-9 percent of its residential usage and slightly less of its commercial usage are consumed during off-peak periods.

The English tariffs consist of primarily three standard tariffs: D.1; D.1.T.; and D.3 (white meter rate) for NEEB and LEB respectively; and D.1 with off-peak restricted hour rates RH/1, RH/2, and RH/3 which go along with them. These English tariffs are presented in dollar terms for ease of comparison.


The NEEB Tariffs

D.1 Rate
6.6¢ per kWh for first 26 kWh per month
1.65¢ per kWh for all subsequent kilowatt hours per month

D.1 T. Rate
39¢ service charge per month
6.6¢ per kWh for first 26 kWh per month
1.8¢ per kWh for each subsequent kWh taken between the hours 7:00 A.M. and 11:00 P.M. per month
0.9¢ per kWh taken at other times per month

D.1 + options of three rates
39¢ service charge applies to all rates. The off-peak period extends from 8:00 P.M. until 8:00 A.M.
RH/1 0.65¢ per kWh for a maximum of eight hours a day per month
RH/2 0.80¢ per kWh for a maximum of eleven hours a day, including three hours in the afternoon, per month
RH/3 0.90¢ per kWh for a maximum of fourteen hours a day, excluding three hours in the afternoon

The LEB Tariffs

The LEB tariffs are based on residential floor space. The one shown below is for 1,000 square feet.

D.1 Rate
91¢ per month for 1,000 square feet of floor space
2.95¢ per kWh for first 65 kWh per month
1.95¢ per kWh for all subsequent kilowatt hours per month

D.3 Rate (white meter rate)
$1.12 service charge is added to the 91¢ per month
0.77¢ per kWh for kilowatt hours supplied between the hours of 11:00 P.M. and 7:00 A.M. per month
2.95¢ per kwh for 65 kilowatt hours supplied at other times per month
1.85¢ per kwh for subsequent kilowatt hours per month

D. 1 + options of three rates
40¢ service charge applies to all of these rates, in addition to 91¢ a month. The off-peak period extends from 7:00 P.M. until 8:00 A.M.
RH/1 0.77¢ per kwh for a maximum of nine hours per day
RH/2 0.93¢ per kwh for a maximum of twelve hours a day, including three hours between 11:00 A.M. and 4:30 P.M.
RH/3 1.1¢ per kwh for a maximum of fifteen hours, including three hours between 11:00 A.M. and 4:30 P.M.

For the American cities, the rates are taken from the Federal Power Commission’s publication, Typical Electric Bills. The breakdown in this publication provides information on both unrestricted and off-peak consumption. Bills in the first part, involving consumptions of 100 and 250 kwh per month, are without any off-peak restricted hour provision. For the second part, involving the consumption of 500 and 1,000 kwh per month, the off-peak restricted hour provision is applied. FPC instructions read, “In the case of rates providing for special night rates where water heating is used, assume for the 500 kwh bill that 250 kwh are billed at the night rate. For . . . 1,000 kwh bills assume that 350 kwh are billed at the night rate.” American utilities for the most part have no special rates applicable to all-electric homes.

Income taxes and other taxes account for 18.8 percent of the American private utilities’ revenue from ultimate consumers. In contrast neither the NEEB nor the LEB pay any taxes. The Paris utility applies 15 percent to the subscription price of electricity as a general tax. It applies municipal and departmental taxes as well. However, none of these amounts are included in the rates. All Indiana cities are mentioned to give the reader some idea of location. All cities of 2,500 population or more are included in Indiana cities and for the United States.

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Bill Comparisons at Representative Usages

Representative bills at 100 and 250 kwh are shown in Table 1. The U.S. national weighted average bill was reduced by 18.8 percent to eliminate the federal income and other taxes borne by privately-owned utilities to make them comparable with the En-

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Representative Bills at 100 and 250 kwh Per Month 1968</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monthly Consumption</td>
</tr>
<tr>
<td></td>
<td>100 kwh</td>
</tr>
<tr>
<td>NEEB</td>
<td>$2.94</td>
</tr>
<tr>
<td>LEB (based on a floor area of 1,000 square feet)</td>
<td>3.51</td>
</tr>
<tr>
<td>Paris, France¹</td>
<td>3.87</td>
</tr>
<tr>
<td>U.S. weighted bills reduced to 81.2 percent of original bills</td>
<td>3.27</td>
</tr>
<tr>
<td>South Bend, Indiana (Indiana &amp; Michigan Electric Company)²</td>
<td>3.21</td>
</tr>
<tr>
<td>Indianapolis, Indiana (Indianapolis Power &amp; Light Company)</td>
<td>2.78</td>
</tr>
<tr>
<td>Gary, Indiana (Northern Indiana Public Service Company)</td>
<td>3.26</td>
</tr>
<tr>
<td>Terre Haute, Indiana (Public Service Company of Indiana)</td>
<td>4.33</td>
</tr>
<tr>
<td>Evansville, Indiana (Southern Indiana Gas &amp; Electric Company)</td>
<td>3.13</td>
</tr>
<tr>
<td>New York, New York (Consolidated Edison Company)</td>
<td>4.39</td>
</tr>
<tr>
<td>Chicago, Illinois (Commonwealth Edison Company)</td>
<td>3.10</td>
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<tr>
<td>Nashville, Tennessee (Nashville Electric Service)</td>
<td>2.37</td>
</tr>
</tbody>
</table>

¹Rates were compiled under the simple tariff of 3 kva for 100 kwh of consumption and 6 kva for 250 kwh of consumption. The bills were compiled before the 12-1/2 percent devaluation went into effect.
lish and French utilities. Bills for Indiana cities, as well as for New York, Chicago, and Nashville are also presented. These bills were reduced according to the taxes paid by the utility providing the service.

Table 2 shows a similar comparison at 500 and 1,000 kwh per month. The bills show a significant drop in the average price per kwh in comparison to those in Table 1; this, of course, is due to the off-peak usage of some of the service. Data on the load factors, average monthly consumption, and revenue per kwh are presented in Table 3 to complete the comparison.

For bills compiled at 100 and 250 kwh per month, lighting, appliances, refrigeration, and cooking were the chief elements of consumption. According to LEB, this range takes in a majority of its consumers. For cooking, the rate may well be handled in the next comparison.

At 500 and 1,000 kwh per month, the use of water heating can be added to the uses of electricity mentioned in the preceding paragraph. The English have a space heating rate but the American utilities, for the most part, do not. Space heaters are served under all-electric rates in the United States. It was assumed that 250 and 350 kwh were billed under the night-time rate in the case of 500 and 1,000 kwh respectively. The off-peak rates of the English utilities ranged upward from the RH/1 rate which permits only eight or nine hours of restricted service to the D.1 rate which is an ordinary block tariff. The NEEB off-peak rates permit a maximum of fourteen and fifteen hours a day of restricted service, plus an additional supply on weekends. In contrast, the American off-peak rates permit eighteen or nineteen hours a day restricted service.

The load factors shown in Table 3 vary widely. At the bottom of the distribution stand the LEB and Paris, France, with load factors of 42.2 percent and 43.2 percent. The Northern Indiana Public Service Company (72.3 percent) and Indiana and Michigan Electric of the American Electric Power Company (72.5 percent) stand at the upper end of the distribution. The NEEB is about average. The Northern Indiana Public Service Company has a heavy industrial load concentrated around Gary and Hammond, Indiana.


<table>
<thead>
<tr>
<th>TABLE 2</th>
<th>Monthly Consumption</th>
<th>500 kwh</th>
<th>1,000 kwh</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate D.1</td>
<td>$ 9.54</td>
<td>$17.79</td>
<td></td>
</tr>
<tr>
<td>Rate D.1.T.</td>
<td>8.39</td>
<td>16.49</td>
<td></td>
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<tr>
<td>Rate D.1 + RH/1</td>
<td>7.43</td>
<td>14.58</td>
<td></td>
</tr>
<tr>
<td>+ RH/2</td>
<td>7.80</td>
<td>15.20</td>
<td></td>
</tr>
<tr>
<td>+ RH/3</td>
<td>8.05</td>
<td>15.55</td>
<td></td>
</tr>
<tr>
<td>LEB (based on a floor area of 1,000 square feet)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rate D.1</td>
<td>11.31</td>
<td>21.06</td>
<td></td>
</tr>
<tr>
<td>Rate D.3 (white meter rate)</td>
<td>9.48</td>
<td>18.05</td>
<td></td>
</tr>
<tr>
<td>Rate D.1 + RH/1</td>
<td>8.76</td>
<td>17.33</td>
<td></td>
</tr>
<tr>
<td>+ RH/2</td>
<td>9.16</td>
<td>17.89</td>
<td></td>
</tr>
<tr>
<td>+ RH/3</td>
<td>9.58</td>
<td>19.48</td>
<td></td>
</tr>
<tr>
<td>Paris, France</td>
<td>10.59</td>
<td>19.42</td>
<td></td>
</tr>
<tr>
<td>U.S. weighted bills reduced to 81.2 percent of original bill</td>
<td>8.42</td>
<td>14.84</td>
<td></td>
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<tr>
<td>South Bend, Indiana (Indiana &amp; Michigan Electric Company)</td>
<td>7.52</td>
<td>12.98</td>
<td></td>
</tr>
<tr>
<td>Indianapolis, Indiana (Indianapolis Power &amp; Light Company)</td>
<td>7.53</td>
<td>12.88</td>
<td></td>
</tr>
<tr>
<td>Gary, Indiana (Northern Indiana Public Service Company)</td>
<td>8.62</td>
<td>16.05</td>
<td></td>
</tr>
<tr>
<td>Terre Haute, Indiana (Public Service Company of Indiana)</td>
<td>9.28</td>
<td>14.76</td>
<td></td>
</tr>
<tr>
<td>Evansville, Indiana (Southern Indiana Gas &amp; Electric Company)</td>
<td>8.52</td>
<td>16.04</td>
<td></td>
</tr>
<tr>
<td>New York, New York (Consolidated Edison Company)</td>
<td>12.21</td>
<td>21.13</td>
<td></td>
</tr>
<tr>
<td>Chicago, Illinois (Commonwealth Edison Company)</td>
<td>7.53</td>
<td>13.44</td>
<td></td>
</tr>
<tr>
<td>Nashville, Tennessee (Nashville Electric Service)</td>
<td>6.77</td>
<td>9.04</td>
<td></td>
</tr>
</tbody>
</table>

Rates were compiled under the double tariff for 6 kva for 500 and 1,000 kwh of consumption. The double tariff involves an off-peak rate for night-time consumption. Rates were compiled before the 12 1/2 percent currency devaluation went into effect.
The high load factor achieved by Indiana and Michigan Electric undoubtedly reflects the high load factor achieved as a result of integration with other utilities in the American Electric Power System. In comparison with an industrial consumption of 45.8 percent of the total load for residential, commercial, and industrial for the United States, the Appalachian Power Company has 61.6 percent; the Kentucky Power Company has 63.8 percent and the Ohio Power Company 78.6 percent of the total load. Meanwhile, the Indiana & Michigan Electric Company has 47.9 percent, just barely ahead of the national average. So the first three contribute to the diversity of the load factor of the Indiana & Michigan Electric Company. Incidentally, industrial consumption is 74.0 percent of the combined residential, commercial, and industrial loads for the Northern Indiana Public Service Company. Presumably the Northern Indiana Public Service Company should be combined with some utility which has a higher proportionate residential load in order to achieve the effects of diversity.

Another consideration that has tended to influence the load factor is the extent of interconnections and pooling. Donald C. Cook, president of American Electric Power Company, of which Indiana & Michigan Electric Company is a part, has spoken of the United States as being combined into twelve to fifteen giant, fully integrated electrical systems. To the consumptive economies of diversification there must be added the productive economies of large scale generating plants of over 1,000 megawatts of capacity and extra high tension voltages of the transmission systems up to 765,000 volts, both of which the American Electric Power Company has. The system stretches east and west for 450 miles and crosses two time belts and north and south for an approximately equal number of miles and has achieved the benefits of a high load factor in spite of their air-conditioning load. The TVA-South Central Electric Companies have obtained the economies of joint operation through pooling without merger. Nevertheless, mergers offer the electric utility industry so much more in joint operational economies that they cannot be overlooked. From a legal standpoint all acquisitions are within the province of the Securities and Exchange Commission.

| Table 3 | Load Factors, Average Consumption, and Revenue Per Kwh for Residential Usage 1968 |
|---------|---------------------------------|------------------|-----------------|----------|--------------|
|         | Load Factor | Average Consumption | Revenue | Loss Due to Deduction |
|         |             | Monthly Kwh | Per Kwh | Sold | kWh | Deduction |
| NEES    | 38.4        | 213        | 2.097  |      |     |           |
| LER     | 47.7        | Complete residential | 278   | 2.021 |     |           |
|         | 418         | Offpeak (not included in complete residential) |       |      |     |           |
| Indiana & Michigan Electric Company | 72.5 | Complete residential | 662   | 1.747 | 1.424 |           |
|         |             | Residential | 647   | 1.756 | 1.415 |           |
|         |             | Controlled water heating | n.a. |      |      |           |
|         | 1,981       | All-electric house | 1,573 | 1.191 |     |           |
| Indianapolis Power & Light Company | 57.5 | Complete residential | 530   | 2.009 | 1.571 |           |
|         | 426         | Residential | 2.222 | 1.798 |     |           |
|         | 420         | Controlled water heating | 1,003 | 0.984 |     |           |
|         | 1,008       | All-electric house | 1,367 | 1.029 |     |           |
| Northern Indiana Public Service Company | 73.3 | Complete residential | 410   | 2.520 |      |           |
|         | 385         | Residential | 2.570 | 2.14  |     |           |
|         | 235         | Controlled water heating | 1.21  | 0.99  |     |           |
|         | 1,624       | All-electric house | 1.57  | 1.25  |     |           |
| Public Service Company of Indiana | 67.0 | Complete residential | 536   | 2.902 | 1.893 |           |
|         | 457         | Residential | 2.690 | 2.016 |     |           |
|         | 1,705       | Controlled water heating | n.a. |      |      |           |
|         | 1,705       | All-electric house | 1,590 | 1.192 |     |           |
| Southern Illinois Gas & Electric Company | 48.8 | Complete residential | 538   | 2.34  |      |           |
|         | 481         | Residential | 2.49  | 2.02  |     |           |
|         | 396         | Controlled water heating | 1.26  | 1.02  |     |           |
|         | 1,262       | All-electric house | 1,52  | 1.24  |     |           |
| Consolidated Edison Company (New York) | 50.8 | Complete residential | 728   | 3.97  | 3.07  |           |
|         | 726         | Residential | 3.99  | 3.09  |     |           |
|         | 472         | Controlled water heating | 2.47  | 1.91  |     |           |
|         | 1,802       | All-electric house | 1,88  | 1.46  |     |           |
| Commonwealth Edison Company (Chicago) | 61.7 | Complete residential | 403   | 2.60  | 1.05  |           |
|         | 365         | Residential | 2.76  | 2.07  |     |           |
|         | 361         | Controlled water heating | 1.06  | 0.82  |     |           |
|         | 1,843       | All-electric house | 1,41  | 1.06  |     |           |
| Nashville, Tennessee | 63.9 | Complete residential | 1,567 | 0.833 | 0.754 |           |
| Paris, France | 43.3 | Complete residential | 90    | 3.76  | 3.75  |           |

1968-69 Figures

4. The diversity is the difference among individual electric loads resulting from the fact that the maximum demands of customers do not all occur at the same time.
and the Federal Power Commission, which so far have given approval of a limited number of mergers. From the economical standpoint both the benefits of north-south and east-west diversity of load and economies of scale from mammoth utility systems give reason to hope for decreasing residential rates.

There remains the question of the comparability of English and American rates. Practically all American utilities have off-peak rates for electric water heaters. Availability varies, but it never runs lower than eighteen or nineteen hours a day of maximum use. It appears that American utilities could offer reduced rates for off-peak space heating requirements to encourage the development of those residences which do not require a full electric home but nevertheless want a limited space heating service. The same applies for space-heating customers on the commercial rates as in tourist courts and motels. Industrial usage, however, is not significantly influenced by off-peak rate reductions. For the North Eastern Electricity Board, for example, electricity for industrial use amounted to only a quarter of the total under restricted hour tariffs.

The load factors of American utilities have varied widely; they have been as high as 72.5 percent and as low as 42.5 percent for the companies included in this study. In contrast, the load factors of the English and French systems were somewhat lower. After due allowance is made for tax comparability between English and American utilities, the variety of the rate schedules for residential consumers, and the maximum hours use of the time, there seems little to choose between English and American rate schedules.

Comment

James R. Nelson
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These two papers deal with different types of electricity pricing: for large power users, in the case of France; for residential users, in the case of the United States. They deal with these types at different levels of abstraction: characteristically mathematical, for France; typically numerical, for the United States. And they deal with their subject from different vantage points: as a description of the process of actual tariff construction, for France; as a comparison of American, British, and French residential rates, in the case of the Clemens article. Therefore to attempt to find a common theme as the basis for an entire discussion would be unfair to both articles. Nevertheless, some of the distance between the two articles may be bridged by using, as a foundation, common questions which the articles raise.

The first is very explicit in the Lhermitte-Caille treatment and implicit in Clemens. This is the problem of how to deal with uncertainty in public utility rate making. MM. Massé and Boiteux have been leaders in exploring the statistical aspects of electrical
pricing for the last twenty years.¹ But the earlier work of Electricité de France pivoted around uncertainty of supply. Two decades ago, half of all French electricity output came from hydro sources, so this preoccupation is understandable. But, for largely thermal systems or for systems with important space-heating (or space-cooling) loads, the most important source of uncertainty is demana. As the Clemens article points out, peak loads for American electrical undertakings are now dominated by air conditioning. He might have added that, in cases such as the TVA which involves winter peaks, the space heating load which has created them is inherently subject to influences which are just as aleatory, stochastic, and uncertain—and amenable, if at all, only to statistical analysis.

At this point both articles, in their separate ways, are less than fully satisfactory. The Lherrmite-Caille statement of the statistical problem is simple, elegant, and novel. By placing so much emphasis on the marginal value of the first unavailable unit, it pushes the whole marginal cost argument away from accountancy and toward the demand orientation implied by the word “benefits.” Moreover, the authors pay attention to cumulative or integral examples of possible power failures, connected with influences on the supply side such as drawing down reservoirs or closing down plants for maintenance. But the statistical methodology is much more realistic for France than for the United States. French air conditioning, still au naturel, is practically restricted to shady café terraces; and French electric heating has not progressed even that far. Given the climate, the air conditioning load at least should always remain low by American standards. For American conditions, however, the Lherrmite-Caille assumptions of independent demand fluctuations, consumer by consumer, and the appropriateness of using the standard deviation as a measure of statistical variability seem to intrude the normal curve of error into demand uncertainties which may be due to causes which are large, few, and interdependent. A hot day is like an epidemic; it tends to affect everyone at the same time.

But having expressed reservations about the application of the Lherrmite-Caille methodology to the American climate and to American methods of coping with it, it must be admitted that their approach does provide a good deal of guidance even for American conditions. The first guideline worth stressing is their argument that peak contribution need not always be covered by a fixed charge; an addition to the energy charge may be more appropriate. Their second guideline is that the introduction of stochastic considerations may affect the relationship between the appropriate fixed charge and the appropriate energy charge. And their point is that load duration, when combined with any degree of average peak responsibility and of load variability, may have an independent influence on the appropriate price structure. Moreover, no matter how aleatory the characteristics of the air conditioning load may seem to be, the fact remains that different types of air conditioning may produce different peaks, different durations of peak use, and different relationships between maximum use of electricity per consumer at the system peak and average use for this same consumer at the system peak. Finally, even a so-called air conditioning peak is not created by the air conditioning load all by itself. The ultimate height of the peak is partially determined by the height of its supporting plateau. And this plateau, formed in different ways by different influences, may be more amenable to the Lherrmite-Caille analysis than the peak itself.

With respect to the special attributes of the space-heating and space-cooling demand for electricity, the Clemens article is both more relevant to American conditions and analytically less helpful than the Lherrmite-Caille discussion. Clemens is more relevant because he concentrates on the residential load, which in the United States is a source of a considerable part of both air conditioning and space-heating demands for electricity. He is also more relevant in that he notes the existence of time-of-day tariffs which are specifically designed both to develop and to control various aspects of the residential demand for various forms of electric heating and cooling. But he does not carry this analysis all the way. His presentation can be extended by borrowing from that of Hans Nissel.² Nissel points out that the main difference between U.S. and French residential rates lies in the French emphasis on time of use, as opposed to U.S. emphasis on amount of use. The two systems are not as different as this contrast may suggest because many U.S. electrical utilities have special functional rates which are at least generally related to


time of use. But Nissel's point, that U.S. practice in residential rate making has been to adopt relatively simple rate structures and hope for general expansion of load to eradicate or compensate for immediate peak problems, is nevertheless an important reminder of the difference between residential electrical rate making strategy in much of the United States and that employed in France and in other countries.

This difference leads to a final main point—for all the emphasis in France and Britain on costs of new investment as ingredients in the problem of calculating marginal cost, and for all the Lhermitte-Caillé stress on how changed conditions of supply and demand in France have affected French marginal costs, the fact remains that the marginal cost rate approach tends to tie the analysis down more closely to static considerations. The approach via maximizing growth of quantity sold may involve the burning of all analytical bridges, and hence a permanent departure from rational dynamic as well as static analysis. This is especially true for a general reason discussed by Lhermitte and Caillé; namely, that electricity rate making involves tariffs, which must be preserved intact over relatively long periods of time and not just prices which may fluctuate over short intervals. Thus the American approach may produce cumulative misallocation by freezing obsolete prices into the structure in the face of progressive changes in demand and supply. It is also true because, as Lhermitte and Caillé point out, in a tariff-dominated (not just price-dominated) market, alternative price assumptions must be worked into forecasts of quantities demanded. So the U.S. approach may be incapable of calling in any other kind of analysis if it neglects static marginal cost analysis. But U.S. practice may still be more dynamic if standard block tariffs are supplemented by an array of special rates. Aside from problems of discrimination, this approach contains obvious dangers if the final follow-on block rate is too low, or if the loads adding most to the peak cannot be properly penalized once they involve consumption on the lower blocks. But before the days of the domestic air conditioning load, U.S. ignorance came close to bliss. In areas with long summers and mild winters, it may still. Elsewhere, the rarity of an explicit time dimension in U.S. residential rates may eventually prove to be as objectionable in dynamic practice as it always has been in static theory.

Rate Making: Incremental Costing and Equity Considerations

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One of the major challenges confronting a multiservice, nationwide public utility is the establishment of the "right" prices for its services. There are at least four objectives which should normally be considered in the evaluation of particular rates or prices. These are: (1) reasonableness of company earnings, however defined, (2) productive efficiency, (3) the responsiveness of supply and of the allocation of resources to the desires of consumers, and (4) maintenance of some degree of competition. These four objectives cannot, however, be considered to be on a par. The first three of these may appropriately be accepted as ends in themselves, while in terms of the logic of the free market economy, the fourth, maintenance of what may loosely be referred to as workable competition, constitutes an important means to the other ends rather than an ultimate economic goal.

In the case of a public utility, the duplication of facilities that would be required by a substantial number of competitors is nor-
mally prohibitively wasteful. In that case, something approaching what the economist calls "natural monopoly" is unavoidable and is in fact desirable, so long as the decisions of the firm are kept within the bounds set by considerations of the general welfare.

A regulatory agency normally permits the company to obtain an overall rate of return which the agency considers adequate and reasonable. Having decided on the level of this aggregate return the agency may then desire to evaluate the appropriateness of the rates proposed or charged for individual services, a problem which raises difficult issues of social policy and involves considerations of justice and economic efficiency. In addition, the agency must permit management sufficient flexibility in the selection of these rates to encourage as full utilization of facilities as is possible and to offer some reward for efficiency of operation and for technological innovation.

Role of Cost in Rate Making

Costs can provide a criterion for judgment of unrecoverable rate levels. But it must be recognized from the outset that cost data alone can never legitimately be used to set a price since an appropriate price can only be determined on the basis of both cost and demand relationships. Moreover, cost is normally not a unique figure, since it will characteristically vary with the volume determined by the state of demand.

Even if cost data are utilized only in determining a floor below which prices will not be permitted to fall, they can never serve as an unambiguous criterion of destructive competition. For this reason no cost test alone will suffice to prevent such action. In essence, destructive pricing (competition) may be described as the temporary reduction of a rate to a level below that which would serve the normal long-run interests of the firm, whatever the goals of the firm may be, other than the deliberate elimination of competition. But without reference to demand patterns one cannot determine that rate level, and so one cannot be sure whether a proposed rate falls short of that level, no matter what the cost figures show.

Nevertheless, cost data do constitute a critical component of the information needed for rate making and, as widely recognized economists all agree, the pertinent cost statistic is marginal cost or some approximation to it. Marginal cost is, of course, the change in total cost incurred by the supply of an additional unit of some output. A slightly broader but related concept that is often encountered in regulatory discussions in practice is incremental cost, which refers to the cost of an additional quantity of output without specifying the magnitude of that output change. The relevant incremental costs are those incurred in the long run. That is, besides covering direct short-run costs of labor and materials and a normal rate of return on additional capital, these costs must include amounts sufficient to cover the capital costs required to provide the incremental unit of output over the indefinite future. It should also be recognized that in practice the available data will be no more than reasonable approximations to the ideal concept of marginal cost of pure economic theory.

The position that prices should be based upon a calculation that utilizes marginal cost, however, does not mean that prices should be set equal to marginal cost. On the contrary, when discussing any real pricing problem in which the firm is expected to earn enough to cover its total costs and a return on its capital the price of its services normally cannot be set equal to their marginal costs. Marginal costs should in these cases serve as a floor to pricing, and the overall revenue requirement necessarily will require that prices will normally lie above incremental costs.

As any elementary text will remind us, marginal cost is the cost datum which tells us whether or not the decision maker is behaving optimally. In particular, we see that if incremental cost is below price, then (depending on the demand configuration) a rate increase and the consequent contraction of volume may well be inimical to the interests of both the firm and the community. If the rate increase results in a decline in volume so great that the resulting decrement in revenue exceeds the decrement in cost, it must harm the supplier by decreasing the net contribution to his profits and overhead, and it must also harm the public by making the service available at a higher price.

In a multiproduct enterprise, whose pricing is determined rationally, there will normally be variation (and sometimes wide variation) from product to product in the ratio between incremental cost and product price. Only if the demand relationships (elasticities of demand) were the same for all products would these ratios be identical. Moreover, even those services whose prices are close to
their incremental costs may nevertheless be making their maximal contributions to profit and overhead.

It should also be observed that it is the service's contribution to profit and overhead which is significant, not any ratio purporting to be a rate of return for a particular service. In determining the incremental cost, a return on the incremental investment (the cost of capital) must of course be included. But for an individual class of service, this is the only way in which rate of return should enter the cost calculation used in setting price. Generally it is not even possible to calculate an overall rate of return for an individual service without some arbitrary apportionment of the common costs of the enterprise in arriving at the total costs ascribed to the service in question.

In dealing with any real problem relating to the pricing policies of an established firm it is clearly inappropriate to utilize as the relevant cost datum what has been characterized as the "Vinerian marginal cost," which implies that in each decision a firm must consider itself recreatable de novo with no plant, equipment, or anything else inherited from the past. It would be absurd to attempt to regulate any public utility on the basis of such a standard. To see what the relevant marginal cost is, consider the situation at any point in time with all current plant and equipment given. Let us then estimate the prospective trends in demand for a particular service and the associated operating and capital costs now and in the future. Suppose that a reduction in the price of the service were to bring some increment in its current and future demand and that we could estimate the corresponding changes in present and future operating and capital costs. The difference between the present values of these two cost streams—between the anticipated current and future costs before and after the demand increase—is the relevant incremental cost corresponding to the change in output in question.

When coming to grips with a real pricing problem, economists employ a concept that may be called an "intermediate" long run, instead of the pure and unusable concept of the theoretical long run. The intermediate long run is long run in the sense that it includes all capital costs associated with the expansion in output under examination. Moreover, it takes into account the cost consequences as far into the future as can be foreseen. It is, however, not perfectly long run because it does not assume that all assets are perfectly liquid with no plant and equipment inherited from the past. The cost of the increment is the economically relevant incremental cost even though the inherited plant is present.

The concept of an intermediate long run was not recently invented. Economists have long recognized the existence of cases intermediate between the two polar extremes—the short and the long run. For example, Marshall noted:

Of course there is no hard and sharp line of division between 'long' and 'short' periods. Nature has drawn no such lines in the economic conditions of actual life; and in dealing with practical problems they are not wanted.
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(1) Decreasing costs refer to economies in unit variable costs made possible by changes in volume supplied. Costs that decrease over time do not, by themselves, prove the presence of economies of scale. However, one can hope to test for economies of scale from time series data if one can isolate the effects of exogenous technological changes and other exogenous variations aside from those associated with changes in the volume of operations.

(2) While there is also a corresponding short-run concept, the preceding definition has been phrased in terms of long-run costs to emphasize that variable capital costs must be included in all calculations relevant to this case.

(3) Decreasing costs, as defined, may involve a change in the nature of the technology used, but they must not reflect any change in technological knowledge. An example from the telephore industry will make this clear. Suppose there were some point in time at which both microwave and coaxial cable transmitted messages, but the volume of demand was so small that it was more economical to use the former. If, however, with a larger level of demand the installation of cable would have permitted reduction in costs per unit this is a legitimate example of decreasing costs. For the choice between microwave and cable involves no new invention. It is merely a selection of the technology appropriate for each volume of operation.

(4) However, if it can be demonstrated that it is more economical for a large firm to produce and institute changes in technology, then this may be the source of a very real economy of scale. In effect, the technology serves as an input to the operation of the firm and if larger firms are more efficient achievers of technological advance, they in effect achieve decreasing costs in the production of this input.

The presence or absence of decreasing costs for a real-world firm is, in essence, a factual issue. It has been surmised by some witnesses in the Bell Interstate Rate Case that marginal costs may have leveled off over some range of output and that this indicates the absence of economies of scale. This assertion appears to imply, incorrectly, that economies of scale are absent where marginal costs are constant over a relatively narrow range of output levels. If it takes X more units of plant to produce Y more units of output, then where plant is in fact replicated it may very plausibly be expected that 2X units of plant will be needed to provide 2Y added units of output. But it does not follow from this by any mathematical or any other principle that average costs must then be anywhere near constant over the relevant range, as the following table’s simple arithmetic readily illustrates, for either short-run or long-run costs:

<table>
<thead>
<tr>
<th>Output Level</th>
<th>Marginal Cost</th>
<th>Total Cost</th>
<th>Average Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>3</td>
<td>6</td>
<td>36</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>42</td>
<td>8.4</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>44</td>
<td>7.3</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>46</td>
<td>6.6</td>
</tr>
</tbody>
</table>

It is an elementary theorem of marginal analysis that if average costs are constant, marginal costs and average costs must be equal. But no such presumption follows from the constancy of marginal costs. In the preceding table where marginal costs are constant for a given range, average costs are more than three times as large as marginal costs. Hence, if taken literally, it is fallacious to argue that because (allegedly), at some point in time, a further incremental expansion of operations will lead to replication of plant and hence to constant marginal costs that the marginal cost for a service can be approximated by some measure of its average cost.

Indeed, the conclusion that if economies of scale are exhausted, average costs will equal marginal costs applies only to the type of prospective average variable costs considered by economic analysis. It does not apply to fully allocated costs (derived by relying on some arbitrary measure of relative use to allocate common costs). First, it must be remembered that fully allocated costs are historical, and so bear no necessary relationship to marginal costs which

3. The distinction is not a truill. If costs are reduced by a new invention which just happens to occur at the same time as a rise in volume, the savings may not require a large scale of operation for their continuation. With the new technology two smaller firms might now be able to operate as cheaply as the old large one.

4. FCC Docket No. 16258.
are entirely current or prospective. Second, the effects of the judgmental allocation are unpredictable in terms of marginal analysis. Thus, even if prospective average variable cost were equal to marginal cost, there is not the slightest reason to assume that some fully allocated cost datun is a good approximation to marginal cost.

Before leaving the general area let me comment briefly on the contention that only short-run costs can decline as a result of unused capacity. It is not difficult to show, on the contrary, that unused capacity can give rise to long-run decreasing average costs. This occurs, for example, in a growing industry in which new equipment is constantly being installed and therefore more efficient to install plant and equipment with capacity sufficient to meet future needs. Here unused capacity will clearly exist for the indefinite future and will represent a rational response to the needs of the firm. Similarly, long-run unused capacity can arise because of complementarities in production — plant just adequate to meet the demand for service A may be more than adequate to meet the demand for service B. In each of these cases greater utilization of the unused capacities, which are neither temporary nor the result of miscalculation, can clearly lead to reduction in long-run average cost.

**Fully Allocated Embedded Cost and Price Setting**

Those who argue for the use of fully allocated costs as a standard of pricing suggest that it will assure that each service will provide a proper contribution toward the fixed obligations of the firm.

Economists reject these arguments on several grounds maintaining (1) that it is impossible to define unambiguously a fully allocated cost, so that any price that purports to be based on such cost is unavoidably arbitrary, (2) that fully allocated cost pricing cannot guarantee that every service will provide a net contribution toward the firm's fixed obligation, and if they do make such a contribution it will generally be lower than that which results from a price based on a correct incremental revenue — incremental cost calculation, and (3) that fully distributed cost pricing can be inimical to the interest of the firm, the consuming public, and the general welfare.

A fully distributed cost calculation undertakes to allocate costs which are essentially indivisible. A dam can simultaneously serve navigation, flood control, and the production of electricity; a radio relay antenna can transmit microwave signals for message toll service, WATS, TWX, and TELPAK; a railroad track can simultaneously serve the transportation of passengers and a variety of commodities. Hence, their cost cannot be traced to any of these uses in particular, as is required by the notion of a fully allocated cost. One can, of course, allocate it arbitrarily in any of a variety of ways: it can be divided equally among all services, in proportion to the incremental costs of the various branches of activity of the enterprise, in proportion to their sales volume, and so forth. The results of any one such arbitrary apportionment will normally be incomplete by different from those stemming from any other, and for many purposes there is no logical basis for choosing any one of these criteria as against any other.

Though incremental costs are by no means easy to estimate and in practice one should not expect more than good approximations to their magnitude, at least their definition is unambiguous. Unlike the case of fully allocated costs, it is possible to clearly determine the nature of the datum that is being sought.

But even if it is conceded that the fully distributed cost allocation is arbitrary, it might still be maintained that it guarantees a profitable operation to every segment of the firm. By assigning to each part of the firm's production some share of the overhead burden it appears to make certain that total costs will somewhere be covered. But the fact is that no cost calculation can guarantee the profitability of the service; that depends also on the state of demand for the production of an item that has gone out of fashion cannot make ends meet no matter what cost accounting procedures it employs. A full cost calculation will bring in the revenues it is designed to obtain only if the demand expectations on which it is based turn out to be justified. A firm providing only one service, with a million dollar overhead and a $12 fully distributed cost price (including a dollar of profit and a dollar of variable cost), will easily cover all its costs if it sells 100,000 units, but if only 10,000 units of its product are sold it will suffer a heavy loss, the fully allocated cost price notwithstanding. Indeed, since only a price consistent with an incremental cost calculation can produce maximal profits, it is necessarily true that such a price will yield profits at least as high as those that will be brought in by a price based on full costing. Of course, even then the firm is not guaranteed a net profit, but it will by definition certainly earn no less than a full cost price could provide.
It is also easy to show that the profitability of a service can sometimes be increased by a reduction of a price to a level below fully allocated cost, but one which covers incremental cost. Consider an enterprise with a million dollars in fixed costs and a service whose variable cost is one dollar per unit of output. If at a price of $10 it sells 100,000 units the price will clearly not cover its full cost—it will bring in $1 million and its total cost will then be $1,100,000. Nevertheless, a reduction in price further below the initial full cost level of $5 will bring a profit to the firm if it trebles sales for then total revenue will be $5 \times 300,000 = $1,500,000 as compared to a total cost of $1,300,000.

A full cost price can redound to the disadvantage of almost everyone concerned. It may harm the firm by making it forego the profits that could be obtained on the basis of demand and incremental cost considerations. It will harm the consumer of the service in question by forcing him to pay rates higher than those at which the company wishes to supply its services. For a multiservice firm, it can harm customers for the firm's other services by preventing the service in question from providing its maximal contribution to profits and overhead. And, particularly where there are economies of scale or unused capacity, it will produce wastes and inefficiencies in the operation of the economy by an unnecessary reduction in utilization of the services of a multiservice firm caused by forcing it to charge prices that are unattractively high.

Above all, fully distributed cost prices are an inappropriate means for the maintenance of competition. Surely, keeping prices high in the first place is not the way to prevent the excessive prices that it is feared will result from a reduction in competition.

I want to assert without qualification that I know of no economist of outstanding reputation who differs substantially from the basic position I have just taken. Thus, the views which I am offering here must not be taken to be simply my own or those of a small group of individuals unusual in their outlook. Rather, it represents the convictions of the leaders of the profession. Surely, the remark-
a rate reduction may be the only way to eliminate such a burden. (c) Even if rates for different services are not proportionate to fully allocated costs, one is not entitled to conclude that any of these services is a burden on any other service or that it will necessarily serve the public interest to raise those rates that are lowest in relation to fully allocated costs.

Proposition (a) is relatively easily justified. An operation is a benefit and not a burden to the firm if it permits the firm to serve the customers for its other services more cheaply. If that service brings in to the company more than it adds to the company's cost of operation, then it makes a net reduction in the fixed cost burden which the company must somehow meet if it is to continue in operation. Thus, the operation must be beneficial if the service's total revenues exceed its total avoidable cost—the outlays that the company would save if this part of its operation were closed down.

But suppose it is decided that some service is a burden, or suppose it is decided on some ground that it is not making a sufficient contribution—what should be done about it? The obvious course of action would appear to be an increase in rates. But depending on the nature of demand patterns this may be precisely the wrong thing to do. The issue can only be decided rationally in terms of incremental costs and revenues.

The following table brings this out clearly through a numerical illustration which, for the sake of simplicity, relates to a single product firm in which the total cost is also assumed to be the avoidable cost. Suppose the price of the service in question were set at $9, so that 1,200 units would be sold. The operation is then clearly a burden—it yields a net loss of $50. Yet a rise in price to $10, instead of reducing that loss, raises it to $450 while a price cut to $8 per unit is able to eliminate the burden and put the service on a beneficial basis.

Note also that the initial price ($9) is below the full cost of the operation (the unit cost is $10.850 divided by the number of units, 1,200, which is greater than $9). Yet despite the fact that price is below full cost (in this simple case where, since the firm produces only one product, full cost can be defined and measured), not an increase but a reduction in price can put the operation on a basis where it is not a burden. This illustration then should demonstrate conclusively the absurdities of rate making decisions based on full costs.

<table>
<thead>
<tr>
<th>Sales volume</th>
<th>Total cost</th>
<th>Incremental cost per unit</th>
<th>Total revenue</th>
<th>Incremental revenue per unit</th>
<th>Total profit (loss) on operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>$10,450</td>
<td>$2.00</td>
<td>$10.00</td>
<td>$10,000</td>
<td>$4.00</td>
</tr>
<tr>
<td>1,200</td>
<td>10,850</td>
<td>1.50</td>
<td>9.00</td>
<td>10,800</td>
<td>2.00</td>
</tr>
<tr>
<td>1,400</td>
<td>11,150</td>
<td>1.00</td>
<td>8.00</td>
<td>11,200</td>
<td>0</td>
</tr>
<tr>
<td>1,600</td>
<td>11,350</td>
<td>1.00</td>
<td>7.00</td>
<td>11,200</td>
<td>-150</td>
</tr>
</tbody>
</table>

It follows that there is no economic import to variations in rates of return to the various services of a company as determined by a fully allocated cost study. For as we have seen (a) avoidable costs and not fully distributed costs are relevant in determining whether a service is a burden; (b) rates for different services are likely to vary from the corresponding incremental costs—the cost figures relevant for rational rate decisions. It follows that these rates should be expected to vary widely from the arbitrary fully allocated cost figures—economists would be highly surprised if it turned out to be otherwise; and that even where a rate is low in relation to fully allocated cost, a rate increase will not necessarily make the service beneficial to the firm.

But What About Fairness?

There still remains the important issue of distributive justice. What if, under the approach to rate making outlined above, some rates are set close to marginal costs while other services are priced well above their marginal cost levels? Is this fair to all of the consumers involved? Does not a fully allocated cost standard provide a reasonable criterion of fairness?

First, let me make my position clear on the general issue of distributive justice—neither I nor any other economists are in a particularly good position to lay down absolute standards of fairness. But this should not be misconstrued to mean that economists think distributive justice is unimportant.

Let me offer several general comments which help to explain my willingness to favor an incremental cost pricing standard despite
any questions about its distributive implications. First, it should be recognized that distribution is an area in which the appearances relating to equity can be highly misleading. For example, in connection with the Bell interstate rate investigation, it may appear that low MTT (message toll telephone) rates benefit the small consumer, while low rates for other Bell System services only serve the purposes of big business—the purchaser of these services. In fact, this is wrong on two scores. First, much, if not the bulk of MTT interstate traffic during the peak hours (where MTT rates are relatively high), is, I am informed, composed of business calls. Thus, a reduction in daytime MTT rates is not obviously less of a boon to business interests than is a cut in, say, private line rates. Second, it should be recognized that in many cases a reduction in costs to private business is passed on to the consumer. Indeed, where the business customer in question operates under conditions involving economies of scale, a given initial cut in the rates charged the customer may well result in a larger ultimate reduction in price to the consumer.

As long as the revenues of a service exceed its incremental costs in a company with an overall revenue requirement subject to regulatory constraint, then the provision of the service must contribute to the benefit of the consumers of other services. If competition makes it impossible to sell service A at any rate higher than X dollars and at that price service A covers more than its long-run avoidable costs including (the annual equivalent of) incremental capital costs and the required rate of return on these costs, then the provision of this service must be beneficial to the consumers of the company’s other services.

A conclusion in these circumstances that service A has no right to exist because it does not cover its fully allocated costs, however that figure may have been invented, i.e., the assertion that in this case equity is violated because the users of service A do not bear their share of the burden, imposes a dog-in-the-manger standard of equity. It is tantamount to the assertion that it is better for the consumers of service B to force them to pay a higher price for their own good because otherwise the purchasers of service A will receive benefits even greater than theirs. Surely a regulatory commission does not want to be in the position of imposing higher rates on others as a means to reduce the benefits accruing to the customers of a competitive service.

Incremental Costing in Practice

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There are many thorny problems involved in the determination, for rate making purposes, of the appropriate costs imputable to separate categories of interstate and other intercity telephone services. In addition, the theoretical concepts applicable to such problems, which, of course, are not unique to the telephone industry, are difficult to apply. These problems arise largely because the characteristics of the interstate and other intercity telephone plant and operations, which are to be examined in the determination of the appropriate costs of particular services, call for consideration of the use of common facilities, cost-responsibility, and alternative courses of action. There are, of course, certain traditional mechanical methods of cost analysis involving full allocations of embedded (historical) costs that can generate almost endless streams of “cost data,” all of which might be argued to be solutions to the same problem.

However, as shown by William Baumol, in his contribution to this volume, such cost analyses should not be utilized for rate making purposes. Consequently, other methods designed to translate conceptual marginal analysis to a useful practical tool for the rate making process should be employed. It is the design of these methods that gives rise to the practical problems previously mentioned.

In this respect, the objective of the forward-looking cost studies that were undertaken for Phase 1B of the Bell Interstate Rate Case dealing with rate making principles and factors was to develop costs that would be the most useful in providing guidance for the appraisal of rates for particular interstate service categories. The cost analyses were based on the most recent data available and were designed to identify the long-run incremental costs properly attributable to the specific service categories under study. The cost information needed in the determination of forward-looking rates for a particular service category should, of course, be based primarily on costs currently and prospectively attributable to the furnishing of the particular service category.

A few general observations about cost studies would seem to be in order at this juncture. Cost analyses of different types are used for a variety of purposes (e.g., for jurisdictional separations of interstate and intrastate expenses and investment, for assistance in making engineering decisions, for formulating future construction programs, and for guidelines in the pricing of services). No one type of cost study is suitable for all purposes. Therefore, any cost study and the methods employed should be evaluated in light of the intended use of the cost data. It should be recognized that cost studies made to provide guidance in the appraisal or design of rates are intended to supply important data for the process of selecting one of a number of alternative courses of future action. The determination of current and prospective costs is necessary for such purposes because the pricing decisions to which such costs are relevant must look toward the future. Furthermore, the cost characteristics of particular service categories in recent years have been increasingly affected by changes in operating conditions, in the types of facilities used, in the kinds and sizes of markets, and in changing patterns of use. It should also be recognized that costs assignable to the various service categories, especially when these services make common use of facilities, cannot be determined with absolute precision. Any calculation of costs for an individual service is, therefore, necessarily an estimate involving varying degrees of judgment even though the total embedded costs for all services in combination are thought to be known with accounting precision.

**Determination of Costs of Particular Services**

The making of cost analyses to be considered in decisions as to the pricing of particular interstate communications services is a complex and intricate matter. An appreciation of the complexities involved in making such cost studies requires recognition of certain characteristics of the Bell System's interstate (and other intercity) plant and operations. (These characteristics are, of course, the same for any multi-service telephone company.)

One basic characteristic of the telephone business is that much plant is used in common for furnishing a number of services. This is true of by far the largest part of the interstate and other intercity plant. Thus, the costs and expenses associated with such plant are in the nature of "common costs" that cannot be directly identified with a particular service. For example, a radio relay system may be used to transmit and receive microwave signals for some or all of the various interstate and other intercity services. Consequently, the equipment employed should be identified with the radio relay tower, with the land upon which the tower is situated, with the access roads and buildings, with the antennas and wave guides, and with other parts of the radio relay system are common to most if not all the different interstate and other intercity communications services.

There are, of course, many formulas, including those based on "relative use" considerations, which can be devised as a means to apportion these common costs. But no one formula provides a solution which is necessarily the best answer from the standpoint of the economics of the situation. Indeed, it has been said that the use of any formula to apportion all the common costs is an attempt to allocate costs that are inherently unallocable. 3

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2. FCC Docket No. 16258. Phase I A of Docket No. 16258 dealt primarily with the issue of rate of return.

3. See, for example, the testimony of J. C. Bonbright, Bell Exhibit 25, pp. 31 and 42, in Docket No. 16298.
Another basic characteristic of interstate and other intercity telephone plant is the shifting of facility assignments among services. The determination of costs properly imputable to a specific service is further complicated by the fact that many of the varied plant facilities are used interchangeably for furnishing different services. An inventory of the use of the plant at one particular point in time does not necessarily indicate that the existence of such plant was caused by the service currently using it, or that this same plant will be used for the same service throughout its life. Decisions with respect to the assignment of existing facilities, as well as those with respect to the construction of new facilities, are based upon the objective of achieving maximum efficiency and economy for the entire operation, and thus achieving lower overall costs for the business as a whole. Consequently, the actual assignments of facilities to the various service categories are constantly shifting. For example, certain facilities may have been assigned to message toll telephone service at one time and may be reassigned to various private line services at another time.

Still another basic characteristic of interstate and other intercity telephone plant that is relevant is the presence of declining unit costs which are sometimes characterized as economies of scale. The process of determining costs for rate making purposes should take into account the fact that much of the interstate and other intercity plant is subject to declining unit costs. By using the expression "declining unit costs," or "decreasing unit costs," to refer to the characteristics of facility systems, which lead the average unit costs to decline as volume or output is expanded. Because of the existence of such decreasing unit costs, the rates charged for a service may, by affecting the volume of use and the type of facility used, significantly affect the unit costs of the service. Thus, although costs are a factor in determining rates, the rates themselves conversely may be a factor affecting the costs.

Several factors have been responsible for the declining unit costs which we have realized in our interstate and other intercity operations. The growth in the use of communications services of all kinds has permitted more efficient utilization of our facilities. Furthermore, increasing circuit demand has made possible the use of broader band types of facilities (i.e., higher capacity technologies). Moreover, planned research, which anticipated increases in demand, has resulted in advances in technology, which have made it possible to increase the capacity of existing facilities and thus produce lower unit costs (e.g., TD-2 radio relay systems are now being converted at relatively low cost to TD-2B systems, which have double the voice grade circuit capacity of TD-2, and most L-1 coaxial cable systems already have been converted to L-3 systems thereby tripling the voice grade circuit capacity).

Without discussing technical engineering terminology and other specific examples from the Bell System, it should be mentioned that the growth in the use of communications services has contributed to declining unit costs for much of the interstate and other intercity plant through more efficient utilization of facilities, including increases in capacity of existing systems through specific design, and the use of higher capacity types of plant with lower unit costs.

The decreasing cost characteristics of interexchange circuit plant associated with the provision of interstate and other intercity services generally benefit users of all types of communications services. There may be a proportionately greater benefit to the private line users because, to a greater extent than is true of the switched network services, the plant needed to furnish the private line services, having practically no switching equipment, has a higher proportion of interexchange circuit plant relative to the total plant required. In addition, the switched network services have traffic operating costs which are not found in the operating cost of the private line services.

Oddly enough (and those who are intimately familiar with the telephone business find this surprising), it has been suggested by a few individuals in their testimony in Docket No. 16258 that Bell may have exhausted its economies of scale. However, this is not the forum to carry out this discussion since it may essentially involve nothing more than differences in the definition of the term economies of scale. Suffice it to say that my testimony in the Interstate Rate Case,4 additional evidence on the record in that case, and current studies support the conclusion that Bell's economies of scale have not by any means been exhausted.

4. FCC Docket No. 16258.
Inappropriateness of a Fully Allocated Embedded Cost Approach

In analyzing the significance of any cost study to assist in making pricing decisions, it is essential to consider whether the study presents the cost information that is most useful for this purpose. A cost study involving a full distribution of historic costs among service categories, such as the "seven-way cost study" (a fully allocated embedded cost study of all interstate services based on relative use that Bell was required to undertake by commission order), does not achieve the objective of presenting meaningful cost data needed for the rate making process. Such an analysis cannot reveal the extent to which a service is contributing to the overall earnings of the interstate business or to the coverage of the common costs of operation. On the basis of such studies, management cannot determine whether rate changes are required, nor can it determine the extent or direction of any needed rate revisions. The incomplete cost information provided by such studies cannot be utilized to tell management whether there would be a gain or loss in net income as a result of the raising or lowering of rates.

Fully allocated studies of this type, by definition, deal with embedded or "sunk" costs—the costs that have already been incurred in a past period. It is the prospective costs, however, that are material in guiding decisions regarding a future course of action as to the pricing of a particular service. Furthermore, traditional analyses of fully allocated embedded costs do not appropriately reflect the significance of declining unit costs which, as previously mentioned, are an important characteristic of our interexchange plant. In addition, a full distribution of historic costs among the categories of services on the basis of relative use does not assign costs on a cost-responsibility or cost-causation basis. Under such relative-use type studies, the greater portion of the total interstate costs—representing facilities used and expenses incurred in common for many services—are assigned to the different categories of services by methods which, to a significant degree, disregard the extent to which any particular service occasioned the incurring of costs assigned to it.

Advocates of a full allocation of embedded costs based on relative use sometimes argue that such costs are useful to indicate the level of rates required of each service category, so that each category will contribute proportionately the same amount to the total enterprise as each other category. This contention necessarily assumes that the relative cost and market conditions for each service are substantially the same. In reality, this is a false assumption. The fact is that each service has differing cost and market characteristics and can contribute to the coverage of the common costs of the enterprise only in differing proportions depending on the nature of the supply and demand characteristics of the service.

It has also been argued that the results of a fully allocated cost study based on relative use can provide a reasonable point of departure for rate making, and that marketing and other considerations can be taken into account to vary rates from the levels indicated by such a fully allocated cost study. But full distributions of embedded costs, no matter how determined, provide incomplete cost information for such purposes. There would be no way to judge from such cost information whether rates raised above or lowered below the levels indicated in a fully allocated cost study would result in an increased or decreased contribution to the total business. It is only by analyses of additional (incremental) costs, current and prospective, together with market factors, that we can determine the extent to which the revenues from a service will contribute to the coverage of the common costs of the enterprise.

Moreover, analyses of fully allocated embedded costs can often present cost information that is misleading in several respects. If such cost studies are used as the fundamental basis for rate making decisions, there is a serious risk that the wrong decisions may be made.

Familiarity with the regulation of the entire interstate operation on the basis of an overall rate of return leads to an understandable tendency to apply this same standard to each of the segments of the interstate business for purposes of setting rates for particular services. Undue significance is sometimes attached to a rate of return figure for each service category. But use of this standard when determined on the basis of a full distribution, determined by relative

5. FCC Docket No. 14650, Bell Exhibit 81, and FCC Docket No. 16258, FCC Exhibits 1-8, 37, 53, and 54.

6. For an example of this, see Bell Exhibit 24, pp. 17-19, in FCC Docket No. 16258.
use, of the embedded costs of the entire interstate business, would, in fact, interfere with a proper determination of rates. Rate of return figures based on fully allocated embedded costs applied to segments of the business can be very misleading. A service category showing a relatively low rate of return on embedded costs, allocated on a use basis, may have made, and may still be making, a contribution to the coverage of the common costs of the enterprise, which is both substantial and greater than it would be if rates were to be set to return a higher rate of return on such an embedded cost basis. Wide variations in such rates of return for different categories of service do not show that any service is either underpriced or overpriced.1

In short, earnings ratios for segments of the business based on studies of fully distributed embedded costs are not significant for appraising the appropriateness of rates for the different services. Cost analyses based on such allocations of the common costs, no matter how painstakingly done, and no matter how seemingly precise, do not provide the guidance needed for determining the appropriate level and structure of rates for particular services.

The seven-way cost study provided an especially striking example of a fully allocated embedded cost study with significant instances of numerous infirmities.8

Initial Analyses of Costs Relevant for Rate Making Purposes

Generally speaking, the Bell cost analyses advanced in Phase I B of Docket No. 16258 used a costing approach that attempted to overcome the infirmities of fully allocated embedded cost studies by the development of long-run incremental cost (LRIC) data for the particular service categories involved. The term “full additional costs” was used by the Bell System early in the case to correspond broadly to what economists would call long-run incremental costs (i.e., an empirical proxy for the theoretical concept of LRIC). Whatever the term used, the analysis sought to estimate the added costs which would be incurred over the long term because of additional service being furnished—costs over and above those which would have been incurred if such service were not furnished. These costs were not merely out-of-pocket or short-run marginal costs, but included a full share of capital and other costs required for expansion. They represented the estimated total costs that would have to be incurred over the long term in order to provide the additional quantity of service.

Bell’s initial practical approach to the incremental cost concept in Docket No. 16258 did not involve computing the cost of adding just one unit of service or just one private line customer. The total additional costs of furnishing an entire category of service were computed. The most recent market estimates available were used as quantitative models for the number of units of plant involved, including the mix (combination of facility types) and various lengths of haul of interexchange facilities applicable to the service under study.

It should be emphasized that practical incremental cost analyses of the long-run variety should include the proportionate increases in plant capacity required for provision of the service. Thus, many plant costs which, in the short run, could be considered to be fixed costs were treated as variable costs in our long-run analyses. And, of course, all elements of cost associated with the additional investment were taken into account including amounts for return on the investment and related income taxes. The cost analyses included not only costs of separately identifiable items of plant which were directly assignable to the particular service, but also costs of plant provided for use in common with other services to the extent that it was estimated such plant would be added because of the service in question. Similarly, the analyses included an amount of common overhead expenses imputed to the addition of the particular service.

The methodology of the full additional cost analyses involved, as a practical approach, the development of unit costs for the various types of plant facilities that were currently being provided to satisfy the growing requirements of interstate (and also other intercity) services. For many equipment items, such as special telegraph circuit equipment and much station equipment, the problem of common use was generally not involved, and the determination and application of unit costs was not overly complicated by this factor. The determination of unit costs for commonly-used plant, particu-

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1. Ibid., pp. 20–24 (for an example of this).
2. A critique of some of the shortcomings of this study may be found in ibid., pp. 25–30.
larly for interexchange circuit facilities, presented a more complex problem. It was recognized at the outset that, while circuits can be added, within the limits of capacity, to existing basic plant (such as coaxial cable and radio relay systems) at relatively little additional cost, each of the major categories of service as it grows contributes to the need for additional basic capacity. Therefore, the determination of the additional costs for such plant involved a recognition of the extent to which, in recent years and in the current construction program, it had been necessary to construct new basic systems, as well as to expand the use of existing systems. That is, in order to provide additional service, we not only expand as planned the use of existing facilities, but also add entirely new basic systems.

Consequently, it was necessary to take into account the proportions of the various types of circuit facilities (microwave radio relay systems, coaxial cable systems, and carrier systems) which entered into the construction program. Also the proportions in which these types of facilities are provided were related to requirements for length of haul, which differ service by service. From analysis of the construction program, we developed the "mix" of the different types of facilities being provided for various circuit lengths. On the basis of the model of the market for the service category being studied, unit costs by types of facilities were applied to the numbers of units of each type required for the circuit lengths called for by the market model. For facilities not related to distance (e.g., carrier terminals and special service circuit terminations), unit costs were developed from the costs of recent installations because they were judged the best estimate of the prospective costs of such facilities and were applied to the number of units found in the analysis of the market models.

The additional investment applicable in each service category was thus determined by applying the unit costs of facilities to the quantitative market model, a demand model of the market at some future time. The additional net investment was determined by deducting depreciation reserve amounts.

In implementing this practical approach to a concept of long-run incremental cost, we included all expense items (e.g., maintenance, depreciation, accounting, commercial, administrative, and so forth). The additional costs also included amounts for an allowed rate of return on the additional net investment and an allowance for the applicable federal income taxes and other taxes. Thus, the total of the amounts for expenses, return, and taxes represented the full additional annual costs for each of the service categories under study.

The work required in making such cost studies was extensive. Some of the economists who were critical of our practical approach to the determination of long-run incremental costs in Docket No. 16258 seemed to be quick to point out what they viewed as theoretical shortcomings in the studies. By and large, they may have failed to appreciate the practical problems involved in applying the economic concepts and the substantial effort required to transform the theoretical incremental costing approach into a workable set of cost data. The costs developed for Docket No. 16258, the original set of estimates of LRIC known as full additional cost, represented a worthwhile pioneering attempt at developing usable long-run incremental costs for specific services.

These initial efforts have been improved through continuing study work in consultation with the staff of the Federal Communications Commission. These continuing studies have already resulted in refinement of some of the methods used in the original full additional cost studies, as well as the development of new, more refined incremental cost methodology. For example, in connection with the statement of rate making principles and factors recently agreed to in Docket No. 16258 (FCC Memorandum Opinion and Order, adopted July 29, 1969, 18 FCC 2d 761), the principles and philosophy inherent in determining long-run incremental costs (LRIC) have largely been recognized by the participants in the case.

**Some Recent Developments in Incremental Costing**

_in the Bell System_

Before further discussion of the evolution of Bell's incremental costing process, some of the economic concepts concerning dynamic situations must be examined. The graphic illustration in Figure I is a three-dimensional view of a multi-service firm's total cost curve.
as a function of quantity and time under two different rates of growth.

The change in total cost (ΔTC) and quantity (ΔQ) at a particular point in time, say year X, may be measured on the total cost and quantity axes as shown. If curve (1) represents the anticipated normal growth of a firm in the absence of any rate changes, and curve (2) represents the estimated growth of the firm as a result of a rate change in a particular service (e.g., increased rates resulting in less demand), ΔTC would represent the expected LRIC (a negative amount in this example) attributable to the particular rate change and the particular service involved. The LRIC in this case would be related to the increment in the firm’s output and not to the total market of the particular service involved. However, if curve (1) were to represent the anticipated normal growth of a multi-service firm and curve (2) to represent the estimated growth of the same firm in the absence of one of its services, say service A, then ΔTC, under certain assumptions, would represent the LRIC for the total market of service A. It is this kind of LRIC, i.e., for the entire service (with the total market intact), that Bell attempted to determine through the full additional cost approach utilized in Docket No. 16258.

It could perhaps be argued since economic concepts indicate that all possible alternatives have to be examined in order to arrive at an optimal decision, the infinite number of alternatives renders a theoretically perfect solution of the problem impracticable. We believe, nevertheless, that these economic concepts can be put to practical use. In our recent cost analyses we have determined LRIC by reference to a reasonable number of various alternative rate plans for a service category. The quantity of service to be furnished under each alternative was computed on the basis of marketing estimates, and the effect on total costs was estimated for each alternative. The incremental costs applicable to changes in output were determined by measuring the differences in the effect on total costs resulting from the alternative quantities to be furnished.

In developing a practical approach to LRIC, Bell has been exploring various methods of analyzing the different cost elements of interstate (and other intercity) plant including operational capacity cost concepts for fungible plant, average and replacement cost concepts for non-fungible plant, economic depreciation approaches for plant involving newer technologies, and differential analyses relative to certain expense items. In addition, along with present worth techniques, modeling and computer methods are being utilized, as well as analyses of cash-flow approaches. Each of these analyses, and others not cited, would require an extensive description to indicate the methodology and techniques currently being studied.

For illustrative purposes, the analysis of interstate and other intercity interexchange radio relay and coaxial cable facilities can be discussed to explain the translation from the economic idea to its practical application. As described earlier, in theory, LRIC may be determined by a comparison of the alternative total cost curves for the firm. In practice, however, the analysis must start with the specific items, or cost components, that will contribute to the differences in the firm’s total cost, rather than with the total cost data alone. Within a specific cost component, however, the economic concept, relative to total cost analyses, may be utilized to produce an important portion of the LRIC that is being sought. The following describes in general terms the approach that Bell is presently undertaking to determine the cost component represented by the interexchange facility cost portion of LRIC.

The Long Lines Department of AT&T estimates annually the construction requirements, involving specific projects and expendi-

10. Fungible plant can be used interchangeably for the provision of more than one type of service.
tures, based on forecasted demand for interstate channel facilities that will be required over a specific period of time. The program involves examination of additions to the interexchange circuit plant, both new starts and additions to existing routes that will be required to handle the normal growth expected in this time period. On the basis of data from the construction program, a total cost curve over time for the interexchange high frequency line facilities can be fitted to the data by combining the costs of the additions with the costs of the existing interexchange channel facilities. These amounts may be plotted according to the quantities of capacity to be provided, which quantities may be expressed in terms of channel miles or circuit miles. Furthermore, the estimated construction costs of the additions to plant can also be translated into a curve representing the cost per unit over time which is more useful in the practical sense, for determining the costs of changes in interexchange facility quantities. Various rates of growth on either side of the planned program can be simulated in order to derive additional curves of the cost per unit over time. Once such curves have been derived with respect to the complete construction program period involved, a time frame can be selected in which it is expected that rates (price) will be stable for say a five-year period. We are now at the stage of the analysis at which we can translate these dynamic concepts and actual conditions into a static view of the investment cost per unit for different quantities as of one point in time, say the midpoint of this five-year period. We can then plot an incremental cost (IC) curve (as shown in Figure 2) relevant to the investment per unit required for interexchange facilities. 11

If we know that with normal growth we would have Y units, but that with a rate change (say an increase in the price of one particular service) we would have a cutback to X units, the shaded area under the curve represents the interexchange channel LRIC, a negative LRIC, for that particular service quantity relative to the specific rate change involved. This analysis may also be expanded to examine the effects of a number of rate changes for the same service, for example, a rate decrease in a service might yield Z units (an increase in quantity) or elimination of the service might result in W units.

11. It should be noted that similar curves readily can be derived for annual carrying charges associated with the incremental investment.

Depending on the service being examined, analyses of changes in various other types of equipment such as service terminals, switching equipment, local loops, and station equipment would also be made using somewhat different methods in order to complete the determination of LRIC. Such analyses should include the material cross-elasticity effects on costs resulting from changes in equipment items in services other than the one subject to the proposed revised rates. Analyses of this kind can become quite complicated, e.g., a loss of dedicated interexchange channel miles, service terminals, local loops, and station equipment as a result of a rate increase in one service may be picked up in part by another service with different cost characteristics. Nevertheless, there should be recognition of such effects in order to complete the build-up of the appropriate LRIC data.

Bell's exploration of incremental costing in practice will continue to build upon earlier efforts, such as those involving the full additional cost concept, to develop more refined practical ways of implementing the applicable economic concepts. The logic, translation factors, and methodology that have been developed for the examination of changes in interexchange channel facilities, as steps in the determination of LRIC, are significant moves in this direction. However, these cover only a small portion of the total effort that
is currently being expended in putting incremental costing into practice.

Explorations of this kind in the area of incremental costing, even though not completely satisfactory to all purists, must give information that is more material to, and applicable for, rate making than any fully allocated embedded cost figures based on relative use. Analyses of LRIC coupled with appropriate analyses of market and demand factors provide the relevant data required by the firm to meet its rate making objectives. The task of devising a vehicle for the translation of economic concepts to practical use is a challenging one, but when the appropriate theory is translated into a practical tool, its use will result in more effective analyses for rate making purposes.

Interservice Subsidy: Regulatory Standards and Applied Economics

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Throughout the history of economic analysis of public utility pricing practices and policies in the United States, there has existed a vast chasm between the conceptual analysis and solutions of traditional price theory relating to how prices ought to be set and the applied guidelines of utility managers and regulatory agencies relating to the actual determination and setting of prices. Despite some significant attempts to build bridges between theory and practice, the two areas generally have been pursued as if they were

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quite different disciplines. The practitioners, forced to make decisions in an environment that has little or no relationship to that described by the assumptions of classical price theory, have developed practical guidelines resting heavily upon an accounting for actual events, historical patterns and trends, normal relationships, and standardized and average measurements. Most price theorists, on the other hand, unable to break out of the rigid restraints imposed by their artificial assumptions, have spent their time slogans for the textbook concepts of "marginal cost" and "demand elasticities," while dismissing the use of any other standards.

Economists have not been much concerned about what practitioners actually do, or how they go about actually trying to measure cost and demand characteristics. Rather the important thing has been what they say. Concern has been almost entirely devoted to the terminology the practitioners use, and the adoption of, or the failure to adopt the correct economic terminology has elicited the appropriate reflex response.

In recent years, there has been an increasing number of attempts to close the gap between theory and practice which has rendered both vulnerable to improvement. For the most part, these efforts have stemmed from the realization by utility managers that maximum price flexibility and freedom from regulatory pricing restraints can be maintained by adopting the terminology of price theory. Such pricing freedom, which most utilities have always had anyway, is becoming more and more important to utilities concerned about preserving their monopoly and near-monopoly market positions from the inroads of potential competition. At the same time, some regulatory agencies have become aware of the enormous potential of many utilities to utilize cross-subsidy pricing practices, where predatory pricing in competitive markets can be combined with whatever prices are necessary in the monopoly markets to achieve the overall rate of return permitted by the regulatory authority. Hence, at the same time utility managers are becoming concerned about maintaining maximum pricing flexibility, some regulatory agencies are threatening to impose some constraints on that flexibility.

That regulatory authorities should have standards to detect and prevent interservice subsidy which has not been determined to be in the public interest is clear from both the law and economic theory. The problem is devising practical standards that a regulatory agency can effectively apply to fulfill this responsibility. For more than a year the FCC engaged in a searching analysis of alternative standards that it might employ in regulating the interstate services of the Bell System. This paper is addressed to the problem of establishing standards by which the FCC can detect and attempt to prevent cross-subsidies among the Bell System's major interstate service categories. The relative merits of the long-run marginal cost concept of traditional price theory, the fully distributed cost standard, and the proposal put forth by the Bell System are each examined in light of the objective of achieving effective regulation of the rate levels of Bell's major interstate services.

Industry Structure and the Potential for Change

The domestic communications industry is dominated by the Bell System through its twenty-four system operating companies, its Long Lines division, its manufacturing and supply subsidiary (Western Electric), and its research and development unit (Bell Labs). Bell provides local service in the most densely populated areas of the country to about 85 percent of the nation's telephones and supplies nearly all interstate long-distance service. The remaining areas of the country are served by nearly 2,000 "independent" telephone companies and cooperatives. Although Western Union is the monopoly supplier of the public message telegraph service and also provides private line and teletypewriter exchange services, it leases the great majority of its local and long-distance channels from the Bell System.

Approximately 30 percent of AT&T revenues come from its interstate services. Of its total interstate business, nearly 90 percent of its revenues are derived from the message toll telephone (MTT) monopoly exchange service. The majority of the remaining reve-

2. See Memorandum Opinion and Order, Docket 16258, 2 FCC 2d 142. The interservice subsidy issue was examined in Phase 1B of this investigation.

3. Wide Area Telephone Service (WATS) is essentially a rate classification for message toll telephone service which accounts for approximately 6 percent of interstate revenues. For detailed statistics of the various Bell Companies, see Statistics of Communications Common Carriers, published annually by the Federal Communications Commission.
nues are provided by the private line services (including TELPAK). The teletypewriter exchange (TWX), and program transmission (audio and video) services each account for slightly more than 1 percent of interstate revenues.

The markets for which Bell faces any degree of competition at present are miniscule in terms of Bell's total operations. Western Union's private line and Telex services are competitive for some users and uses with AT&T's private line and TWX services. For certain kinds of record and data communications, there are competitive overlaps between some of these services and Western Union's INFCOM or Bell's Dataphone services. However, since Western Union's inability to compete depends upon contracts for the lease of Bell facilities at wholesale rates, which are not regulated and which contain use-of-facility and interconnection restrictions, the competitive—or noncompetitive—relationship is controlled by Bell. Although the great majority of private microwave development has been by right-of-way companies to meet their special communications requirements for system control, safety, flexibility, and so forth, Bell has been seriously concerned over the possibilities of private microwave as a substitute for its private line services. To date, private microwave growth has been modest and mostly in remote and rural areas.

Events in recent years have broadened the potential for competition in some communications markets and dramatized the importance of the interservice subsidy problem. In a 1959 decision relating to the allocation of microwave frequencies above 890 Mc, the FCC concluded that it would grant private microwave licenses under certain conditions, even though common carrier service could be obtained in the area. Although the decision was premised upon

4. At present, negotiations are underway for the purchase of TWX by Western Union.


conclusions that there existed communications needs that were unfulfilled by the common carriers and that any impact upon the common carriers would be insignificant, it cracked the dike of absolute market protection from private microwave for the established carriers. Viewing the FCC's Above 890 decision as allowing a threat of potential competition, AT&T drastically altered the structure of its private line rates by introducing its TELPAK rate classification of private line service. The TELPAK eligibility requirements paralleled the FCC's new microwave rules and the new reduced rates ranged from one-half to one-seventh of the previous private line rates for the same private line service. After investigation, the FCC concluded that part of the TELPAK tariff was unlawfully discriminatory and that there was insufficient information to determine whether the remaining TELPAK rates were compensatory. The TELPAK tariff classification has remained in effect for nearly a decade and the FCC has still not determined whether the TELPAK rates are compensatory, whether the TELPAK tariff classification is being subsidized by other services, or whether the discriminatory TELPAK rate structure is justified.

Although the TELPAK pricing policy helped preserve the industry structure from private microwave intrusion, it upset the historic lopsided duopoly arrangements in the private line market between AT&T and Western Union. As part of an investigation into the potential adverse effects of deteriorating public message telegraph service, the FCC requested that AT&T undertake a study of its earnings for each of its seven major interstate service classifications for a test year period. By indicating that the earnings rates for AT&T's monopoly service classifications were substantially higher than those for its competitively oriented classifications, the Seven-Way Cost Study tended to support the standard inferences about cross-subsidization. Although the overall interstate rate of return for the 1964 test year was 7.5 percent, such services as TELPAK and private line telegraph earned at rates of 0.5 percent and 1.4 percent respectively. On the basis of the Seven-Way Cost Study results and other information derived from its comprehensive domestic telegraph investigation, the FCC began an investigation into the


rate making standards that it should employ in dealing with the interservice subsidy problem.

More recently, the FCC has arrived at landmark decisions in the areas of interconnection and entry. Restrictions prohibiting the interconnection of equipment and facilities to AT&T facilities have played an historic role in the development of the industry structure as we know it today. At the turn of the century, interconnection restrictions curbed the expansion of independent telephone systems and foreclosed them from the long distance market. They also played a key role in enabling AT&T to establish a monopoly over long distance TV transmission between major cities in the late 1940s and 1950s. And they have served as an effective barrier to entry into the terminal equipment market. In its 1968 Carterfone decision, the FCC concluded that AT&T's interconnection restrictions had been unreasonably discriminatory and unlawful since their inception and ordered the tariff to be revised to prohibit interconnection or attachment to the AT&T network only where those connections would cause harm to the network.

In August 1969, the FCC approved the applications of Microwave Communications, Inc. (MCI) for construction permits to establish point-to-point common carrier communications service between Chicago and St. Louis. The commission majority concluded that MCI proposed to offer differentiated communications services with a probability of substantial public benefit. The MCI decision brought about a major change in FCC policy by indicating that entry into the common carrier communications market was a possibility and that proposals for entry would receive serious consideration. Since the MCI decision, there has been a ground swell of applications for common carrier microwave stations by new applicants, and there is no indication of abatement.

The Carterfone and MCI decisions are already proving to be giant steps in opening up what heretofore has been a tightly controlled and virtually closed communications industry. Advancements in communications, computer and related technologies, together with the rapid growth and diversification of communications demands provide regulatory authorities with unprecedented opportunities for permitting alterations in the inherited industry structure. In the next few years, the FCC should be developing policies relating to domestic satellites, CATV distribution, digital communications systems, the data market, special service common carriage, and the regulatory boundaries between the communications and computer industries. However, effective implementation of policies in these areas requires that they be coordinated with regulatory policy relating to pricing practices.

The existing Bell services for which the company faces potential competition in the near future include some portions of its private line, TWX, and program transmission services, aggregating probably less than 1 percent of the company's total revenues and not more than about 2 percent of interstate revenues. If entry is permitted by the FCC and the state commissions, the entrants will compete with the established carriers for the rapidly developing, but still relatively small data markets. Considering only the interstate services subject to FCC jurisdiction, the potential for predatory pricing and interservice subsidy is immediately apparent. One-tenth of 1 percent in AT&T's interstate rate of return amounts to approximately $25 million in revenues. Hence, AT&T could give away significant volumes of TWX service and impose a burden on MTT-WATS monopoly users of less than 0.3 percent rate of return; it could give away private line telegraph for less than 0.5 percent; and TELPAK for less than 1.2 percent. The enormous size of the

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15. Forecasts of the growth of data communications vary dramatically, ranging between 5 percent and 50 percent of the total communications market by 1980. The Stanford Research Institute in its report to the FCC in the Computer Inquiry indicated that 10-50 percent of Bell System plant will be serving data users (as measured in terminal hours) by 1980. AT&T estimated that data use would be only 5-10 percent of the peak network load by 1980.
captive MTT monopoly market completely engulfs the impact of drastic changes in the other services. Thus, although such drastic rate reductions as those instituted under TELPAK could drive firms the size of Western Union or smaller to the brink of financial disaster in a short period of time, their effect is almost imperceptible in AT&T’s total jurisdictional operating results.

In addition, the market circumstances make the task of effective regulation over interservice subsidies a most difficult one. In light of advancing technology which is reducing the costs of interstate service over time, predatory price reductions in one market need not require price increases in the basic monopoly services. Rather the predatory price cut can simply replace a warranted reduction in prices in the basic monopoly service. Hence, if the FCC elects to foster a degree of competition in the development of the rapidly growing heterogeneous data markets by permitting the entry of special service common carriers, effective implementation of such a policy will require active and timely regulatory control over carrier pricing practices.

In fact, since the introduction of the TELPAK private line rates, AT&T has taken significant steps both to shield Western Union from the direct financial impact of the low rates and to prevent Western Union from benefitting from them. Initially, a special contract for the lease of facilities by Western Union was drawn up under which the charges for leased facilities used by Western Union to sell private line service at TELPAK rates were based upon AT&T’s TELPAK tariff rates discounted by 7 percent. Stringent use-of-facility restrictions required Western Union to pay the higher charges as determined by previous contracts if the service was sold at regular private line rates. Hence, Western Union was prevented from arbitraging in the private line market or even obtaining the benefits of the TELPAK rates for circuits leased for its own use. At the same time, Western Union was provided with an opportunity to supply service at TELPAK rates and still be able to cover its leasing costs. Opportunities for Western Union were more apparent than real, however, because the TELPAK tariff structure made it economic for consumers to purchase all of their private line requirements from a single carrier. Thus, when the Department of Defense indicated that it was going to base its communications purchases on the basis of minimum cost (more than six years after the introduction of the TELPAK rates), AT&T and Western Union revised their TELPAK tariffs to enable customers to combine their private line purchases from AT&T and Western Union and calculate their TELPAK charges as if all purchases were from a single carrier.

The Regulatory Environment

Most regulatory policy in domestic communications is founded upon the presumption that communications markets require supply by classic natural monopolies. The focus of regulatory activity is directed to the broad issues of jurisdictional cost separations and revenue requirements. Due at least in part to severe limitations on budgets and professional staff, virtually all other substantive issues of economic regulation have been left to the expertise of the carrier. Adopting this narrowly focused and relatively passive view of regulatory responsibility, the public authorities typically confine their rate making activities to a periodic testing of the utility’s total revenue requirements subject to the agency’s jurisdiction. The actual financial record of a recent historical test year is used to calculate the accounting revenues, expenses, net investment, and rate of return actually realized during the test year. Adjustment for known

17. Even this opportunity was not a guarantee since it was based upon the assumption that, on the average, the requirements of Western Union’s TELPAK customers would be the same as the requirements of Bell customers. See AT&T Ex. 31, Sec. 2, Docket 14600.

20. For a summary of information relating to the size, staff, and scope of state public service commissions, see State Utility Commissions, Senate Subcommittee on Intergovernmental Relations, 90th Cong., 1st sess., September 11, 1967. Outside of California, the state commissions reported a total of two economists on their staffs. The FCC Common Carrier Bureau has four economists on a professional staff of less than one hundred.
changes such as obligated wage increases are made to the financial data, but speculative and conjectural adjustments such as future market growth, estimated future costs, or cost and demand elasticity effects are specifically not made. After scrutiny of the financial record, a "fair" rate of return is determined, a test year revenue requirement is calculated and rate increases or decreases (expressed in terms of revenues) are ordered. The implementation of specific rate changes is generally left to the carrier.

It is important to emphasize that the framework of analysis for regulation is specifically historical and factual. An accounting for actual events is undertaken; results are analyzed; only adjustments for known future changes are considered; estimates of future service costs and revenue requirements are not used; and estimates of alternative future revenue requirements for meeting different quantities of output are not used. In addition, the same framework of analysis is used for allocating AT&T's costs and revenues among regulatory jurisdictions and for regulating revenue requirements in the other public utility industries.

The historical test year approach is vigorously defended by both the regulators and the regulated. Regulators can point to an unfortunate history in the use of speculative forecasted information that permitted widespread abuses that were not brought under control until the passage of the regulatory laws of the 1930s when uniform systems of accounts were established. Many analysts have observed that a significant reason that regulation was notoriously ineffective prior to the creation of the uniform systems of accounts was the absence of any basis for assessing a wide variety of conflicting speculative information. Today, the basic and, in most instances, only tool of informational control by regulatory agencies is the uniform systems of accounts and the standardized information that they yield relating to costs actually incurred and revenues actually realized.

Most recently, in sessions before the FCC in September 1969, relating to AT&T's interstate revenue requirements, AT&T refused to supply a staff request for the company's annual forecasts of operating results for three years into the future on the grounds that such forecasts have not been relied upon by the company or the commission in the past, that the best guide for the immediate future is the experience of the recent past, and that serious problems and liabilities could result from disclosure or improper use of forecasts. AT&T Vice-President D. E. Emerson stated, in this regard:

So our position is, basically, not that the Commission should not take into account what some possible future situation is but that there are a number of uncertainties, a number of variables in any forecast that could very well distort the picture and we have to be extremely careful in how that information is used. As a matter of fact, it is information that would probably never come about. It is within this framework of analysis that the FCC approached the problem of determining whether some AT&T interstate services were being subsidized by others. In the Domestic Telegraph Investigation of the mid-1960s, AT&T testified that rates for its services were initially designed to yield revenues that would be compensatory on a fully allocated cost basis, but that value of service considerations were taken into account from time to time in subsequent revisions in rates without definitive cost studies. The Seven-Way Cost Study was requested by the FCC as the first systematic attempt to disaggregate test year data and measure the actual earnings performance of each of seven major interstate service classifications. Concerned about the possible implications of the results of the Seven-Way Cost Study, the FCC established its investigation of standards for regulating the rate levels of the major categories as follows:

The Commission will consider respondents' total revenue requirements applicable to their interstate and foreign communication services, and the relevant rate making principles and factors that shall control in the distribution of such revenue requirements among respondents' principal rate classifications.


23. Ibid., p. 179.

24. Domestic Telegraph Investigation, Docket 14650, 51 Tr. 5150-91.

25. 2 FCC 2d 142, 143.
Issues relating to the setting of specific prices and development of rate structures within each of the service classifications were not placed under investigation in this proceeding.

The Nature of the Rate Level Problem

The rate levels for AT&T's interstate service classifications are amounts of revenue realized by the firm for a particular accounting period. When applied to major nationwide service classifications, rate levels have the same characteristics as revenue requirements in that they represent enormous aggregations of many different prices and quantities of different types of service provided in different locations under widely varying types of circumstances. They clearly do not come close to representing specific prices under any circumstances. The establishment of a rate level standard does not dictate specific rates, rate structures, or sub-classifications of service. It does provide a benchmark against which actual revenues for a broad service classification can be compared and provides the regulatory agency with a tool of control that goes somewhat deeper into the structure of the carrier's operations than traditional jurisdictional revenue requirements.

The application of any set of principles or standards to a particular problem must recognize the constraints within which these standards must be applied. In analyzing alternative standards for evaluating the rate levels of AT&T's major service classifications, special attention must be given to the costing and pricing practices of AT&T that affect the actual rate level calculations and the applicability of the suggested rate level standards. Of particular importance are: the framework of analysis for regulatory decisions; the methodology for determining jurisdictional revenue requirements; the methodology for determining the investment costs that will be recognized in particular time periods, i.e., depreciation policy; and, the practice of employing uniform nationwide interstate tariffs.

Consumers of all AT&T interstate services contribute, in aggregate, revenues to meet the firm's periodic revenue requirement as regulated by the FCC. Conceptually, if each service is to contribute sufficient revenues so that it is not a burden on the other services, the others must not be required to contribute more revenues over time than they would have, had the service in question not been offered. If the actual rate level of any service classification is insufficient to meet this test, then the residual services are subsidizing the service under examination.26

Clearly this conceptual rate level standard is an incremental standard. However, it is a special type of incremental standard that must be defined, interpreted, and applied within the particular circumstances of regulation. First, the increment is not the marginal cost of classical price theory, but an increment in revenue requirements as determined by the methodology of revenue requirement regulation. Second, the standard is clearly dynamic in that it requires recognition of all interperiod effects upon alternative revenue requirement calculations. Third, the standard does not relate to an increment in the firm's forecasted revenue requirement for a future time period, but rather an increment in the test year revenue requirement based upon the record of actual events. It is immediately apparent that the information requirements of this incremental rate level standard could never be met because what is required is a series of lifetime records of events as they would have been recorded had each service not been offered. One would have to simulate not only what the series of management decisions would have been over the life of each service for each alternative foregone, but also what would have actually happened and been recorded.

Accountability vs. Economic Theory

By far, the greatest difficulty with applying traditional economic theory to the interservice subsidy problem is that the framework of analysis is entirely different from that which encompasses the real world problem. The regulatory authority sits outside the arena of detailed managerial decision making and focuses its attention upon the periodic ex post review of the overall results of thousands of managerial decisions in an attempt to make management accountable for its actions. Microeconomic theory is addressed to the deci-

sions of management before they are made and the problem of selecting the best alternative from those available to the firm. Thus, whereas rate level regulation is directed neither to a detailed review of all the alternatives that should be considered by management in each of its decisions, nor to the decision rules that are followed by management in selecting among alternatives, microeconomic theory is in no way directed to the problem of assessing the results of the decisions actually made in light of the reality that actually developed. The regulatory test is not the static mathematical test of whether management did what it thought was best on the basis of what it knew at the time. Rather, it is the market test of whether management decisions made in an uncertain environment with limited information turned out to be prudent and not terribly inefficient in light of the reality that developed. Since the rate level standard being sought by the FCC is an accountability standard, we must conclude that the classical economic theory is irrelevant to the problem at hand.

We should note the overwhelming difference on this crucial point between publicly owned utilities such as the nationalized utilities in Britain and France and privately owned but publicly regulated utilities that characterize the telecommunications, electricity, and gas industries in the United States. In the former case, the utility managers are directly charged with setting their policies in the public interest. They are not responsible to stockholders for meeting short-term profit objectives; they do not have to worry about protecting markets from competitive inroads. Intra-industry competition is not employed as a tool for stimulating the development of new services and markets. Thus, problems relating to structural relationships within the industry such as internal cross-subsidization do not assume any real importance. Since the regulators are managing the company, the test of accountability is solely for purposes of internal management.

There seems little doubt that regulation could be improved if the framework of regulatory analysis was extended to encompass forecasted information of many kinds. If the utility's forecasts of annual revenue requirements, cost levels, and rate levels for several years into the future were made a part of the standard reporting requirements of regulatory agencies, commissions would have not only valuable information to supplement existing revenue requirement information as a basis for their decisions, but also a continuing record of comparison between company forecasts and the reality that develops. However, under the prevailing view of most utilities and commissions, such an extension of reporting requirements is not likely to occur.

**Long-Run Incremental Cost as a Rate Level Minimum**

Although AT&T had never used long-run incremental cost as a basis for determining the minimum rate levels for any of its major service classifications, it advocated that the FCC employ the concept as the test for determining if one service is being subsidized by the other services. AT&T testimony was directed toward demonstrating the theoretical superiority of marginal cost over fully distributed cost and the measurement of an approximation of long-run incremental cost for some of the firm's service classifications. It was assumed for the AT&T presentation, but not demonstrated by it, that the company is operating under conditions of continuing economies of scale so that marginal cost pricing would not recover total cost.

The argument was made in terms of classical price theory and the mathematical rules for optimization under static conditions and perfect foresight. Inasmuch as, given the principle of maximization of something, the marginal conditions follow as simple mathematical tautologies, the analysis presented is obviously logically correct. Unfortunately, it is irrelevant to the practical problem at hand.

27. See principal testimony of A. M. Froggatt, Bell Ex. 24, J. C. Boubright, Bell Ex. 25, W. J. Baumol, Bell Ex. 26, and W. M. Ellingshaus, Bell Ex. 46.

28. Prices are not set to yield total cost as defined by economic theory, but rather revenue requirements as determined by the methodology of regulation which may exceed, equal, or fall short of total economic cost. Further, "[A]n a priori statement about the relationship between long run marginal cost and total cost is possible only if the system lacks history—i.e., in practically no real system. Thus, simple statements of the sort that, since the industry is one of increasing returns, marginal cost pricing would involve a deficit, are irrelevant." R. Turvey, *Optimal Pricing and Investment in Electricity Supply* (Cambridge, Mass.: The MIT Press, 1968), p. 59.

hand. Keynes put it best:

Our criticism of the accepted classical theory of economics has consisted not so much in finding logical flaws in its analysis as in pointing out that its tacit assumptions are seldom or never satisfied, with the result that it cannot solve the economic problems of the actual world. 30

And Turvey recently observed that "the definition of marginal cost as the first derivative of cost with regard to output is too simple to be useful. Both cost and output have time dimensions and both may be subject to uncertainty." 31

In terms of applied problems, the textbook mathematical solutions tend to portray several illusory conditions to many practitioners. One such condition is that there is a single marginal cost figure that is being sought and that the direction to it is clear; in reality, there are an infinite number of marginal costs for any complex problem and it will never be known whether one's measurement of marginal cost was correct or how close one came. A second condition is that marginal cost does not involve any arbitrary cost allocations; in reality, the arbitrary effects upon cost recognition begin with the definition of terms and proceed through every step of the marginal cost calculation. A third illusory condition is that marginal costs are always less than average cost and therefore they include only some of the cost elements. In reality, marginal costs reflect the rates of change in total costs and may be either greater than or less than average costs in either the short run or the long run. A fourth condition is that marginal or incremental costs are those that represent the actual costs that the firm decides to add to its inherited plant; this increment is not the production increment of economic theory and it tells nothing about the firm's marginal cost characteristics.

The long-run marginal cost concept must be reviewed in light of its potential applicability as a standard for determining inter vivos subsidy in the Bell System's interstate operations. It is important to emphasize that long-run marginal cost is a planning concept relating to alternative courses of action as they are perceived by the decision maker prior to the commitment of any capital or the establishment of any price. The framework of analysis assumes a planning horizon sufficiently distant that all the relevant effects of all alternative decision possibilities can be taken into account. All the information is hypothetical and subject to the forecasting ability of the decision maker. Once the optimum alternative is selected and pursued, the firm must await the judgment of reality to see if its decision was good or bad. If the firm correctly perceived and made perfect forecasts for all alternative decision possibilities, its decision would indeed have been optimum. If it did not, however, its marginal cost calculations would have been inaccurate. Marginal cost calculations are based entirely on expectations which will not be borne out by reality except under conditions of perfect forecasts, not only of the alternative selected, but also of the alternatives foregone. We know in advance that our hypothesis of optimization will be disproved by reality.

As a theoretical construct, the classical long-run marginal cost concept does not come to grips with the problems created by the continuity and incomplete nature of the firm's activities. The concept assumes that the decision to be made involves a complete venture. At the time the decision is to be made, there are no constraining conditions of past decisions and events that will influence the decision alternatives. The firm is in a completely uncommitted state. Moreover, the evaluation of the alternative decision possibilities reflects all effects through the completion of the activity under consideration. Hence, the framework for decision is closed. The firm is undertaking a venture in which it can both start fresh and complete the activity. At this theoretical level, there is no need for an evaluation of the state of affairs before the effects of the decision are complete. There will be no modification of the decision as reality unfolds. An accounting is required neither during nor at the completion of the venture.

As a result, the application of the long-run marginal cost concept to reality is not only difficult but subject to widely varying interpretations. At any point in time, AT&T, or any other real firm, is highly constrained by its past decisions. Moreover, it does not reflect in its plans all the marginal effects associated with the service that are made possible by an investment decision. At any point in time, the real firm is a going concern involved at different stages of decision making with respect to many investment decisions that relate to different elements of capacity for different areas of the coun-

try and different combinations of output for the various services. The characteristics of the investments, including the amount of the expenditure, the type of facilities added, and the timing of the addition depend directly upon the quantity and structure of the elements of capacity inherited from the past as well as plans for related investments in the future. The firm is in a continuous process of partial adaptation to changing events and is almost never in the position of complete adaptation assumed by the long-run marginal cost notion. It must make its investment decisions on the basis of the capital that it inherits from the past, and its planning into the future is severely limited by its inability to forecast future events accurately and perceive all the effects of its alternative investment possibilities.

In terms of the provision of service over time, there are a myriad of possible marginal cost functions that might be called the "reasonable" long run. Turvey has stated:

"It cannot be emphasized too strongly that any estimate of long-term marginal cost has no significance in abstract but only in relation to a specified load increment. There are as many marginal costs as there are conceivable load increments." 32

In addition, for every difference in the amount and/or structure of inherited capacity that is acceptable to the analyst, a different marginal cost function can be derived; for every difference in the actual planning period to be employed, a different marginal cost function can be derived; for every change in the relative proportions of the various services that will be utilizing common facilities, a different marginal cost function can be derived. For every different forecast of future events and every different perception of the timing and influence of the marginal effects, different sets of marginal cost functions can be derived. In fact, since the unit of output is far from homogeneous, different marginal cost functions will be obtained as the dimensions of the output unit are varied. An output level of one hundred circuit-miles may consist of a single one hundred mile circuit or one hundred one-mile circuits; the marginal cost calculation in the one instance may be significantly different from the marginal cost calculation in the other. 33 Any measurement of marginal cost is entirely bound up in the judgment of the analyst, the "arbitrary" decisions that he makes, and his changing expectations. In fact, marginal costs are very personal things. Presumably the optimists in a firm would have quite different marginal costs than the pessimists. And this raises the question of whose marginal cost will the firm use?

Moreover, since the marginal cost concept relates to specific output that would result from specific investment decisions, there is a host of marginal cost functions for the various Bell services depending upon the location where the service would be added, the elements of capacity that would be added, and the conditions under which the addition would take place. There can be no such thing as a marginal cost function for a nationwide service. Even under the best of circumstances, any attempt to derive one involves such gross averaging of the diverse conditions under which communications service is supplied throughout the country, that the result must be a very poor indicator of the marginal costs of anything. Indeed, one would expect that the first step in any attempted application of marginal analysis would require a change in the practice of calculating costs on the basis of nationwide averages.

Further, the information requirement for measuring marginal cost is an extremely difficult one to meet as a very detailed forecast is required of the effects of alternative decision possibilities upon the state of affairs in quite distant future periods. There is no indication that on the basis of the existing state of information, marginal cost measures can represent anything but arbitrary judgments based on the subjective expectations of Bell management. "If a firm cannot know what its marginal costs and marginal revenues are, it is useless to advise it to act so as to bring them to equality." 34

If the FCC were to employ a long-run marginal cost standard as a guideline for evaluating the rate levels of Bell's interstate services under present conditions, the commission's standard would simply amount to periodic judgments on the part of AT&T management as to whether the company planned to practice cross-subsidy. There would be no accountability standard; it would make a farce out of the attempt to regulate against interservice subsidies. The commission cannot regulate effectively on the basis of Bell's stated expec-

33. For example, see G. L. Wilson, "On the Output Unit in Transportation," Land Economics, August 1959, pp. 267-76.
tations. The indicated plans are not always implemented; and when implemented, they are not always realized. There must be a calling to account by the commission on the basis of what actually happens. Rate level standards for the various services must be established so that if management expectations are not fulfilled with regard to a particular service category, the deficiencies will not automatically fall on the consumers of the residual monopoly services.

Fully Distributed Cost as a Rate Level Standard

An alternative standard under consideration by the FCC is an allocation among the major service classifications of the historical costs actually incurred for the provision of service and recognized as chargeable to consumers in the revenue requirement test year accounting period. After the arbitrary allocations of Bell's total historical investment costs among regulatory jurisdictions and among the accounting periods for which the investments in capacity to serve are expected to be productive, the costs that are allocated to interstate service for the test year and recognized as justified for revenue requirement purposes are distributed among the services on the basis of the actual usage of each service. Although such a distribution is intellectually disconcerting to economists because it fails to optimize on the basis of marginal conditions, in many respects, it is far superior for addressing the interservice subsidy problem.

A commonly accepted standard for determining minimum rate levels, fully distributed cost represents neither a minimum nor a maximum. Rather, it is proposed as a benchmark, a standard that indicates the state of affairs under normal conditions. Actual rate levels that deviate significantly in either direction from the standard signal the need for special justification or the realignment of rate levels with the standard.

A fully distributed cost standard is consistent with the cost measures used to calculate AT&T's interstate revenue requirement. The information base encompasses the recording of the business activity that actually took place; it is also virtually complete and readily available. A distribution of test period costs on the basis of rational economic analysis can provide timely, implementable, benchmark approximations of the rate levels that the commission could expect in the normal course of operations. Indeed, any accountability standard requires allocations of historical costs. The majority of criticisms that have been leveled at fully distributed cost as a rate level standard have been misdirected or they apply equally well to the application of marginal cost. Such criticisms must be considered in the context of the rate level problem.

A. Joint Costs

It is argued that fully distributed costs fail to recognize the existence of joint costs. If conditions of joint production or joint supply exist, there may be services that do not cause investment in capacity to take place over time, but which always use the capacity that is unavoidably created by the provision of other services and which otherwise would lie idle. In communications, the obvious instance is time jointness where the provision of service for peak use requires the simultaneous creation of capacity to serve during off-peak periods. Since peak usage is responsible for investment in capacity and off-peak usage is not, the capacity costs being charged to consumers should be allocated among the service categories in accordance with the actual usage at the peak period. Since all of the major service categories are peak users, they should all bear portions of the capacity costs. But this precludes neither the establishment of off-peak prices within the rate structure of the various services, nor the creation of new service classifications that use only off-peak service. This is an area where marginal analysis and demand elasticities should be used to devise rate structures that will encourage maximum utilization of off-peak capacity.

B. Historical Costs

A second criticism of a fully distributed cost standard is that the costs are historical and therefore irrelevant to the determination of rates. It is argued that the cost guideline should be current cost. Whether a revenue requirement or a rate level calculated on the basis of historical costs actually incurred differs from what it would be if it were calculated on the basis of the most efficient current cost alternative, will depend upon: the efficiency of the investment alternatives actually undertaken in the past as judged by the reality
that has expired; the depreciation policy employed in past and present periods; and the precision of the current cost estimates (which cannot be judged until future periods). 

Investment decisions, made in remote or immediate past periods, are based upon the assumption that future periods will absorb a portion of the capital costs of investing in long-lived facilities. Depreciation policy determines the timing of the periodic recognition of capital costs over the life of the facility. If past investment decisions and depreciation policy were founded upon a correct forecast of the reality that has unfolded to the current time period, and current cost estimates are based upon a correct forecast of future events, historical costs and current costs will yield identical results.

If historical costs deviate from current costs, there has obviously been at least one incorrect forecast made. There are several possible explanations. The past investment decisions that created the capacity to serve today were founded upon assumptions or forecasts of the conditions that would actually exist when service would be provided. If the actual costs of the investments differed from their expected costs, or if events that have transpired in the interim have not conformed to the forecasts upon which the investments were made, historical costs may reflect investment inefficiencies. If depreciation has not been based upon a correct forecast of events, then the historical costs remaining in the accounts would differ (they could be higher or lower) from current costs. If current costs are founded upon inaccurate assumptions or forecasts of future events, the historical costs could provide a better estimate of the real current costs. Inasmuch as all of these decisions are based upon the same type of forecasting, it is probable that if historical costs differ from current costs, neither cost calculation is correct.

In any event, if it is concluded that historical costs differ from current costs, adjustments in depreciation policy should be made to bring the two measures into line. If past investment in the creation of capacity to serve a particular service was premised upon the current period absorbing a portion of the investment costs, the responsibility for covering those historical costs cannot be discontinued in the calculation of the rate level for the service in question unless it is also discontinued in the calculation of the revenue requirement. Within the constraint of the revenue requirement standard, historical costs provide a rate level measure that is superior to current costs as an indicator of the cost responsibility of a service. To illustrate, if certain telegraph terminal equipment with an historical book value of $100 per unit is recognized as a legitimate cost to consumers for revenue requirement purposes, it cannot be revalued at an estimate of its current or future costs, say $75 per unit, for purposes of determining the rate level for private line telegraph without burdening other services.

Depreciation policy is another area where the tools of marginal analysis should be brought to bear. The straight line depreciation method allocates investment costs equally over all time periods within the anticipated life of the facility.35 As a result, both the fully distributed and the long-run incremental cost studies are premised upon an arbitrary full distribution of historical investment costs uniformly among time periods. Each time period is allocated the average cost per period of the investment. In an environment of rapidly changing technology, the use of some kind of liberalized depreciation methods will probably provide better approximations of the rate of economic depreciation over the life of the investment. Such a policy would still provide an arbitrary full distribution of historical costs, but the distribution could be specifically designed to accord with estimates of the incremental economic effects of new technology upon historical book values as time passes.

C. Fixed and Common Costs

It is argued that fully distributed costs allocate fixed and common costs which are unrelated to changes in output levels. Inasmuch as investment must take place before a price can be set, in reality there are always fixed costs. But once the investment has actually taken place, the firm’s decision horizon has been constrained from the long-run planning period to the short-run operating period. By definition, if elements of costs are treated as fixed

35. It is remarkable that economists have been getting exercised for generations over the static marginal cost-average cost relationships, while readily accepting, in the framework of the same problems, the averaging of costs over extensive time periods. Such a disproportionate allocation of the profession’s activities provides a living memorial to the power of the classical theory to impose its assumptions on almost every level of thinking about practical microeconomic problems.
costs, the long run is being given a shortsighted application. In reality, the firm is making decisions simultaneously in planning periods ranging from the very short run to the long run. It sets prices in a state of partial adaptation to the capacity that it has inherited from the past and therefore is not now considering all the long-run effects of its decision to supply service.

The term "common costs" is used in two different ways which denote quite different conditions. Fungible facilities that a firm uses or plans to use to supply several services are common facilities, but there need not be any common costs in the economic sense. Similarly, there may be common costs in the economic sense, i.e., non-marginal, even if all facilities are specialized or if the firm is providing a single service. If a firm is operating under constant cost conditions, there will be no unallocable economic costs even though all the plant may be used in common by several services. The fact that all or any portion of the firm's facilities are used in common by several services indicates nothing about the existence of unallocable economic costs.

In order for unallocable costs to be present in the long run, there must exist additional economies of scale beyond the output level of operation that is selected at the time the selection is made. In terms of the investments actually undertaken, the projected market was too small to make most efficient use of the economies of large scale plant that were available.

**D. Economies of Scale**

The most significant criticism of a fully distributed cost standard for evaluating rate levels is that it fails to reflect the marginal costs of added output when economies of large scale operation that could not otherwise be realized are made possible by this additional output. It is important to emphasize that economies of scale is a static concept that refers solely to alternative investment possibilities at a moment in time. It does not encompass the improvement in technology over time. As has been previously noted, depreciation policy is the vehicle by which historical costs of the old technology are written down over time to the current costs of the new technology.

Determination of the significance of economies of scale, and therefore the unallocable costs at the marginal unit of service, requires a comparison of alternative courses of action, i.e., the course that has been selected and the alternatives that are being foregone. But the alternatives foregone are not small scale versions of the brontosaurial structure of the firm; they are entirely different. The achievement of static large scale economies requires the conglomeritation of diverse functions and the supply of general standardized services, thereby requiring that potential economies of particular specializations be foregone. This is the relevant trade-off. Moreover, in a dynamic market environment, the selection of a single supplier to reap the benefits of economies of scale may bring serious dynamic inefficiencies by limiting the direction and speed of adjustment to changing market and technological conditions.

Whether or not the selection of the larger scale of output, which was made possible by the added service in the firm's plans, actually provides greater efficiency will depend upon how the accuracy of the forecasts of alternative investment possibilities stand up to the conditions of reality that unfold. It is entirely possible that even though the alternative selected at the planning stage would permit the apparent realization of additional economies of scale, inaccuracies in the forecasts of future cost conditions or market characteristics could make the apparent scale benefits illusory. The planned addition of special services at planned prices above the planned marginal cost do not guarantee real benefits to the users of other services.

Economies of scale is not a phenomenon that is unique to the overall cost conditions of a firm. Rather, it characterizes particular elements of plant or functions of the firm. Economies of scale may exist in the provision of interexchange circuits, but diseconomies of scale may exist in switching and management.

One test of the significance of economies of scale is the number of identical units of plant that are used in the production process. If there is more than one unit of the same kind being employed, then the economies of scale for existing output levels are likely to be exhausted for that type of plant. Another test that provides some indication of the significance of economies of scale would be the existence of competition or potential competition in the supply of service. If more than one firm can exist in a market, this would tend to indicate that available economies of scale can be exhausted at a small level of output relative to the size of the market. If economies of scale are significant, the costs to a competitor of producing at a
relatively small level of output would be so high that he would not consider entering the market. If economies of scale in interexchange plant have not been exhausted because the market has been too small, a system of pricing designed to reflect the significance of marginal costs under economies of scale would require different rates for different route densities, rather than for different users who use routes at widely varying densities in all types of geographical locations. A uniform nationwide pricing system would tend to average away the significance of marginal costs when economies of scale cannot be exhausted. Uniform nationwide pricing is inherently anti-competitive in character.

A full distribution of costs among the service categories allocates any scale benefits from common supply in accordance with relative usage. To the extent that economies of scale exist, each service benefits from the addition of the other services. If the services were not combined in common supply, the marginal costs for all the services would be considerably higher than they are. Separation of the services should result in increases in costs ranging from relatively small for the larger services which can still realize a substantial portion of scale economies, to very large for the smaller services which would have to operate at a much smaller level of output. Thus, the greatest beneficiaries of the scale benefits are the smaller services. If the smaller services cannot yield large proportionate contributions above long-run marginal cost because of the existence of competition that cannot be effectively restrained, it would appear that either economies of scale can be exhausted at small output levels, or the large firm is considerably less efficient in its operations than the smaller competitors.

As a purely theoretical matter, if the commission desired to establish an equal basis for competition, it should set the rate levels for Bell’s monopoly services equal to their long-run incremental costs. By giving all the scale benefits from combined operation to the monopoly services, the commission would be taking away from Bell the enormous competitive advantage that a fully distributed cost rate level standard would provide.

In this writer’s opinion, the available evidence does not support the proposition that AT&T is realizing significant economies of scale. If this interpretation is correct, fully distributed costs can provide as good an approximation of the periodic incremental revenue requirement responsibility of each service as can be obtained. If economies of scale are significant, fully distributed costs might yield a figure above long-run incremental costs by allocating the benefits from the combined supply of the services among the services in accordance with relative use. Hence, it would be not at all unreasonable for the commission to expect AT&T’s competitive services to yield a rate level approximating fully distributed costs. In light of the tremendous competitive advantage that continuing economies of scale would provide for AT&T’s competitive services under a fully distributed cost standard, the company should be able to realize actual rate levels that exceed the standard without difficulty unless AT&T is quite inefficient relative to its competitors. Clearly, it would not be unreasonable to establish a fully distributed cost standard as a rate level maximum for the monopoly services.

E. Demand

It is argued that fully distributed costs ignore demand characteristics. Although demand characteristics can be ignored under any cost standard, there is nothing inherent in the use of a fully distributed cost standard as a guideline for rate level determinations requiring that demand be ignored. Both demand and incremental cost characteristics can be employed to the extent they are known in the determination of actual rates and rate structures. However, the commission would have to be extremely careful in examining proposals to ensure that the conditions of extensive economies of scale and a competitive market are incompatible. If the market conditions permit competition, economies of scale should be readily exhausted. A competitive response of any magnitude would have to result in a burden being thrown on the other services. On the other hand, the cost conditions that are prerequisite to the possibility of significant rate reductions in response to competitive necessity, i.e., economies of scale beyond the existing output level, should foreclose the market to competitors.

A Critique of the AT&T Proposal for a Rate Level Standard

The basic premise of the AT&T proposal is that the rate levels should be designed to achieve Bell’s overall interstate revenue re-
requirement. The revenues for each service classification should cover "the relevant costs" which provide the basis for determining minimum rate levels. The difference between expected revenues of a service and the relevant costs represent the "contribution" that the service makes. Full additional costs represent AT&T's approximation of long-run incremental costs, and each service should have a rate level such that expected revenues at least cover expected full additional costs.

A. "Contributions" and Residual Revenue Requirements

It is immediately apparent that the Bell proposal, which is designed to reflect marginal costs and demand characteristics, determines the rate level for the major service category which is nearly 90 percent of the interstate business without reference to its marginal cost or demand characteristics. MTT becomes a vast monopoly reservoir to which all residual revenue requirements are automatically allocated. Inasmuch as the rate levels for the special services would be determined from a different set of standards than those used to measure Bell's revenue requirement, full additional costs cannot provide a guideline to a determination of the existence of possible intercircuit subsidy. The Bell proposal relates forecasted "contributions," calculated as forecasted revenues in excess of forecasted full additional costs, to revenue requirements calculated on the basis of historical costs for historical accounting periods. Considering the application of the Bell proposal would require a forecast of expected revenue requirements for the same time period in which the rate level calculations were being made. Expected "contributions" will not automatically permit the furnishing of MTT at rates lower than would be required otherwise, and it may result in higher rates.

Although avoidable costs provide an indication of the incremental revenue floor that is relevant to the decision of whether a service should continue to be offered, it provides no indication of whether the service is imposing a burden on other services by requiring them to provide more revenue than they would have, had the service in question not been offered. Within the constraints of past investment decisions the avoidable cost standard is a short-run standard for all existing services. If a firm's expectations at the time of investment have not been realized, and the firm cannot obtain revenues to cover its total periodic costs, it should continue to provide service as long as revenues exceed the costs that can be avoided. At least portions of the inherited plant will represent costs which cannot be avoided. Since the decision is not whether the firm should invest new capital in the service, but only whether the service should be continued with existing plant, there are fixed costs that will be borne whether or not the service is offered.

If the past investment costs, which cannot be borne by the service in question, are included in revenue requirement calculations, they will result in the imposition of a burden on other users. It cannot be concluded that a service is compensatory simply because it is not economic to discontinue the service. If a service does not live up to the assumptions or forecasts of its past investment commitments, it will not be compensatory in the long run. Whether other services should bear the cost of investment inefficiencies in a particular service is a question that should be decided by the commission. Under AT&T's proposal, such costs would flow automatically to the residual monopoly MTT service.

With the monopoly service supplying the residual revenue requirement, AT&T's proposal virtually guarantees that the revenue requirement will be met regardless of the expectations upon which the rate levels for the non-MTT services are determined. The burden of uncertainty of errors in forecasting for the competitive ser-
Pricing Practices and Problems

vice falls directly on the monopoly service. As a result, AT&T's incentive for attempting to perceive all the long-run effects of its investment decisions tends to diminish considerably from what it would be if the uncertainty were borne by stockholders. Thus, the proposed standard tends to bias the estimates in a manner that makes the standard inapplicable. In addition, there is an additional incentive for AT&T to structure Western Electric equipment prices so that the full additional cost calculations are minimized.

For virtually any private interest objective that might be attributed to management (within the rate of return constraint), whether it be maximizing profit, revenues, growth or market shares, the incentive tends toward the establishment of rate levels for all the competitive services as close as possible to the full additional cost minimum, as well as an incentive to reduce expected future costs. Understatements of expected future costs can justify reduced rate level minima for competitive services while the actual costs are included in the revenue requirement and guaranteed by MTT.

8. Full Additional Cost as an Approximation of Long-Run Incremental Cost

Bell's full additional cost estimates are calculated on the basis of selected actual costs of facilities that were added to the system in recent past periods. It is apparently assumed that the actual costs of the recent past provide a good approximation of the expected costs of the near term future because the same facilities that have been constructed in recent past periods will be replicated in future periods. For the interchange transmission facilities, an average cost per circuit mile figure is calculated for each of three types of facilities that have been added to the system in the recent past. Facilities of the newest technology that are now being installed, such as the twenty tube coaxial cable, are excluded from the study because the cost estimates would be speculative at this point in time. For each of the ten distance bands, a weighted average of the three average cost per circuit mile figures is calculated so that a set of average cost per circuit mile figures, representing recent histori-

37. For a detailed description, see the testimony and cross-examination of A. M. Froggatt, Bell Ex. 24.

cal costs, is obtained. This set of unit cost figures is deemed relevant for all services. Most expense classifications are allocated to services on the basis of their past relationships to historical book investment or revenue.

It is immediately apparent that full additional costs were not calculated on the basis of comparisons of the expected total costs for alternative output levels. In fact, the full additional cost approach does not even consider the production (or service) increment of economic theory, which weighs alternative courses of action by considering the marginal conditions. It is a set of average cost calculations that distribute those historical costs that the methodology of the cost analysis permits it to distribute. It has more arbitrary elements than the general approach to fully distributed costing, which distributes all the costs that are recognized in a particular time period, by arbitrarily selecting that portion of the historical costs that will be distributed. Thus, the full additional cost concept is incremental only in its selection of the vintage of historical plant that it employs in the calculations. Rather than select all the historical investment in plant that is being used productively in the provision of communications service today, the full additional cost approach bases its average unit cost calculations upon selected additions to plant during a recent past period. It attempts to divide the productive facilities being used today into distant past and recent past categories, and then measure the average unit costs of selected recent additions. The approach does not recognize, however, that the additions in the recent past depended upon the capacity inherited from the more distant past. In essence, the capital cost of the older vintage capacity that has been allocated to current periods is treated as a fixed, unallocable cost relevant only for revenue requirement purposes. On the other hand, the planning horizon does not involve a detailed forecast of future events. Apparently, it is assumed that future investments will essentially replicate past investments, and that future periods will bear that portion of recent investment costs allocated to them by existing depreciation prac-

The problem of the proper timing of the periodic recognition of investment costs over the life of the facility is a cost problem of a different dimension from the problem of establishing the cost standards to be used in evaluating the rate levels of the various interstate services for a particular period of time. But the method em-
ployed to allocate investment cost to accounting periods over the life of the facility will directly affect the results of the application of the alternative rate level cost standards at any particular period in time. Whereas fully distributed cost requires the service classifications to be responsible for all costs that have been allocated to current periods, the full additional cost concept provides only a fleeting cost responsibility for a single annual accounting period when the investment in long-lived facilities will last many years. 

The full additional cost calculations are premised upon an assumption that the investment costs of the facilities added during the recent past can be allocated uniformly over the productive life span of the facilities. The greater the proportion of recent investment costs that are not recognized until future periods, the lower will be the full additional cost calculations today. However, in future periods there will be new facility additions for which full additional cost calculations will be derived so that there will be no continuing cost responsibility by service for the inherited costs associated with inherited capacity, even though the initial full additional cost calculations were premised upon the assumption of continuing cost responsibility. Thus, the basic criterion for separating the allocable costs from the unallocable costs has no relationship whatsoever to the marginal conditions of economic theory.

As an historical cost study, the full additional cost approach does not permit a comparison between the depreciation cost levels of investment in plant of different vintage. It assigns the average depreciation reserve ratio to plant of all vintages, i.e., it assumes that all plant has been depreciated to the same degree. The aggregate depreciation reserve ratio figure that is applied is 22 percent of gross book investment. The figure is based upon a weighted average of the depreciation that has been taken in past periods on the existing plant of all vintages. It therefore reflects the higher depreciation reserve ratios of the older plant and the lower ratios of the newer plant. The 22 percent figure is not the recent historical additions to the capacity that were selected for inclusion in the full additional cost calculations.

Although the depreciated investment costs of the older plant are specifically excluded from the full additional cost calculations, the effect of the depreciation taken on the older plant upon the aggregate depreciation reserve ratio is reflected. As a result, net full additional investment tends to be substantially lower than it would be otherwise. By applying the historical book depreciation reserve ratio to plant of different vintages, the full additional cost methodology makes it impossible for the net investment costs of older vintage equipment to be written down to the net full additional investment costs. The assumptions relating to the depreciation reserve make it impossible for the full additional costs of the various service classifications to sum to Bell's revenue requirement. To illustrate, accepting a 22 percent depreciation reserve ratio, for every $100 in new investment that goes into the rate base, $78 is included in the full additional investment calculation. In addition, it should be noted that the depreciation reserve ratio that is employed is purely fortuitous insofar as current investment costs are concerned because it depends entirely upon the quantity and timing of past investment and the depreciation policy employed in past periods.

Another significant tendency toward understatement resulting from the full additional cost methodology arises in the calculations of the proportions of expenses that are included as part of the full additional cost calculations. For many of the expense components, the allocated amounts were derived on the basis of weighted ratios of the expenses incurred in the current (i.e., recent past) period to gross historical investment recorded on the books in the same period. These ratios were applied to the full additional investment estimates for the service classifications studied. But expenses are always current, never past, and the gross historical investment at any particular point in time represents the accumulation of the history of investment in plant still being used. The result is that these current expense amounts are divided between allocable and non-allocable categories in accordance with the relationship between current undepreciated investment costs and the undepreciated investment costs of all historical plant being used. Since gross investment costs per unit of interexchange transmission plant have been declining over the years due to advances in transmission technology, only a portion of every dollar of current expenses is recog-

38. For an illustration of this phenomena, see testimony of H. H. Wein, FCC Ex. 80, Docket 16298, July 22, 1968, pp. 38-45.

nized as a current cost in the full additional cost calculations. Here again, the influence of the plant that has been excluded from the full additional cost studies is arbitrarily brought to bear in a manner that tends to reduce the cost calculations.

As an experiment in the application of a long-run incremental cost concept, the full additional cost approach has clearly failed. The full additional cost calculations are entirely a product of the arbitrary methodology adopted. The procedures employed require that the full additional cost calculations understate current costs. The allocation criteria have no discernible relationship to the marginal conditions of economic theory. We must return to defining the essential nature of the marginal cost concept in dealing with the practical problem.

Demand and Incremental Revenue Calculation:

The revenue figure employed by AT&T in the calculation of the "contribution" above full additional cost was the total revenue calculation for the service under examination and not the incremental revenue to the firm. This, of course, fails to recognize the significance of cross-elasticity among the various service classifications. However, the AT&T testimony emphasized the high degree of interrelationship among the interstate service classifications. Hence, the incremental revenue for most special services will be considerably less than the total revenue directly forthcoming from the added service at reduced prices.

To illustrate, assume that a new service category has been added, and that the firm has sold 100,000 units of the new service during the past year at a price of $1.00 per unit for a total revenue of $100,000 for the service. Assume that the long-run incremental cost is calculated correctly to be $0.90 per unit or $90,000 for the period. Under the Bell proposal, it would be concluded that a contribution of $10,000 was made and that consumers of MTT benefited from the addition of the service. However, if 50,000 of the units purchased under the new service classification at $1.00 per unit were diverted from the older service classifications and would have been purchased under the old classifications anyway at $2.00 per unit, the incremental revenue was actually zero dollars. There was simply a shift of $100,000 in revenue from an old service classification to the new one. In addition, the creation of the service category required that output be increased by 50,000 units and an incremental cost of $45,000 incurred. Thus, what would appear to be a contribution of $10,000 in the calculations would really be a deficit of $45,000. The residual service would not be benefiting from the addition of the new service classification; it would be subsidizing that service classification.

The cross-elasticity among AT&T's interstate services is likely to have its greatest impact upon the incremental revenue calculations applicable to AT&T's TELPAK service classification because it has by far the lowest effective rates. When TELPAK was created there was a shift from other service classifications to the TELPAK classification; and as TELPAK rates are increased, shifts of communications usage from TELPAK back to other classifications can be expected. The revenue calculation used by AT&T will tend to overstate the incremental revenues of all service classifications for which AT&T offers a higher priced substitute. Moreover, the impact of the cross-elasticity tends to be magnified by the practice of employing uniform nationwide tariff rates. In the case of TELPAK, AT&T responded to some specific elements of apparent potential competition consisting of specific users and specific communications uses in specific locations. By responding with a new nationwide tariff at tremendously reduced rates, AT&T made the special low rates applicable to a broad spectrum of users that includes great quantities of communications usage for which there is no "apparent competitive necessity."

Recent Developments

In May 1969, the FCC's extensive investigation into the inter-service subsidy problem for all practical purposes came to an end with a negotiated stipulation among the FCC staff and the parties to the case—the common carriers and representatives of large special interest user groups. Users of the basic monopoly service did not have an advocate of their interests. The stipulation consisted of

a summary of the alternative principles and standards proposed by the various witnesses in the investigation. It acknowledged that all of the contending principles may have some degree of relevance to some kinds of problems related to rate making or rate level regulation, but that "(i)t is not intended that any one of the principles be given undue weight." 41 The stipulation recognized that the fundamental issue posed in the rate level investigation was not resolved.

As recognized above, the agreed ratemaking principles and factors herein contained are, of necessity, rather general and nonexclusive. An adjudication of other relevant and more specific principles and factors will be required in connection with a Commission determination as to the appropriate rate level for any category of service. 42

There is no evidence that the stipulated statement of rate making principles and factors was reached by applying marginal analysis. Although there is certainly a full distribution of principles and standards, it appears that the criteria related more to classical political economy.

The stipulation called for new studies by AT&T of both incremental and fully distributed costs, based upon methodologies to be developed, for the rate levels of AT&T's interstate service. It indicated that the issue of the proper rate level standard could be pursued as part of an examination of specific rate proposals for particular services. On July 29, 1969, the commission noted the stipulation and agreed to the procedures. 43 In a dissenting opinion, Commissioner Johnson stated that "there is no agreement; it is just that some way had to be found to terminate this proceeding." 44 He observed that the commission has been trying to evaluate charges of unlawful price discrimination, service cross-subsidization and predatory pricing for fifteen years and posed the fundamental issue, once again:

Unless the Commission intends to retire from the field of contention altogether, allowing Bell to price in any manner the company finds in its interest, these issues and their attendant differences will have to be resolved." 45

Having made an extensive investigatory excursion into the general area of rate level regulation of major service classifications, the FCC must now decide whether to push forward and establish rate level standards or retreat to the traditional arena that confines regulation to jurisdictional revenue requirements. However, the specific problems of cross-subsidy will not be fading away in the immediate future. Moreover, the commission cannot expect to effectively implement policies directed toward opening selective communications markets to new entrants without exercising regulatory controls over interservice subsidy and predatory pricing.

With regard to the commission's recent decision allowing the entry of MCI as a specialized common carrier, an outline of the future predatory pricing issue can be seen. While arguing in extensive hearings that the MCI applications should be rejected by the FCC because there was no public need or demand for the types of services proposed by MCI, AT&T introduced a new classification of private line service in its private line tariff (Series 11,000) incorporating several of the same service characteristics proposed by MCI. Therefore, in the MCI decision, the commission was prompted to observe: "(t)he statements by AT&T in support of its own proposals substantially undermine the arguments advanced by the carrier in this proceeding to the effect that no public need exists for the sharing provisions of the MCI proposal and that MCI is cream-skimming." 46 At the same time that AT&T was vigorously insisting that rates and rate levels must be based upon analyses of demand and market conditions, the company was telling the FCC that it had not analyzed the market for Series 11,000 and it could not specify any customers or types of use that would be accommodated under Series 11,000. No forecasts of any kind were made. Typical of the response of the carrier to a series of questions raised by the FCC staff addressed to AT&T's implementation of its own professed rate making principles was as follows:

Information responsive to these questions is not available. . . . One of the basic objectives of the trial offering is to determine what shifts will occur in the actual marketplace as a result of the introduction of this new service. . . . There are so many differences between Series 11,000 service and other Bell System private line services . . . that it would be highly speculative to

41 Ibid., Section I, Par. 3.
42 Ibid., Section II, Par. 3.
44 Ibid., Dissenting Opinion of Commissioner Nicholas Johnson.
45 Ibid.
46 18 FCC 2d, 962. For a discussion of the specific service characteristics, see pp. 961-62.
estimate how, what, and where existing services might be substituted with Series 11,000. 47

The Series 11,000 tariff was an experimental service with obviously discriminatory low rates for certain kinds of service between certain large cities. For some assumed volumes and conditions of use, the effective rates were lower than TELPAK rates for equivalent service. The rates were set at "full additional cost" plus 20 percent. It was claimed that the former reflected nationwide average incremental costs while the latter reflected the company’s judgment.

This series of events is important because it illustrates the environment in which problems of communications rate regulation are examined. The carriers apparently see immediate short-run objectives of keeping free from regulatory constraints, using regulation to constrain any developments that would upset established institutional relationships, and putting forth all theories, arguments and rationalizations that tend to support what they want to do. Diagonically opposed positions by the same carrier in different proceedings at the same time or even in the same proceeding are commonplace. 48 It is an adversary process where a complete picture of the real state of affairs can only be obtained through the sifting and winnowing of critical examination of carrier justifications and the application of a practical test of accountability.

To a significant degree economists and their theories are simply pawns in an adversary process addressed to the larger issue of whether there will be regulation over interservice subsidies and if so, how effective that regulation will be. It is still very uncertain whether AT&T has seriously committed itself to the continuing study of incremental market and cost characteristics as a basis for making better investment and pricing decisions and as a basis for

47. AT&T, Response to FCC Letter of May 27, 1969, in Connection with Series 11,000 Service, June 20, 1969, p. 10. 48. The petitions of the established common carriers to deny the entry of proposed new specialized data-oriented carriers are among the most flagrant. To illustrate, the established carriers argue that there is no demand for the proposed services but that if entry is permitted, they will lose business; that the proposed systems cannot realize the tremendous economies of scale of AT&T, but that AT&T will have to reduce prices to compete; that everyone is optimally served now, but that the proposed entrants are cream-skimming, thus forcing portions of the nation to be denied the proposed service.

being more responsive to the objectives of economic regulation, or whether it desires only to acquire a stable of economists and an inventory of economic theories and complicated studies that will prevent the establishment of effective regulation.

Conclusion

The FCC has been seeking a test of accountability to be applied to AT&T’s major interstate service classifications that will identify interservice subsidies and enable the commission to prevent losses in specialized and potentially competitive markets from being recovered automatically and imperceptibly by the basic monopoly message toll telephone service. The options are clear; if it adopts the AT&T incremental cost proposal, there will be no effective regulation over service rate levels. No matter what understandings, forecasting errors, inefficiencies or manipulations occur with regard to the incremental costs derived for a particular specialized service, the residual revenue requirements will be recovered from the massiv monopoly market. And there will be no way of testing the incremental cost measurement or holding management and stockholders accountable for the company’s performance on a service-by-service basis.

The commission should use fully distributed cost as the best guideline available to indicate the rate levels that would be expected from AT&T’s interstate service classifications in the normal course of operations where markets are growing and additions to plant are being made continuously. Actual rate levels that deviate significantly from the fully distributed cost standard should signal the necessity for special justification or the realignment of the levels with the standard. The distribution of the costs of capacity that is used in common by more than one service classification should be made in accordance with relative use at the peak demand on that capacity. In applying the fully allocated cost guideline, the commission can recognize that there are special circumstances where deviations from the standard could be justified. Available evidence on a wide variety of incremental cost relationships as well as demand characteristics can be considered in evaluating special circumstances.

Most importantly, MTT should not be treated as the automatic
supplier of the residual revenues necessary to meet the overall revenue requirement. At present, the maximum rate level can be set at fully distributed cost including the allowed rate of return, although there are many good reasons why it should be lower. Competitive necessity pricing responses should be confined to the specific locations, users, and uses for which the competition exists, and for which there has been a demonstration, using cost and market evidence, that the net revenues are being maximized in these markets. When rate reductions are proposed to meet competitive necessity, the commission should require a submission of detailed forecasts of the estimated cost and market conditions under the alternative rate plans that were considered, including the effects upon AT&T's other services.

The commission should foster entry in the private line and data markets both as a means of testing the significance of the carrier's economies of scale belief94 and of stimulating the industry response to improvements in technology and diversifying demands in communications markets where the growth potential seems to be enormous. The commission must take steps immediately to establish an improved information base95 for evaluating cost and market characteristics, by requiring Bell and the other carriers to submit on a regular basis: (a) forecasts of future markets under alternative pricing assumptions; (b) forecasts of the alternative investment plans being considered by management under alternative pricing assumptions. The FCC has begun to move in this direction by proposing, in a Notice of Proposed Rule Making, to require carriers to support rate changes and new service classifications with forecasts extending up to three years from the date of filing.96 It should be emphasized that the use of fully distributed cost as a rate level benchmark does not alleviate the need for research on demand and cost characteristics, the results of which can play an important role in the derivation of specific rates and rate structures. The adoption of a fully distributed cost rate level accountability

standard and the establishment of maximum rate levels for the monopoly services can be expected to stimulate AT&T's interest in obtaining an improved understanding of the cost and demand characteristics of its markets. Since the basic monopoly service would no longer be the supplier of all residual revenue requirements, the judgments and expectations built into the company's estimates will tend to reflect the more realistic condition that the stockholder bears at least part of the uncertainty of estimation errors. Moreover, this increased regulatory activity by the commission is likely to prompt a greater willingness on the part of AT&T to supply forecasted information on a regular basis and assess the role of forecasts in the total regulatory process.

There is already evidence that the Seven-Way Cost Study has had a significant impact on AT&T. It prompted AT&T to vastly increase its attention to the study of cost and market characteristics, even though the primary reason was to refute the Seven-Way Study. On the basis of AT&T's full additional cost for its special services that were prompted by the Seven-Way Study, significant rate increases were instituted in the private line telegraph, TELPAK, TWX, and audio-video services.97 These increases have enabled significant reduction in MTT rates. Thus, the Seven-Way Study clearly did provide a benchmark that prompted adjustments in rates to be made in the directions indicated by the study. Moreover, the adjustments proposed by AT&T have involved very substantial rate increases, particularly in the TELPAK and audio-video services. And further adjustments may be required when the company finishes studies currently underway. The issue now is the magnitude of additional rate increases for the special services and rate reductions for MTT that are necessary to eliminate the remaining interservice subsidies.

The problem of rate level regulation and interservice subsidy is not one of optimizing from known alternatives. Rather it is a search for general guidelines that, when applied within the constraints of existing institutional relationships under conditions of uncertainty, will provide a signal that deviations from a broad economic path of

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94. Obviously, if predatory pricing and cross-subsidy is permitted, the market test would have no meaning.
95. See, Trebing and Melody, Pricing Practices and Policies.
97. See testimony of William M. Ellingham, Bell Ex. 46, Docket 16258. For a discussion of the evaluation of AT&T's pricing practices for these services, see Trebing and Melody, Pricing Practices and Policies, chap. 6 and 7.
development are occurring. Economists recognize that there is a tendency of regulation of the utility's overall revenue requirements to bias management investment and pricing decisions away from their optima in the direction of cross-subsidy even under conditions of perfect foreknowledge, and that:

Under imperfect markets . . . there is a double uncertainty—we are not only uncertain as to the future, but we are uncertain even as to the present parameters of the market functions." 53

Hence, the real world regulatory problem is not even subject to a sub-second best solution or a local optimum. It is subject only to general guidelines.

The extensive inquiry by the FCC into the cross-subsidy problem provided much support for Joan Robinson's assessment:

The neo-classical heritage still has a great influence, not only on the teaching of economics but in forming public opinion generally, or at least in providing public opinion with its slogans. But when it comes to an actual issue, it has nothing concrete to say." 54

Other than the mathematics of marginal analysis, the standard theory of pricing contributed very little to the resolution of the cross-subsidy problem. But the marginal analysis is an historic contribution of mathematics, not economics. It is a tool of economic analysis, not the analysis.

There are many areas of much greater significance than the rationalization of predatory pricing, cross-subsidies, and price discrimination, where economic analysis of incremental relationships is desperately needed and where substantial benefits could be obtained. First, the possibilities for extensions and more sophisticated applications of peak-off-peak pricing are substantial. Despite some major changes in recent years altering some rate structures in this direction, there are still tremendous opportunities for increasing the efficiency of the communications network by means of rate structure modifications of this nature.

Second, study of cost and demand characteristics by location, route density, and dimension of service is surely needed. Such hypotheses as economies of scale, nationwide averaging, and cream-skimming that form the folklore foundation upon which much of management and regulatory policy is based have never been effectively tested. For example, nationwide averaging is not applied by averaging anything. Rather rates are determined for special services and the tariffed rates for the monopoly service are adjusted to recover the residual revenue requirements which are calculated on the basis of total accounting costs. Uniform tariffs, which may or may not result in uniform charges for the same service, are applied generally without distinguishing geographical location. But no conclusions can be drawn about the specific characteristics of the costs that were included in the aggregate pot of costs. It can only be concluded that nationwide averaging has been fairly effective folklore and that the detailed costs characteristics are not known. 55

Third, the criteria for allocating costs among time periods is in desperate need of economic analysis. Depreciation policy is the most significant factor in determining the periodic recognition of costs and therefore has a great influence upon periodic revenue requirement calculations. But the revenue requirement determination is no more a matter of distributive justice or equity than any other regulatory problem relating to prices, revenues, and costs. 56 The regulatory objective is to set the periodic revenue requirement to cover the periodic total costs. Under present practice, arbitrary straight line depreciation allocations are used as the fundamental criteria dictating the periodic recognition of costs. Moreover, depreciation policies in communications, as well as most other public utility industries, include a wide variety of practices that tend to group and average investments in a manner that completely obscures specific information about the nature of particular cost characteristics, or even the particular vintages of investment. 57 The significance of using group depreciation plans and composite depreciation rates, as well as the straight line methodology itself are important areas in need of extensive economic analysis. 58 In light of the fact that tech-

56. "The first natural extension of the elementary marginal analysis would seem to be in the direction of taking explicit account of the time and capital-asset dimensions of the firm." Boulling, "Present Positions," in the Theory of the Firm, p. 4. For example, see Boulling, A Reconstruction of Economics (New York: Wiley, 1966).
58. Turvey, Optimal Pricing, pp. 291-98; P. Lhermitte, De L'Equivalence entre le Calcul Economique Classique et le Langage de L'Amortisse-
nological change is acting to reduce unit costs over time in major elements of communications supply, a liberalized depreciation allocation method may provide a closer approximation to the periodic economic costs of service than existing straight line allocations.

In the future, the cross-subsidy problem in communications will be much more subtle and complex than it is today. AT&T has established an analogue communications system specialized for voice communications. Although it can be used for data communications, it is relatively uneconomical in comparison with a digitalized system specialized for data.

The telephone network was developed for speech transmission, and its characteristics were designed to fit that objective. Hence, it is recognized that the use of it for a distinctly different purpose, such as data transmission, may impose compromises both in the medium and in the special service contemplated. 10

By the same token, digitalized systems are not the most economical for standard voice communications. At present, the data market potential is providing the stimulus for the entry applications of specialized carriers. At the same time AT&T is adapting its investment program to the digital technology and converting major portions of its system from analogue to digital communications. The question for the future is, if AT&T decides to attempt to convert its system to a specialized data system in order to maintain its dominant competitive position in the data market, will the monopoly voice user pay for the conversion of his service to the less economical method of supply? Consideration of this crucial problem will require much more sophisticated analysis than has been brought to bear on the cross-subsidy issue to date. However, if economic theory is going to contribute to a resolution of the problem, it will have to be moved out of the comforting confines of the textbook models. What are needed for decision making by both management and regulator are specific economic models based upon an understanding of the particular characteristics of the industry and its markets.

III
Pricing, Competition, and Market Structure

It is a fundamental tenet of industrial organization that market structure affects behavior or conduct, which in turn influences performance. In the past, market structure in the regulated industries has been assumed to be of minor importance, but with the transition from natural monopoly to an admixture of monopoly and competition in many regulated sectors, this factor can no longer be relegated to a secondary position. Price and market structure are interrelated, and so ultimately is performance.

The emergence of selective competition in particular markets has been reflected in both price and nonprice rivalry. The paper by the late Wallace F. Lovejoy examines both, and provides a detailed discussion of promotional practices, shades or variations of price competition, and the regulatory response. The Lovejoy paper also looks toward the question of whether such rivalry is in the public interest. Charles F. Phillips, Jr., Gary L. Luck, and Randall T. Klemme provide a range of viewpoints as discussants for the paper.

In the second paper, David S. Schwartz examines competition in a broader setting. There can be little doubt that the institutional framework and industry structure have a discernible impact on innovation and change as well as
pricing behavior. Schwartz examines the two major alternatives which face the energy utilities, notably pluralism and organizational diversity on the one hand, and increased concentration on the other. The fundamental question is whether pluralism or greater concentration will maximize the net contribution to the general welfare. Does pluralism result in higher prices? Is greater concentration necessary to achieve economies of scale and thereby lower prices? Schwartz argues persuasively for pluralism; Horace M. Gray and Rene H. Males as discussants reach divergent but stimulating conclusions.

The Impact of Competition Among Public Utilities: Gas Versus Electricity

Wallace F. Lovejoy

Southern Methodist University

Competition is fast becoming a fact of life for public utility companies, whether the industries involved or those who regulate them like it or not. It promises to complicate the regulatory processes, but it also holds out the possibility of considerable benefits for the consuming public. This competition has increased in almost all areas, and discussions of its effects have begun. It is unfortunate in some respects that the discussion has centered in the adversary proceedings of state and federal commissions in which the examiner or commission must attempt to evaluate extremely complex issues of economic theory and make a decision without the help of a body of

This paper was written for presentation at the conference held at the Public Utilities Institute, Michigan State University, East Lansing, Michigan, March 25, 1969. The author wishes to express his appreciation to Mr. Terry M. Hagle for his assistance in gathering data and for his helpful comments.
disinterested literature on the subject. This comment is not intended to disparage the testimony of extremely competent individuals before commissions; it is meant to urge more conferences where interested people can get away from the heat of specific cases and take a broader, more long-run view of the competitive problem.

The major areas in which competition is having a major impact are several. Only one will be discussed in detail, but mention of the others points up the pervasiveness of this phenomenon and thus the need for more attention to it. The list includes the following areas:

1. Gas versus electricity for residential and commercial service customers. Competition is intense here and is carried on with price and non-price weapons. This area will be the primary topic of my paper.
2. Gas versus electricity for large industrial loads.
3. Gas versus other fuels for large industrial loads.
4. Competition among pipelines for new or growing markets.
5. Competition among pipelines for gas supplies.
6. Competition between different modes of transportation for specific groups of traffic, for example, bus company complaints against certain types of promotional air fares; rail versus motor carrier versus barge competition.
7. Competition between the same kinds of carriers for given markets.
8. Competition between the Bell System and other telecommunications carriers, both public and private, for voice and data long-distance communications markets. The current FCC investigation is developing one of the most comprehensive records of the economic theory and analysis needed to deal with competition among public utilities and should be studied by economists and regulatory authorities concerned with this problem.

1. Gas Versus Electricity; The Nature of Competition

Competition is not new for gas and electricity in residential and commercial markets. For many years both gas and electric appli-

ances have been used for cooking, water heating, and refrigeration. More recently, there has been the development of several types of electric space-heating techniques, several types of gas-fueled air-conditioning systems, both gas and electric clothes dryers, and total energy systems in which a building can get all its energy needs from either gas or electricity. These developments have in fact created good substitutes in most uses of either gas or electricity, and where there are close substitutes there will be competition.

One vigorous aspect of gas versus electric competition has been found in consumption technology, that is, the development of appliances. Currently, it appears that electricity is winning the appliance battle. Electricity has been able to develop space-heating equipment that is gaining wide acceptance among consumers, and thus gas is threatened in a market once served almost exclusively by gas, oil, and coal. Electricity has also had some degree of success in developing rapid-recovery water-heating equipment. Gas, on the other hand, has not succeeded in significantly penetrating the air-conditioning market despite the fact that a basic technology of gas refrigeration has been known since the 1930s, nor has gas had much success in developing an appliance to generate electricity for the lighting load. The gas turbine generator is used in total energy systems, and in the future the gas-powered fuel cell may be feasible. However, such devices have not yet gained wide acceptance.

While it is always dangerous to specify the reasons for success in technology, one aspect stands out in this area. The electrical appliance manufacturers as a group are extremely aggressive and competitive among themselves, at least when it comes to innovation. General Electric and Westinghouse are huge diversified electric equipment manufacturers who will sell more electric generators and switchgear equipment if they develop home appliances that use more electricity. These, as well as smaller companies in the industry, tend to be research-oriented to a much greater degree than gas appliance manufacturers as a group. Until recently the electric appliance and electricity industries devoted much more effort to promoting new appliances than did the gas industry. Innovational competition will not be discussed here, but it underlies much of the price and non-price competition between gas and electricity today.

A second aspect of competition is in price itself. There has always been some price competition, but promotional rates have become more and more common in the past decade. These rates have come
in with the availability of new or improved appliances. Most frequently, promotional rates have been for electric space heating, electric water heating, all electric service, gas air-conditioning, and total energy gas service. As one would expect, after promotional rates have been introduced by one competitor, there is frequently a price response from the other competitor.

A third aspect of competition, non-price promotional practices, has in the past five or six years assumed growing importance. This aspect of competition will be discussed in detail. It is important for two reasons: it has some effects different from price competition, and regulators are not in agreement as to whether or not it should be regulated, and if so, how.

There are several reasons for the adoption of some of the non-price techniques of competition used by utilities. (1) Since prices under utility regulation are often regulated in considerable detail, and since price changes often require a full-blown rate investigation, there is often little room for flexibility in the use of price as a competitive weapon. (2) Prices are in some respects a clumsy tool for attempting to attract particular customers to use a service. (3) The general philosophy of average-cost or fully distributed-cost pricing, which is generally accepted (though not always precisely applied) for pricing between classes of customers, has tended to dampen experimentation in using different pricing schemes. (4) In instances in which there is a desire to promote business within a class of customer, the mere grouping of customers into classes reduces the possibility of using price as a competitive tool within a class. A utility usually cannot offer two different prices to two different customers in the same class if they consume the same amount of service. (5) There is a growing awareness that decisions to use gas or electricity are often not made by the people who will ultimately use the service; thus, price concessions may do little or nothing to attract new business. This aspect introduces an entirely new variable into the analysis of competition, one that is not easily handled with the standard economic tools.

These arguments are not intended to convey the impression that price competition is not significant, but rather to emphasize that competition must now be viewed in several dimensions. The spectrum of competitive practices being used encompasses all that is legally done in non-regulated industries plus things which might be illegal under the Robinson-Patman Act for non-regulated firms. The following list illustrates but is not inclusive of all the practices used: all forms of direct radio, television, and newspaper advertising by utilities; cash payments to builders, developers, and promoters to install a specific type of space heating, water heating, cooking, and clothes drying equipment; free or reduced-cost installation of utility service lines; free or reduced-cost appliances; financing of builders’ prospects; free or reduced-cost installation and maintenance of appliances; free or reduced-cost insulation for buildings; advertising allowances to builders, developers, and appliance dealers; free or reduced-cost service for model homes and apartments; guaranteed maximum utility bills for specified times; free gifts, trips, trading stamps, and so forth to builders, home owners, and dealers; financing appliances on customers’ monthly bills; and cash bonuses to appliance dealers for selling specific types of appliances.

In the non-regulated world, many of these competitive devices are standard, acceptable business practices. The relevant question is: should they be considered acceptable practices for gas and electric utilities, and how does one judge their desirability? The question can be broadened to ask, is competition between utilities, both price and non-price, in the public interest?

Questions like these must be answered to determine what, if any, types of promotional practices and prices should be used by public utilities, and what, if any, regulations should be imposed by commissions on such practices and prices. Clearly, utility regulation is a pragmatic process in which the regulator encounters great frustration with the economist telling him what he should be doing from a theoretical viewpoint, when the regulator has neither the data that the economist says he needs, nor the freedom to act experimentally in a laboratory, nor the time to wait and see what happens if he

2. There are significant exceptions to this statement which require more justification than commissions usually require.

3. Price competition has also increased in many areas. In fact, experimentation with the discussion of new pricing techniques has reopened, at the regulatory level, the old but relevant questions of marginal-cost pricing. See, for example, William G. Shepherd, "Marginal-Cost Pricing in American Utilities," Southern Economic Journal, July 1968, pp. 58-70.
moves in one direction or another when perhaps millions of dollars are at stake. Yet, the economist can help the regulator by demonstrating the possible effects of different types of behavior. Added insights into a problem can hopefully aid in its solution.

The justifications for non-price promotional practices follow the same lines as those for promotional pricing. Basically, promotional efforts are used for three reasons: (1) to build load in off-peak seasons; (2) to build base load for general system growth; and (3) to protect against the inroads of competitors using non-price promotional practices and/or promotional pricing. Frequently it is difficult to separate these aims when analyzing a particular practice. The following discussion will analyze several practices with the view to separating objectives and effects in these categories. Much of the material used in the discussion comes from the Hearings and Report of the Subcommittee on Activities of Regulatory Agencies of the House Select Committee on Small Business. Among other things, the subcommittee sent questionnaires to utility and petroleum refineries to obtain information on promotional activities. A total of twenty-six electric companies, twenty-two gas companies, fourteen combination gas and electric companies, and seventeen petroleum refining companies responded. There is no way to determine precisely what portion of the respective industries these companies represent, but the list of names indicates it must be substantial in each case. Table 1 shows the operating revenues for each group in 1966, as well as total industry figures and indicates 22 to 56 percent coverage by the sample, depending on the specific group. There may be some double counting in the industry figures, but this would just raise the share of the respondents in the industry. There is not uniform geographic dispersion. In particular, the southeastern United States and Rocky Mountain areas are lacking for all classes, and the south central area is not represented for electricity. No other data are available; therefore the data will be considered as being roughly representative of industry practice.

The analysis is complicated by the fact that promotional practices are directed at several groups. Table 2 shows total utility promotional payments by type of recipient for 1963–66 that were made by respondents to the questionnaire. The group receiving the largest share, about 50 percent of the total, has been builders and developers of residential tracts and apartments. This in itself is striking because for the most part this group will not be the group that ultimately ends up paying for utility service. Thus, these promotions are inducements to put in particular kinds of appliances and service. The recipient may have little interest in the level of service cost to the utility customer.

Another group of recipients is the appliance dealer and distributor. His share is the smallest, about 8 percent but it is not insignificant. This group also has little or no interest in the cost of utility service to the ultimate consumer. The "other" category is comprised mostly of payments by utilities to trade associations. This is evident from Table 3 which breaks down promotional payments by type rather than recipient. Thus for 1960, for example, trade associations received $10,522,000, and the "other" category in Table 2

TABLE 2
Total Utility Promotional Payments,* by Type of Recipient, 1963-66
(amounts in thousands)

<table>
<thead>
<tr>
<th>Payments</th>
<th>1963</th>
<th>1964</th>
<th>1965</th>
<th>1966</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>%</td>
<td>Amount</td>
<td>%</td>
</tr>
<tr>
<td>Builder, owner,</td>
<td>$20,663</td>
<td>51.0</td>
<td>$24,139</td>
<td>49.8</td>
</tr>
<tr>
<td>developera</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dealerb</td>
<td>3,237</td>
<td>8.2</td>
<td>3,824</td>
<td>8.0</td>
</tr>
<tr>
<td>Customerc</td>
<td>4,174</td>
<td>10.2</td>
<td>5,146</td>
<td>10.6</td>
</tr>
<tr>
<td>Owner—residentiald</td>
<td>3,301</td>
<td>9.3</td>
<td>5,773</td>
<td>11.9</td>
</tr>
<tr>
<td>Otherc</td>
<td>8,282</td>
<td>21.5</td>
<td>9,838</td>
<td>19.7</td>
</tr>
<tr>
<td>Total</td>
<td>$41,087</td>
<td>100.0</td>
<td>$48,450</td>
<td>100.0</td>
</tr>
</tbody>
</table>


NOTES: *Represents the cost to the utility and not necessarily the value to the recipient.
1. Person or company which develops, builds, or owns tract of residential homes or apartments.
2. Distributor or retailer of appliances and related equipment.
3. Individual owner of single-family residence or small multi-family residence.
4. Trade associations, schools, hospitals, and miscellaneous recipients.

received $12,653,000. It is clear that over 80 percent of the "other" recipients were trade associations. It is perhaps safe to assume that most of the rest of the "other" category were ultimate consumers of service. If this assumption is made, it can be said that ultimate consumers received the following amounts in 1966:

Commercial and industrial consumer $ 7,132
Residential consumers 6,143
Others—schools, hospitals, and so forth 2,420
$15,695

This comes to 28.7 percent of the total promotional payments for 1966, a relatively small share. Some of the trade association efforts may take the form of payments in one form or another to ultimate consumers, but it seems likely that the total amounts in this cate-

TABLE 3
Total Utility Promotional Payments, by Type of Promotion, 1963-66
(dollar amounts in thousands)

<table>
<thead>
<tr>
<th>Type of Promotion</th>
<th>1963</th>
<th>1964</th>
<th>1965</th>
<th>1966</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amount</td>
<td>%</td>
<td>Amount</td>
<td>%</td>
</tr>
<tr>
<td>Installation</td>
<td>$12,524</td>
<td>30.5</td>
<td>$15,554</td>
<td>32.1</td>
</tr>
<tr>
<td>Appliance</td>
<td>6,542</td>
<td>15.9</td>
<td>7,692</td>
<td>15.9</td>
</tr>
<tr>
<td>Conversion</td>
<td>939</td>
<td>2.3</td>
<td>1,791</td>
<td>3.7</td>
</tr>
<tr>
<td>Advertising</td>
<td>12,459</td>
<td>30.3</td>
<td>14,007</td>
<td>28.9</td>
</tr>
<tr>
<td>Financing</td>
<td>4 (2)</td>
<td>0.5</td>
<td>5 (2)</td>
<td>0.7</td>
</tr>
<tr>
<td>Underground wiring</td>
<td>107</td>
<td>0.3</td>
<td>70</td>
<td>0.1</td>
</tr>
<tr>
<td>Total</td>
<td>$41,087</td>
<td>100.0</td>
<td>$48,450</td>
<td>100.0</td>
</tr>
</tbody>
</table>


NOTES: 1. Includes only the cost to respondent for financing arrangements or equity investments when rate of interest or return is lower than the market rate.
2. Less than one-tenth of 1 percent.
3. Includes miscellaneous promotions not falling within a particular promotional type.
4. Includes miscellaneous promotions not falling within a particular promotional type.

5. "Payment to cover costs incurred by a builder or owner for wiring and piping during installation of systems or appliances; includes costs to repondents for any installation at no charge to recipient; does not include allowance for underground residential distribution system." Report, p. 103.
6. "Payment to dealer, builder, or owner for sale or purchase of heating and air-conditioning systems, or major appliances." Report, p. 103.
represent about 50 percent of total promotional payments for 1966. The data do not show a breakdown for installation and appliance allowances by type of recipient. It is noteworthy that appliance allowances have grown relative to the other big expenditure categories in recent years. These data seem highly significant for the economist. One thing they show is that the cost of appliances, wiring, and installation may be more important than the price of service in determining whether gas or electric service is used. In an attempt to get more evidence on this point, the gas and electric rate schedules for a number of large cities scattered around the country were inspected. A chart prepared by H. Zinder Associates of Washington, D.C., was used to find the number of usable BTU’s that could be purchased for one cent if spent on gas or electricity for space heating. Such a chart must, of course, make assumptions about the efficiencies of different appliances, and the assumptions here seemed reasonable. Space-heating costs were compared since, as a rule, electricity rates are lower for this use, and preliminary analysis indicated an advantage for gas in comparative rates. Table 4 shows the approximate number of usable BTU’s which could be purchased for winter space-heating purposes in fifteen selected large cities under rate schedules in effect in late 1968. One cent spent on electricity purchased more

### TABLE 4

Usable BTU’s for Gas and Electric Space Heating Purchased for One Cent in Selected Major Cities, 1968

<table>
<thead>
<tr>
<th>City</th>
<th>Gas</th>
<th>Electric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chicago</td>
<td>2890</td>
<td>7300</td>
</tr>
<tr>
<td>St Louis</td>
<td>2600</td>
<td>8250</td>
</tr>
<tr>
<td>Atlanta</td>
<td>2700</td>
<td>7050</td>
</tr>
<tr>
<td>New Orleans</td>
<td>2900</td>
<td>7600</td>
</tr>
<tr>
<td>Dallas</td>
<td>3200</td>
<td>8750</td>
</tr>
<tr>
<td>Seattle No 1</td>
<td>7450</td>
<td>7850</td>
</tr>
<tr>
<td>Seattle No 2</td>
<td>7450</td>
<td>7850</td>
</tr>
<tr>
<td>Denver</td>
<td>1750</td>
<td>4300</td>
</tr>
<tr>
<td>Los Angeles No 1</td>
<td>2500</td>
<td>6500</td>
</tr>
<tr>
<td>Los Angeles No 2</td>
<td>2500</td>
<td>6500</td>
</tr>
<tr>
<td>Cleveland</td>
<td>2800</td>
<td>7300</td>
</tr>
<tr>
<td>New York</td>
<td>2350</td>
<td>6000</td>
</tr>
<tr>
<td>Milwaukee</td>
<td>2150</td>
<td>5400</td>
</tr>
<tr>
<td>Houston</td>
<td>3450</td>
<td>6000</td>
</tr>
<tr>
<td>Phoenix</td>
<td>1950</td>
<td>3200</td>
</tr>
<tr>
<td>San Francisco</td>
<td>2750</td>
<td>7100</td>
</tr>
<tr>
<td>Salt Lake City</td>
<td>2150</td>
<td>5400</td>
</tr>
</tbody>
</table>

### Sources:
1. Usable BTU’s based on the following: gas 1050 BTU/kwh at 75 percent burning efficiency; electric resistance 3413/kwh at 100 percent efficiency; heat pump 905 BTU’s/kwh; heat pump and electric strips, 60 percent heat pump and 40 percent strips 9.3 BTU’s/kwh.
2. Usual least residential block, or if commercial and residential schedule combined an appropriate block was chosen. When special rates were available for space heating, these rates were used.
3. Usual least residential block for winter service was chosen, or if commercial and residential schedule combined an appropriate block was chosen.
4. 75¢/kwh was next to last block with last block at 90¢/kwh.
5. General service schedule. Either block could apply, depending on consumption.
6. Brooklyn only.
BTU's than one cent spent on gas in only one case, Seattle, Washington, of all the cities surveyed. In all other cities, gas had an advantage, and in some instances the advantage was more than two to one over the most efficient electric space heating system.

If consumers are installing electric space- heating equipment, and many are, it is quite clear there are reasons other than service prices that dictate this choice. One reason could be lower appliance costs or lower installation or maintenance costs. While a detailed study has not been made of these costs, the price advantage for space- heating appliances seems to be with gas rather than electricity, particularly if costs of insulating the structure are included. Another possible reason could be a superior service from electricity in terms of quality. No attempt to measure this was made. Finally, and what seems relevant here, there are various types of promotional efforts, including the payment of subsidies to third parties who construct homes and apartments, and payments to consumers themselves.

For this reason non-price competition should perhaps get more scrutiny than price competition. Fortunately, much of the theoretical analysis applies to both types.

II. A Critique of Competitive Weapons

The Report of the Subcommittee of the House Small Business Committee is perhaps a good place to begin the analysis of competitive practices used by utilities. The conclusions of the subcommittee are fairly typical of the criticisms one finds of promotional practices, and they present a partial framework for analysis. Other aspects will be brought in where appropriate. The subcommittee's conclusions are as follows:

1. The whole system of payment to third parties, such as builders, promoters, or developers smacks of venality. The payments are often individually negotiated in secret with the promoter demanding and receiving whatever the traffic will bear. In most instances, the party who pockets the bonus is not the ultimate consumer and the payments are designed to induce the promoter to make a decision which consumers—whether they like it or not—are compelled to accept. Where the practice is widespread a substantial portion of the public is being committed to gas or electricity, not because they prefer it but because of the promoter's payoff.

2. Some utilities have been successful in capturing new business with these special deals principally because a competing utility or the oil supplier may simply not have the resources to match the bonuses or may insist on offering their products and services to all on the basis of quality and price. Here, the net effect of the allowances is to shape the future of the energy market by the size of a utility's bankroll and by marketing practices which are designed to buy customers rather than to deal directly with consumer response.

3. The promotional allowances are also used by certain electric utilities to capture new business by penalizing consumers or developers who will not deal exclusively with them. For example, ordinances, mortgage standards, or simply strong consumer preferences are now calling for underground wiring. Some electric utilities will make this relatively expensive installation free, but only for all-electric homes. In other cases, electric utilities will pay for expensive wiring in large buildings but only where electricity is used exclusively. The consumer, of course, must have wiring for his lighting and thus, he can only exercise his preference for oil to heat or gas to heat or cook if he is willing to take a substantial financial penalty.

4. The funds that the utilities use for these inducements come from the rates that the public pays for electricity or gas. These rates are required under State regulation to be nondiscriminatory. However, the ratepayer who agrees to go all electric (or all gas) receives a handsome bonus which, in fact, constitutes a rebate on his utility bill that other ratepayers do not receive. That same discrimination is present when the ratepayer receives his rebate indirectly in the form of a portion of the bonus which the promoter or builder may pass on to him.

5. This discrimination may assume particularly invidious forms. Since these allowances are paid largely for new commercial or residential construction, it is quite likely, for example, that the ghetto dweller who must pay uniform charges for electricity is subsidizing the special bonuses that wind up in the hands of promoters or in the more affluent portions of society. Even where the social burden is not so clearly pronounced, there is no question but that all ratepayers are in fact paying for the special deals which line the pockets of a few.

6. The promotional allowances have, in fact, provided utilities with a way to circumvent the regulatory process in pricing product and service. If a utility attempted to establish a system of rates which set up the same special deals, the rates would have to be filed in a tariff, there would be opportunity for public participation in a regulatory decision and judicial review, and the rates would customarily not take effect until appropriate regulatory standards had been applied and the tariff approved. But with the promotional allowances, regulatory standards have been avoided and, in some instances, no regulatory approval has even been sought. Neither the utility commissions, competitors, nor the public have been afforded the opportunity to examine the practices and to test them by sound pricing and other public interest standards.

These criticisms can be grouped into several categories for purposes of evaluating the practices and the criticisms of the practices. The first relates to the role played by third parties, the builders, developers, promoters, and so forth and the effects of promotional payments to such groups. The data presented earlier on recipients of payments makes it clear that this is a major area of concern. The discussion might be broken down into several questions. (1) Do third party payments result in (a) discrimination among the third parties, and/or (b) discrimination among utility customers, and (c) if there is discrimination among utility customers, is it undue discrimination? (2) Is there discrimination against non-regulated groups, for example, fuel oil dealers, or is there some form of monopolization of certain markets by regulated industries and exclusion of non-regulated industries? (3) Do third-party payments in some way distort patterns of energy consumption and utility growth and development from the patterns that would otherwise occur?

The second general area of concern relates to promotional payments to customers of utility services as contrasted to third parties. Do customer payments result in undue discrimination among utility customers, either within a given class of customers or between classes? And, as in the case of third-party payments, do customer payments distort in some undesirable way patterns of consumption and development of utility services?

A third area, but not of major concern, is one of equity considerations. Is there, in the overall effects of promotional payments, a subsidy to the well-to-do groups in society paid for by lower income groups?

The last area raised in the Report, and one of crucial importance, relates to the adequacy of regulation of promotional payments. Has this device been used as a means to circumvent price regulation? What regulations have been adopted, and what, if any, are needed?

To these points raised in the subcommittee report, one much which is basic to the whole discussion must be added. Is competition, in any form, something to promote among utilities or between utilities and unregulated firms? And can regulation eliminate competition if it is not desirable, or appropriately modify and control it if it is desirable?

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Wallace F. Lovejoy

Is Competition Desirable?

This last question must be treated first because if competition among utilities in any form is undesirable, it can be said that all promotional practices and promotional pricing should not be allowed. While it is true that public utilities are usually given protection from competing firms selling the same services, there is probably no way that competition from substitutes can be controlled short of regulation of prices, costs, and profits of all types of substitutes. This seems undesirable and unworkable in the present U.S. economic context. Most economists would probably agree that an important dimension of competition is consumer choice among goods and services. The presence of a choice of services provides a benefit from the standpoint of not being locked in to only one alternative, and probably the benefit that the prices of both alternatives may be lower than they would in the absence of each other. This latter benefit would not be present if it is assumed that regulation always eliminates above normal profits and always insures the lowest cost of service possible. The first assumption is approximately valid. Regulation does place a ceiling on profits, although there is usually no insistence that every class of customer earn the same rate of return. The crucial role of competition probably lies in cost reduction, quality improvement, and innovation. It has been pointed out many times that one of the most difficult problems facing regulators is inducing efficient company operation. Without competition from substitutes, a utility has much less reason to minimize costs (and thus the minimum-profit price) than if substitutes are available in the same general price range. Thus, we conclude that competition generally is beneficial to utility customers from a choice, a price, and perhaps a quality standpoint.

Having made this general statement, it must be pointed out that there will undoubtedly have to be limits on competitive behavior of utilities to avoid unreasonable discrimination in any of several directions and to avoid inefficient allocation of resources from society's view. It is to these two questions that the committee's conclu-

8. This question is quite central in the current FCC telephone rate investigation. The Bell position is roughly that competitive markets can earn a lower rate of return than "normal," and that non-competitive markets can earn a return higher than normal to give a normal overall return.
sions are primarily directed. It must be remembered that successful competition requires that no one competitor succeed too well. If one does succeed, then a situation exists, which under regulation may have its profits controlled, but also under which incentives toward efficiency are reduced.

Aspects of Discrimination

One series of questions mentioned previously relates to discrimination.

1. Do Third-Party Payments Result in Discrimination to Third Parties Themselves?

Sufficient testimony and evidence exist to answer this question affirmatively in many jurisdictions. The grossest forms of discrimination occur when a utility negotiates secretly with individual builders and developers on the amount of payment the third party will receive if he adopts one utility service over another. The amount paid by the utility is partly a function of the relative bargaining strengths of the builder or developer and the utility. Under such circumstances, there is no fixed schedule of promotional payments which are a function of size of dwelling, capacities of appliances, or whatever. The third party with less bargaining power receives a lower payment, and thus has been discriminated against.

Discrimination can occur in both competitive and non-competitive housing markets. In a competitive housing market, presumably the payment to a builder would be reflected in the price of the house. With a larger payment the house price would be lower, and not because of any quality, locational, or other consideration. This discriminates in favor of the recipient of the larger subsidy and against the recipient of the smaller subsidy. If large builders get large subsidies and small builders small subsidies, then the effect is to help the big get bigger at the expense of the smaller. The possible conflict with the current antitrust philosophy is obvious.

In a non-competitive housing market several possible situations could exist. If home prices are fixed by agreement among builders, then the recipient of the larger subsidy is better off and discrimina-

tion occurs. If prices on comparable homes differ (perhaps because of lack of information on the part of buyers), it is possible that discrimination could be eliminated if the recipient of the larger subsidy lowers his price relative to the recipient of the smaller subsidy, and both can sell their homes with equal ease. This seems rather unlikely.

The remedy to the third-party discrimination problem is fairly simple. If schedules of promotional payments to third parties are published and payments made available to all potential recipients, with no deviations from the schedule, most of the discrimination among third parties can be eliminated. Some states have taken action to require the filing of non-discriminatory schedules of third-party promotional payments and have outlawed secret, negotiated deals. It seems that this sort of action is simple, straightforward, and would be welcomed by the utilities concerned. It is interesting that regulation of this phase has received so much attention, when utility commissions have no legislative mandate to protect builders and developers. The concern is supposed with utility customers, a group only indirectly affected by third-party subsidies. There is a legitimate regulatory concern here, but it lies in the area of distorted market development and consumption rather than the area of discrimination.

2. Do Third-Party Payments Result in Discrimination Among Utility Customers?

When looking at undue customer discrimination resulting from third-party payments one has to look at both the cost and benefit sides. Assume that before any promotional payments are made, there is no undue discrimination either between classes or among customers within any class. On the benefit side the only way there can be customer discrimination is to have the third-party payment passed on in whole or in part to a particular customer or group of customers. The benefits might take the form of lower appliance, installation, servicing, or wiring costs, or simply a lowered-priced

9. States which have acted to make uniform the payments to third parties include Connecticut, Maine, New Jersey, New York. See testimony of J. W. Karber, President of the NARUC in Hearings, pp. 383 ff.
home. If the third party pockets all the payment, presumably there would be no change on the benefits side to customers, and thus no discrimination. If some of the payment is passed on, then the question of discrimination seems clear, but one must still resolve whether there is undue discrimination.

The cost side to the consumer is much more complex. Discrimination occurs whenever there are unequal increments of costs imposed on different classes or on different customers within a class. If, for example, industrial customers are asked to pay higher rates and to bear all the costs of promoting residential service, there is discrimination. A difficult question to answer is whether there is customer discrimination if, for example, all space-heating rates are raised to cover the cost of third-party payments to promote space heating. In the sense that all customers are paying the same rates for the same service, there is no discrimination. In the sense that old customers have had their rates raised to attract new customers, perhaps there is discrimination.

The picture can be further complicated by assuming that promotion attracts new customers which either enable the utility to operate its plant more efficiently (for example, at a higher load factor) or enable the utility to expand its plant and take advantage of lower costs due to scale economies. It seems almost impossible to sort out the discriminatory effects in terms of costs and benefits to the customers whether rates change or do not change.

3. Do Payments to Utility Customers Result in Discrimination?

It seems appropriate to cover briefly one other area of discrimination. Do promotional payments made directly to utility customers result in discrimination among customers? The answer here is obviously "yes." If one customer in a class is given a payment, and he pays the same rates for service as others in his class, clearly there is discrimination in his favor. This is true no matter how the cost of the promotion is spread over other customers. That customer has received a benefit others did not. Whether it is undue discrimination is again not exclusively an economic question. It may be that customer promotions enable all rates to be reduced, and this may be beneficial. However, it still does not eliminate discrimination.

Much of this sort of discussion seems academic because the question is not whether or not discrimination occurs under utility pricing and promotional practices, but whether it is undue discrimination. There is no economic measure of which I am aware that tells us when discrimination becomes undue.10

The economic conclusions on discrimination are, therefore, weak. Corwin Edwards defines the economic concept of discrimination as occurring "whenever prices and costs do not vary concomitantly. Price difference without cost difference is discrimination; so is cost difference without price difference."11 The political idea of discrimination is quite nebulous and encompasses some general concept of inequality. The economic concept seems to be relevant to the discussion here. It appears that most types of promotional payments made to third parties or to utility customers result in new discrimination. These are insufficient grounds for condemning such payments. Most utilities purposefully set rates (prices) between classes of customers and within classes of customers that are discriminatory in an economic sense. There are no economic criteria for judging the acceptability of discriminatory pricing as being due or undue and thus no way to judge the acceptability of discriminatory promotional practices. Equity considerations imply value judgments that go beyond economics. The economist can perhaps measure the amount or extent of discrimination and analyze its effects on costs and revenues, but he cannot say whether or not it is undue by using economic criteria alone.

The Impact on Utility Consumption and Growth

The more important and more difficult questions relating to promotional efforts—price and non-price—concern the effects of these on patterns of utility service consumption and overall utility

10. Discrimination does have the effect in some instances of permitting greater efficiency (lower costs). Efficiency may be a criteria for judging whether discrimination is undue, but we submit this has not been the usual test.

growth. If it can be shown that promotional efforts in some way distort consumption and growth patterns from what they ought to be, then perhaps changes in these efforts should be required by regulation.

A basic economic issue presents itself at this point. If most economists would agree in principle, but not in detail, that an expenditure by a utility, to be justified, must in some fashion pay its way in terms of generating additional revenue equal to or greater than the expenditure, one guideline in judging both promotional rates and promotional payments has been determined. Put in the language of the economist, the marginal revenue brought in must at least cover marginal cost. To the extent that marginal revenue exceeds marginal cost, there has been a net addition to profits. If profits are constrained at a maximum, as they are for a utility, the savings made from an incremental expenditure can result in the lowering of revenue requirements elsewhere in the utility.

Promotional efforts can be viewed as valley-filling or base-load building, or a combination of both. Valley-filling is the addition of consumption at off-peak periods which adds nothing to the peak demand, and thus nothing to the required plant capacity to serve the system. Base-load building is the addition of consumption at the peak which requires an increase in the system's capacity to meet peak demand.

Basically, the promotion of summer use of gas and winter use of electricity is designed to fill valleys. This primarily means gas air conditioning and electric space heating. Promotion of cooking and water heating is primarily base-load building for both gas and electricity. Total electric and total gas energy promotion tend to be both valley-filling and base-load building. The load-building aspects are unquestionably the primary consideration since a customer who opts, for example, for a total electric home is committed financially to use only electricity for a considerable period into the future. Heating, cooling, cooking, and water heating are all added. Since the addition of such a customer will likely improve the system load factor because of the addition of heavy winter use, this type of promotion also is valley-filling.

The promotion of gas space heating and electric air conditioning is, in a sense, load-building also, but it is load-building that will likely reduce the system-wide load factor and thus create some special problems. This is not to say that such promotions are not profitable; on the contrary, these are massive loads which are the mainstays of the respective industries' markets in many regions.

For valley-filling promotional practices one must ask first, does the cost of the promotion pay for itself in terms of additional revenue? Since no additional plant capacity is needed to serve new off-peak customers, the cost of serving them is the cost of the promotion plus the usual short-run incremental costs—added fuel costs, some added labor, some added supplies, and the like. If the promotion is done through special rate reductions, the same principles apply. The revenues generated by the promotional rates and increased consumption must offset any increases in costs. If the revenues added exceed the incremental costs, the utility is better off. If we assume that before the promotional effort the utility was earning sufficient revenues to cover costs including a fair return on its investment, the added revenues permit a rate reduction to some group of customers. If added revenues just cover incremental costs, no customers are better off in terms of lower rates, but the utility's plant is being used more fully, and society as a whole benefits from increased consumption.

It is at this point that the value-of-service and cost-of-service bases for determining inter- and intra-class rates may conflict. There are those who argue that each class of customers should bear its share of fully distributed costs and no more. There are others who argue that it is sufficient if a class of customers pays no more than its incremental costs. This well known marginal-cost versus average-cost pricing controversy will not be reviewed here. It should be noted, however, that a utility cannot be forced to charge each class of customers its marginal costs if these costs, when summed, do not equal total cost. The legal requirement of permitting rates which are sufficient to generate revenues to cover total costs has not been met. To meet this requirement necessitates the pricing of some services above marginal cost, and perhaps in some instances above average cost, and the most reasonable approach to determining what prices are best is value of service, or in economic terms, price discrimination, elasticity of demand. The basis for inter- and intra-class price discrimination is different elasticities of demand more than it is different costs by class.⁰

⁰ See R. K. Davidson, Price Discrimination in Selling Gas and Electricity (Baltimore: Johns Hopkins Press, 1955), for a full discussion of this point.
Valley-filling promotional efforts, either prices or expenditures, should be given approval if the cost and revenue requirements noted above are met. Interestingly enough, benefits may occur in both the gas and the electric markets from efforts by either utility to fill valleys. A simplified example to demonstrate this phenomenon follows.

Assume that there is a market in which both a gas and an electric utility are operating, and for simplicity's sake assume the market is not growing in the sense of new homes, industry, and so forth being built. If a gas utility is successful in promoting gas air conditioning, which means that consumers switch from electricity to gas, then the load factors of both the gas and the electric utility improve. The same number of customers are being served as before (by assumption), and the required investment in the gas and electric utilities combined is less. The best situation from a social efficiency viewpoint might then be for gas to capture a large part of the cooling market and for electricity to capture a large part of the space-heating market. This minimizes investment relative to sales for both. Obviously, there are major cotton paribus assumptions implicit here. Does it cost the same to cool or heat with either energy? What if one energy is preferred to another? Are there significant scale economies present in either energy? Who pays for existing plant no longer needed? Despite its shortcomings, this simplified example does point out an area of possible benefit from competition between gas and electricity, and one which seems neglected.

The thorny question for regulators when asked to approve valley-filling promotional pricing or promotional expenditures is: how can we determine incremental costs and incremental revenues for the utility proposing the promotion, and how can we determine the cost and revenue effects on the competing utility? Since both costs and revenues are prospective at the initiation of a promotion, approval hinges on projections which, if faulty, require adjustments in the promotional practices. It must be a trial and error process, sometimes that regulators are loath to undertake because of the instability in costs and revenues it is apt to create.

Promotional pricing and payments for base-load building raise many of the same problems and can be analyzed with many of the same tools. The primary difference here is that increments to base load require increments to capacity, and thus incremental plant costs as well as incremental out-of-pocket costs must be considered.

This is roughly the economist's concept of long-run marginal costs in which all costs are variable. Most economists would accept the general statement that base-load promotion is desirable as long as the incremental revenues equal or exceed complete incremental costs. There is, however, one dilemma which is perhaps insoluble. Economists also agree that at the margin it is impossible to distinguish among customers as to who is responsible for marginal costs. If a customer drops the service, at least theoretically the same marginal cost is saved no matter which customer drops. Thus, it is impossible to say that an incremental cost is assignable to a particular customer; it is assignable to a particular increment of output which could be consumed by any customer.

A more crucial question in load building is what happens to costs as the size of the utility expands. If, as some have argued, there are true scale economies in gas and electricity distribution, it is possible that the expansion of sales through promotion will lower the cost of service to old customers, even if new customers contribute no more to revenue than the incremental cost of serving them. This happens because the cost per unit is less at larger outputs than smaller outputs. It may very well pay, therefore, to sell to a class of customers at marginal cost to enable cost reduction through scale economies to be effected.

Economists tend to frustrate regulatory people with comments such as have just been made. It is difficult enough to calculate short-run incremental costs. The determination of so-called long-run incremental costs is even stickier. For example, if the long-run is defined as a situation in which all costs are variable, and the plant has a thirty-year life, are we to look at thirty years as the long-run? Is it legitimate to have some costs fixed and some variable and still talk about complete incremental costs? What if we do not precisely size investment in electric generating equipment to investment in transmission and distribution equipment? We have enough generating capacity but not enough transmission capacity to serve additional load. Can we say that the complete incremental cost is the cost of added transmission plant plus out-of-pocket costs, and not worry about generating facilities? These are the types of frustrating questions the economist blithely slides over in his discussion of long-run incremental costs, and they tend to be the rule rather than the exception.

It is not intuitively obvious that there are scale economies pres-
ent in gas and electric distribution systems. For gas pipelines, scale economies are apparent because the throughput capacity of a line is a function of the area of a cross section of pipe, while costs are roughly a function of circumference or diameter. Since the cross-section area rises faster than the circumference as pipe size increases, the throughput capacity at any given pressure rises faster than costs. Thus, cost per unit of throughput falls as line size gets larger. This does not apply as fully to gas distribution systems because here we are talking about (1) serving a geographic area with a network of pipes, (2) in which population density varies considerably, and (3) in which geographic portions are added piecemeal. (4) Another choice a gas utility has in planning is to decide in main size is whether to lay a line that will serve market growth for, say, ten or fifteen years, but which currently will be only partially used, or lay a line with five years’ growth capacity which will be used more fully today. There may be technical scale economies present but a utility may be unable to take advantage of them because it costs too much to build far in advance of need. Some of the same sorts of problems exist for electric distribution systems, although they are probably not as severe. Once right-of-way has been secured and transmission towers erected, it is far easier to add capacity to an electric system than to a gas distribution system. Also, the generating process itself may produce true scale economies since unit costs do tend to decline as plant size increases. However, increments to base load often cannot justify a new large generating plant, but rather an addition to an existing plant. In this case the scale economies become less obvious.

The point to be made is that scale economies do seem to be an important assumption made by those advocating long-run marginal cost pricing as a method of lowering overall average costs. More work is needed to determine if, in fact, utility systems have inherent scale economies, and whether growth patterns of utilities in fact allow them to take advantage of any economies that do exist. Another point related to scale economies needs to be made. There is considerable confusion among economists and the utility industry as to the difference between a cost-saving technological innovation and a true scale economy. If a lower cost compressor or generator has become available and can be added incrementally to serve a growing market, this is not a true scale economy, but rather a cost saving innovation; but they both have some of the same effects. That is to say, without the market growth new lower cost equipment would usually not be added until old equipment wore out.

With market growth, however, the saving can be made earlier. Is it reasonable to say that the lower long-run marginal costs that result from adding lower-cost equipment should be used as the incremental cost of the new customers? In a sense this may be a straw man, but it does bring into focus a question which may be quite relevant when new supposedly low-cost nuclear powered electric generation plants are added to existing systems. Such plants are low cost if they are base load plants. Is one class or group of customers designated to be assigned the marginal costs of the added nuclear plant?

Regulators must also resolve the question of whether there is a different impact if promotion is done through the pricing mechanism as opposed to promotional payments. To be more specific, let us ask if it makes a difference if an electric utility reduces rates for winter space heating and makes no promotional payments or keeps residential space heating rates unchanged and offers promotional payments for adopting electric space heating. To answer this requires some insights into the reasons customers choose one service over another. Customers undoubtedly look at the initial investment in appliances and auxiliary connections, the cost of maintaining the equipment over its life, the cost of the utility service, and any real or imagined quality variables relating to such things as personal experience with one energy or the other, preference for design and/or performance of a particular appliance, reliability of service, behavior of utility, and appliance company personnel.

If a customer is given a choice between promotional rates and a promotional payment, presumably he can compute the relative economic benefits to him over the life of his appliances. For example, if a potential consumer could expect to pay $300 a year for electric service and was offered either a 10 percent discount in price, or a $300 lump sum subsidy toward the purchase of appliances which would last ten years, he should choose the subsidy. While it is true he can save $300 in his bill over ten years, he can take $300 today and invest it at some interest rate so that compounded over ten
years he would have considerably in excess of $300. A similar calculation can be made if a customer is trying to choose between gas or electricity for any specific use, although obtaining the information necessary to make the calculation is difficult, if not impossible. It requires that alternative appliance costs be known (both initial and maintenance costs), that the expected service lives of appliances be known, and that expected energy consumption for different appliances be known. It is assumed that the rates schedules are known.  

It is obvious that relatively few customers could get this information even with the help of the competing utility companies. It is possible that large commercial and industrial customers would find such calculations worthwhile. Utility companies themselves would be hard pressed to develop information for a specific family, using specific appliances, in a specific type of home construction.

The point of this rather academic exercise is to illustrate that it is indeed difficult to determine what "normal" consumption patterns are, or should be, even if it is assumed that "normal" is what consumers find maximizes their economic well being. If, as some critics say, promotional efforts distort consumption patterns, it is necessary to know the normal patterns. This is a difficult thing to find even sweeping aside by assumption, as was shown in the example, the quality variables real or imagined in consumers' minds. What the critics are saying is that some types of promotion change consumption patterns significantly, and this is true. However, the change is not necessarily bad. The primary guideline to use is what happens in terms of efficiency to both competing utilities. Is society collectively having to pay more for gas and electricity (and appliances) than before without receiving correspondingly higher benefits?

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13. If $300 were invested today at 5 percent per year for ten years, and was compounded annually, it would be worth $489 at the end of ten years. If $30 per year were saved and each year invested at 5 percent per year for the remainder of the ten years, and compounded annually, the value of the annuity after ten years would be $377. It would pay to take the subsidy rather than the rate reduction under these terms.

14. A further complication might arise if it is uncertain into which block on a rate schedule a customer would move.

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III. The Regulation of Promotional Practices

The status of regulation of promotional practices is, to put it mildly, in flux. Some states have formally taken up the question and have handed down decisions in this area. Some states have been quite permissive in allowing almost any kind of promotion, other states have been quite restrictive, allowing only certain types and requiring a filing with the commission of promotional allowance schedules. A substantial number of states have studied the problem informally; others are interested but have done nothing; and still others seem to have no interest at all. Several commissions were contacted to determine what is being done, and there is absolutely no consistent pattern of behavior.

In the Small Business Committee Hearings of 1968 about twenty-eight commissions were reported by James W. Karber, then president of the National Association of Regulatory Utility Commissioners, as having considered some aspect of the promotional problem. 15 Electrical World in December 1967 reported that twenty states had dealt with the promotional practices question. 16 Historically, North Carolina seems to have the distinction of being the first state to impose controls on promotional practices. Other states have followed. Illinois, a state which has seen substantial competition among gas and electric utilities, provides an example of the types of controls being imposed. In July 1966, the Illinois Commerce Commission issued a citation order in which all electric and gas utilities under its jurisdiction were directed to appear before the commission to show cause why the commission should not issue orders regulating a wide variety of promotional practices. 17 After having heard testimony and received evidence from numerous parties, the commission issued an interim order. The major provisions were:

1) It is unlawful for utilities to make loans, guarantees of loans, or grants to anyone for building construction or to engage in any way in the investment or financing of non-utility property.

2) It is unlawful for utilities to make promotional allowances to anyone for promotional, advertising, or publicity purposes.

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15. Hearings, pp. 385-94.


3) It is unlawful for utilities to make payments or grant benefits to architects, engineers, builders, developers for work done on property not owned by the utility.

4) It is unlawful for utilities to acquire for the purpose of leasing or renting to others any electric or gas equipment, appliances, or facilities the cost of which exceeds $1,000 for each specific location, without commission approval.

5) All promotional practices or allowances granted by utilities shall be available on a uniform basis and shall not be "unlawfully discriminatory."18

In March 1968 the commission added two other provisions to its 1967 order. It allowed a utility to engage in the same promotional practices as those carried on by a competing utility, and it authorized combination utilities to grant the same allowances to both gas and electric customers.19

In March 1969, the Illinois commission handed down a general order defining in detail promotional-type activities and specifying the rules and regulations applicable to promotional practices. Of particular interest was the statement that

a promotional practice or allowance should be considered economically feasible if the cost of such practice or allowance can be recovered from the additional revenue obtained from the installation of such appliance, less the estimated incremental cost of supplying the additional electricity or gas in a period of time not in excess of 50% of the estimated life of the space-heating, air-conditioning, or appliance being promoted.20

Promotional payments had to be justified on this basis. Incremental costs were adopted over some average or full cost concept. The length of time allowed to recover the cost of the promotion was made flexible, depending on the life of the appliance.

The Virginia Corporation Commission instituted an investigation of the same type in April 1968 which illustrates some different aspects of promotion. The proceedings were precipitated by the introduction of a bill in the Virginia General Assembly, and supported

by fuel oil dealers, that would have outlawed all utility promotional practices. The bill failed to pass, but the commission began proceedings. The findings were as follows:

1) Guarantees by electric utilities that customers' heating bills would not exceed a specified amount, and that customers would be satisfied, were outlawed.

2) Cash allowances and incentives given by electric utilities were held to be lawful, and not contrary to the public interest. They were justified on the basis of improved load factors and utilization of plant, and on the basis of additional revenue that was sufficient to recover promotional costs within a reasonable time (within less than two years generally). Such promotion was felt to benefit all customers.

3) Appliance allowances were held to be lawful, but it was held that each appliance must carry a separate allowance, and no allowance above the sum of the separate appliance allowances could be given.

4) Allowances for conversion to gas or electric heat must be uniform regardless of from what type of fuel the conversion is made. (One combination utility had paid allowances only for conversion from oil heat to gas and not from electricity to gas.)

5) Allowances must be uniform and non-discriminatory and cannot be negotiated on a case-by-case basis.

6) While underground wiring is desirable, customers receiving such wiring must be paid for it. The cost may be paid directly in a lump sum payment or may be collected over time in revenues. "All electric" customers cannot be given a reduced cost burden just because they are all electric.

7) All promotional plans must be filed with the commission and changes to existing plans must be approved.21

These two states illustrate the types of problems that recur everywhere. Time has not permitted us to search state records to expand on the list of problems encountered. No doubt there are

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many others. It would be extremely beneficial to all states if some group or organization could compile a digest of state action in this area with appropriate references.

Peter B. Spivak, chairman of the Michigan Public Service Commission, certainly must rank as one of the leading experts in this area, and one who has spoken out thoughtfully and frequently on the problems. His view is, and I concur, that utility competition is desirable in a general sense, but that it must be regulated by the state commissions. There must be more work done by state commissions to gain an understanding of what promotional efforts occur, what the impact of these efforts is on the various segments of the public that are concerned, and what regulations are needed to forestall the undesirable effects and to encourage the beneficial effects. Surely there needs to be more uniformity among the states. The public interest cannot be served fully when some states do nothing and others impose detailed regulations.

IV. Some Concluding Observations

Economists and regulators must discuss more the problems of utility competition. Two excellent textbooks for background reading on this subject are the direct testimony presented in the AT & T rate investigation, and the Small Business Committee Hearings mentioned earlier. Marginal cost pricing discussions have at last come down out of the academic ivory towers, and the academicians are finding the "real world" much less neat than their theoretical assumptions require. Regulators are finding that this economic theory, albeit vague in many respects, is a potent analytical tool. Promotional pricing and non-pricing practices require a detailed analysis of both incremental costs and value-of-service pricing. Competition is, as our economy demonstrates, an extremely efficient allocator of resources and an effective stimulant to economic growth and greater consumer benefits. Competition can take much of the burden from the regulators' shoulders, and these public servants should not be reluctant to work themselves out of a job, if this is in the public interest. Hopefully, regulators will ask the economists to continually review their work and economists will respond with originality and an understanding that the regulator is truly a practicing political economist.

22. See "Promoting Utility Services," in Public Utility Fortnightly, December 19, 1965, pp. 40–41, for some current comment on FPC, FTC, and Department of Justice activities in the area of promotion.

Comment

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It is Professor Lovejoy's thesis that there has been substantial growth in interfuel competition—competition that has been accompanied by a variety of promotional (both price and non-price) practices. After examining non-price promotional practices in detail, he raises questions as to whether they should be regulated and, if so, how. His general conclusion is that some non-price promotional practices may involve undue discrimination and, therefore, should be disallowed. At the same time, he is concerned about the lack of uniformity among the state commissions in dealing with all types of promotional practices.

Accepting the position that competition should be encouraged, Lovejoy is rightly concerned about discrimination, but he argues that we lack an economic measure of undue discrimination. This statement, I think, is too pessimistic, for there is an economic justification for competitive rates and competitive practices—a justifi-
cation that involves the complete or total incremental cost concept.¹ The basic proposition is the following: if a utility can take on business which it might not otherwise get at rates which more than cover total incremental cost (that is, the out-of-pocket expenses of the added service, the portion of the common plant required by that service expansion, the required return thereon, a portion of any increase in overhead expenses which may result from the service expansion, and a portion of the investment required to meet the company’s future growth), such additional business will benefit its other customers. Likewise, even if the new business covers only its total incremental cost, existing customers cannot be burdened and may well be benefited by accepting the rate. It is admittedly difficult to determine total incremental costs. Like demand elasticities, such costs must be estimated. But as Stelzer has argued, with respect to fully-allocated versus total incremental costs, “it is surely unreasonable to favor an arbitrary measure of cost over an inexact measure. . . . Because we cannot see the future clearly does not mean we should shut our eyes to it.”²

No implication is intended that competitive rates should be determined by total incremental costs. Rather, total incremental costs set the lower boundary, the floor below which rates should not fall, with the upper boundary set by demand conditions and regulation.³ To be sure, one customer class may well make a greater contribution to the overhead costs of the utility than another, but all customers benefit from such differentiated rates. If a utility does not gain new customers, the so-called discriminated-against customers might have to bear an even higher rate, for services which are not


² Stelzer, “Pricing in Regulated Industries,” p. 133.


In summary, the historic monopoly position of the utilities is being eroded. The utilities, in turn, are beginning to act more like traditional competitive enterprises. In this environment, the issues confronting the regulatory commissions become more complex. Such is true, for example, of the controversy over some specific promotional practices, such as cost guarantees to customers. But the commissions are dealing with these issues and there is more uniformity among the states than Professor Lovejoy implies. After a careful review of state decisions, one utility executive summarizes:

The common theme running through most decisions seems to be that although competitive plans and practices largely grew up in response to the needs of the marketplace, they can be justified in sophisticated regulatory proceedings on an incremental cost basis. When complete incremental costs are allocated for electric heating, the main bone of contention, it is perfectly clear in most cases that the new business can produce more revenues than expenses. More importantly, it reduces the unit cost not only for new customers, but in time for existing customers of the regulated utility. Upon appropriate proof of these facts, most commissions have had little difficulty in finding that this form of competition, like most other forms, benefits the general public. Any remaining need for regulation is best handled by state action at the local level where the particular of any given competitive plan can be examined in the light of local conditions.6

Approval of competitive activities is as it should be. As long as they meet the criteria discussed above, promotional rates and practices will further stimulate competition to the benefit of all consumers.

6. It should be noted that the controversy over the competitive activities of utilities has been taken to state legislatures (by local fuel oil dealer associations), as well as to Congress and the state regulatory commissions. But with the notable exception of North Carolina, the state legislatures have refused to enact legislation prohibiting such activities. See Re Virginia Electric and Power Co., 54 PUR 3d 591 (N.C., 1964).


Comment

Gary L. Luick

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Northern Natural Gas Company

The major consideration to which Professor Lovejoy addresses himself is the relative importance of utility price of service versus installation and appliance costs. On the basis of a schedule of relative space heating costs for both gas and electricity which shows gas as having the advantage in a majority of the cases, and a schedule of data showing the growth of promotional expenditure for appliance and installation allowances, he properly concludes that the continued growth in electric space heating in spite of a price of service disadvantage must be due to non-price promotional policies of utilities. The hypothesis is then raised that non-price promotional payments, which have grown in recent years, are possibly being used as a tool to circumvent regulation, to distort free choice in the marketplace, and to discriminate between existing customers, new customers, and the builder or developers to whom the majority of payments are made.
It would seem that Lovejoy has failed to answer the question of whether utility customers are willing to evaluate competing fuels on a cost-of-service basis or whether they have the capability of doing so if they so desire. The American consumer is well known for his willingness to give purchase preference to items which can be acquired for a low initial outlay even though the total use cost discounted may be larger than an alternative purchase with a greater initial outlay. This type of reasoning would, of course, apply primarily to residential customers, but in some cases would apply to commercial customers as well. In the second case, even if fuel consuming customers were able to get information concerning alternative fuel costs and relative efficiencies of fuel consuming equipment (which seems extremely doubtful, if not impossible, witness Lovejoy's treatment of equipment efficiencies in Table 4), it would be sheer folly to think that residential customers specifically and commercial users generally would have adequate knowledge of the time-value of money and the discounting techniques involved to allow them to properly evaluate a low initial cost, high operating cost alternative as against a high initial cost, low operating cost alternative.

If pricing policies are as ineffective as they would seem to be in the imperfectly competitive world of the gas and electric utility, then price competition would of necessity be de-emphasized, as it is in most oligopolistic industries, in favor of non-price promotional efforts.

There is very little to be said argumentatively against Lovejoy's hypothesis about discrimination among third-party members. To the extent that discrimination exists and can be proven to exist among third parties, it would indeed be in conflict with current antitrust philosophy. There would seem to be some question, however, about what is described as a "fairly simple" solution to the problem as it may exist. If one were to speculate that discrimination based upon purchasing power exists for other materials and services used in the construction industry, then the question would have to be posed as to how effective the fairly simple solution would be in curbing practices which have not been eliminated under federal antitrust procedures.

In attempting to answer the question of whether payments to utility customers result in discrimination, there can be no disagreement with what Lovejoy says about the necessity of placing the emphasis on undue discrimination. While the phrase "undue discrimination" may lend itself to value judgment, there exists in fact no long range effective quantitative techniques for evaluating and distinguishing between levels of discrimination. There may be, however, some value in examining the relationship between non-price promotional policy at various levels of capacity utilization.

Pragmatically, we must recognize that the cost structure of a public utility is not incremental. It has discontinuities. It may be that a utility which is currently operating at the lower end of the most recently added block of capacity could be considered as having justification for using promotional payments of some type in order to secure economies of scale associated with greater utilization of capacity in place. On the other hand, the utility already realizing economies from high capacity utilization adds a burden on existing customers by actively following a non-price promotional policy to the point where a new block of capacity would have to be added to the system with resultant extremely low utilization rates. This latter situation does arise periodically, out of the normal growth of a company's market area, but as economies of scale reach a point of maximization under existing capacity in place no additional economies accrue to existing customers to offset the costs associated with additional promotional efforts.

The question of whether promotional payments, particularly to a third party, distort normal market growth is a difficult one. As Lovejoy has stated, the question of what is normal becomes one of the major stumbling blocks. For the sake of expediency, it may serve to assume that any set of circumstances which hinder the consumer's free choice is a distortion of the normal relationship between competing fuels. In discussing the issue, the residential sector would seem to be the more sensitive to distortion if it does exist since here the ultimate consumer has the greatest opportunity to influence the choice of fuels. One additional distinction remains to be made between residential construction which is initiated by a builder or developer for speculation in the housing market and customized residential construction which is initiated by the prospective home buyer.

In many ways, these two types of home construction are different products when considering fuel choice decisions since these decisions are made by different parties for different reasons. With regard to residential construction for speculative purposes, the prospective
home buyer has for his consideration a completed product, in the planning of which he has played no part except that of acceptance-rejection. In this case, third party promotional payments would seem of necessity to at least partially distort natural growth of competing fuel markets. Since residential consumers have very little knowledge of operating costs of competing fuels, their bias rests either on personal preference or initial outlays for the pertinent appliances themselves. When builders or developers are persuaded by way of promotional considerations to install appliances using a particular fuel, the appliance consideration becomes very inconsequential relative to the larger investment decisions to be made by a prospective home buyer. A pre-emptive fuel choice such as this has a tendency to feed upon itself. The consumer who finds himself using a new fuel, or the same fuel for new purposes, tends to adapt and modify his habits or bias, thereby affecting the appliance replacement market some years hence.

Customized residential construction on the other hand is somewhat different in that the intended home owner has a great deal of control over the planning process and is able to dictate (within the limits of local building codes) to a greater degree what type of heating and cooling equipment, as well as other appliances will be used. With this degree of freedom, consumer preference can be more easily exercised. As was mentioned earlier, however, residential consumers have very little awareness of their relative cost of utility services through time. Decisions are made on the basis of initial cost or on the basis of psychological factors such as ease of use, prior habits, cleanliness, and image (modem). The initial cost consideration has its greatest impact in consideration of appliances in which little personal contact is involved such as air conditioners and furnaces. However, if personal preference is strong enough based upon real or imagined differences in appliances using alternative fuels, even the initial cost consideration will be relegated to a poor second place.

Summary

On balance, there is no general disagreement with the considerations Lovejoy has set forth in his paper and surely there could be no disagreement with what he has said about the need for econo-
Impact of Technological Change on Pricing in the Energy Industries and the Regulatory Response

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Introduction

The objective of this paper is to provide a comprehensive overview of the central problem areas of the regulated electric power and natural gas pipeline industries. The effects of technological change and its implications for pricing will be explored within the framework of the basic institutional factors impinging on these industries. After delineating the major issues and the alternatives for decision making, I will focus on the policy implications for regulation.

The views and conclusions contained in this paper are solely those of the author and do not necessarily represent those of the Federal Power Commission.
At the outset, it may be helpful to articulate my predilection as a regulatory economist. In this context, I should point out initially that the paper will not concern itself with the legitimization of operating expenses in a cost-of-service context, or problems associated with rate base determination, or the factors affecting the appropriate rate of return. My emphasis will be on the basic institutional structure, particularly industrial organization and ownership configuration, which affects pricing and ultimately, performance. Of course, a closely allied consideration is the promulgation of the institutional arrangements that encourage innovation.

Any consideration of pricing alternatives must be viewed in the context of a given market structure. To the extent that competitive factors are present, the pricing decisions within an industry or among industries will be closer to a cost-price balance. Price decisions are not made to conform to theoretical norms but are the end results of the interplay of supply-demand relationships as influenced by organizational structure. This is clearly illustrated by considering the motivation for the joint ventures in the electric field and the "price effects" associated with duopoly rivalry among pipelines.

I want to emphasize the two sides of the "pricing coin." In the first instance, pricing acts as a rationing mechanism as it relates to the production function. In this sense, pricing channels the nation's resources between and among industries and, of course, this includes the regulated industries. Looking at pricing in this context is to focus on the allocation of real goods among competing uses. The primary motivation of the economist should be to induce technological innovation and exploit the economies of scale so as to optimize our resource use.

The other related side of the pricing coin highlights the consumption function and the income distribution aspects of pricing. The key factors affecting the maximization of consumer welfare were suggested in the Report of the Cabinet Committee on Price Stability:

... The special characteristics that give rise to regulation include high capital intensity with substantial economies of scale. The march of technology and the growth of demand therefore offer the prospect of above average long-term productivity improvement. It is of particular importance, therefore, that the regulatory agencies require passing through to consumers the benefits of increased productivity in the form of lower prices.

Assuming that regulatory price decision making covers all legitimate costs and allows a fair return (and many will feel this is quite an assumption), and to the extent that cost-price relationships are kept in balance, allocative efficiency will be maximized and consumer equity realized.

In this regard of greatest importance is the institutional framework and the regulatory policies that provide the conditions that will maximize efficiency in resource allocation and consumer welfare. The thrust of this paper will support the contention that public policy can best accomplish these objectives by encouraging a competitive industrial structure in the electric power and natural gas pipeline industries. By promoting competition, where feasible, the pecuniary incentive for the business enterprise will induce technological innovation and scale economies and also provide the basis for potential price reductions.

Within this context, we can now move to the following areas. First, I will discuss the impact of technological change on the organization of the electric power industry, and its implications for performance and pricing. Second, I will discuss the pricing alternatives relating to certificate decision making, interpipeline competition, change in organizational structure of the gas pipeline industry, and the emergence of antitrust considerations.

I. Electric Power Industry

Preface

It is customary to view the electric power industry as a regulated monopoly with an exclusive franchise to serve a given geographic area. In this context, it is difficult to appreciate the important countervailing competitive factors within and outside the industry.

One external force pressuring the industry toward technological change and greater efficiency is the ever-present interfuel competition. The competition for industrial, commercial, and new residential markets has prompted the industry to utilize promotional rates to encourage load growth in line with increasing scale economies.

Equally important are the competitive forces within the electric industry. One facet of this competition is ideological; the other, traditional. The former reflects the rivalry between the public and private sectors and concerns the controversy over the superiority of ownership configuration. Undoubtedly, both have been motivated to innovate and reduce rates because of their ideological differences. The dispute over the "yardstick" concept is a good illustration of the "flow through" benefits to the consuming public of these tensions. The traditional benefits of competition between and among independent systems is manifest in the efforts to attract new industry, commercial construction, and to a lesser extent residential development, to an operating systems territory.

At the outset then, prior to an examination of the changes taking place in the electric industry, it is critical to stress the importance of inter- and intra-industry competition as it relates to future organizational structure. The relevant public policy must foster a competitive industrial organization and those relationships that promote the introduction of new technology and scale economies on the one hand, and the distribution of these benefits through the price structure, on the other.

The Technological Premise

The hallmark of the industry's technological advances in generation and transmission reflects ever-increasing size of new generating units and substantial increases in transmission voltages. When this is combined with the acceleration of interconnected coordinated arrangements for economy as well as reliability, one can assess the inherent advantages of these technical advances relative to lower unit costs of operation as well as greater dependability.

One of the typical benchmarks cited is the continuing growth of the electric power industry which has resulted in a doubling of electric requirements about every ten years. The National Power Survey indicated that the electric industry's annual rate of produc-

5. It is interesting to note the significant economies in transmission (in addition to improved reliability of service) relating to scale problems. The cost of constructing a 138,000 volt line of standard transmission in the 1940s at $40,000 a mile resulted in an investment of about $50 for each hundred kilowatts in contrast to a 345,000 kv line which costs about $80,000 a mile or an investment of $12 for each hundred kilowatts. Of course, here the difference is in the proportionately greater number of kilowatts that can be transmitted over the higher voltage line. In addition, it is estimated that the present 765,000 volt line under construction by American Electric Power, while double the cost of a 345,000 volt line will result in a cost of $4 for each hundred kilowatts.
construction. This portent has profound implications not only with regard to technical factors but relative to ownership configuration, concentration, and pricing decisions.

Composition of the Industry

Up to this point, the discussion has centered on the technical factors that reflect the operational characteristics associated with large scale efficiencies and we now turn to their implications for industrial organization. In other words, what are the implied relationships which would translate optimal efficient operations in the engineering sense to market structure and corporate organization so as to optimize consumer benefits in a pricing sense?

A convenient starting point to delineate the various ownership sectors is the FPC’s National Power Survey. The study shows that for 1962 there were 3,617 electric systems of which 1,300 were engaged in generation and transmission and 2,317 exclusively in distribution. There is evidence that in the relatively short period of three years, the number of systems has perceptibly declined. In the FPC publication, Prevention of Power Failures, the total number of electric systems has declined to 3,550 and, more importantly, the number of systems engaged in generation and transmission dropped to 1,098 or a decrease of 202 electric systems. The disproportionate shift of a total reduction of 67 systems versus a drop of 202 in those engaged in generation and transmission can be accounted for by the increase from 2,317 engaged in distribution only in 1962 to 2,452 electric systems in 1965. These data indicate a significant shift in the functional business activity and not just a total decrease in numbers. The significant shift out of generation and transmission is illustrated in the public sector which went from 864 systems in 1962 to 725 in 1965 while the private sector went from 318 to 262. The difference is made up by the co-ops and federal systems. I am not reporting the shift in composition so as to measure precisely the number of system changes as much as to gauge the trend in industry mix.

The data indicate that the trend towards higher annual energy requirements is continuing. In the power survey, there were twenty electric systems with annual energy requirements of over 10 billion kwh. In contrast, the report on Prevention of Power Failures shows twenty-six systems in this category.

One aspect of ownership composition relates to the number of systems and their functional relationships. The other side of the consideration reflects a shift to increased energy requirements for each remaining system. Presently, the private sector supplies about 77 percent of industry’s total output, the federal sector, about 14 percent, and the municipals and co-ops, the remaining 9 percent. With the tendency towards fewer and larger systems, the crucial question for future pricing options is whether these relationships will continue. This proposition should be recast slightly to consider the problem as one reflecting the relationships between large and small systems and the continuity of the ownership patterns currently existing. Because the public sector makes up such a large proportion of the smaller systems, this has particular significance for the future of municipal operations.

Interconnection, Coordination, and Pooling

With the continued introduction of EHV transmission facilities, the capability of moving large blocks of power over long distances became a reality. In most cases, this requires planning and coordination by two or more systems so as to achieve the economies and

9. In fact, this may be a conservative count because if an electric utility was merged into a holding company system, it would still be included. I have made every effort to ascertain that the reporting for the power survey and for the Prevention of Power Failures was on a common basis. Barring certain errors in reporting, the fact that certain systems that earlier reported separately may be tied together and reporting as one system, and given the fact that some distributors may have stand-by equipment which would be tested in one period and possibly reported as generating while not reported in another period, the basic format for reporting was the same in both.

7. FPC, National Power Survey, p. 17.
reliability inherent in large scale generation and transmission. Of course, the coordination of power systems requires high capacity interconnection so that large blocks of power can flow throughout the network of a coordinated system. As I have indicated, such arrangements can result in both significant reduction in costs of service or substantially improved reliability, or both. These reductions in costs come about not only because of the inherent savings in large generation resulting in lower costs per kw of capacity and per kw of energy, but also through the reduction in reserve capacity that a company standing alone would have to construct. Today, approximately 94 percent of the total installed generating capacity in this country is interconnected and operates in electrical synchronism.10

The shift to interconnected and coordinated arrangements to exploit operating economies in the engineering sense has had its counterpart in organizational change and impact as well. In this paper, I have simplified the various kinds of coordinating mechanisms that have evolved in the electric power industry. While there is no generally accepted definition of the "formal power pool" for my purpose, it is adequate to distinguish their characteristics as reflecting the interconnection and coordination of two or more electric systems for the purpose of achieving greater economy and reliability in the supply of their combined loads in accordance with specific contractual arrangements which provide for the exchange of capacity and energy among them and establish a procedure for the sharing of their generating reserve requirements.

As distinct from the pooling arrangement, I have delineated the other broad coordinating mechanism as planning groups. This designation at times is referred to in the trade press as coordinating groups. The relationships of the various electric utilities that are members of planning groups are diverse and stem from varied needs.11

Today, there are 19 major formal power pools with about 65 percent of total generating capacity in the continental United States; these include 90 of the 211 Class A and B private utilities. An examination of the composition of the various power pools leads one to conclude that they are characterized by the absence of small private electric systems as well as small municipals and cooperatives. There are only three pools of the 19 that contain some form of non-private utility participation.

An examination of the power pool membership can only lead to the conclusion that small systems have not been successful in finding an accommodation in the various pooling arrangements. If small systems are to remain viable and independent, it is essential that a means of providing entry to power pools be formulated. The information provided on the formal power pools relates to those agreements on file with the FPC; of course, there are other pooling arrangements not covered by rate schedules on file with the FPC. In fact, as a reaction to the exclusion from these major power pools, a number of small municipals and cooperatives have joined together in power pools of their own. This still leaves open the important question of whether these latter arrangements can fully exploit scale economies.

The data relating to the other coordination mechanism, that is, the power planning groups, indicate fourteen in number. In this less interdependent context, the planning groups reflect a greater degree of joint action, but by no means extensive, between the large private and smaller public and private systems.

It would appear that there is a little more willingness to allow for membership in certain sections of the country (in the Midwest and Far West) in these power planning groups than in formal power pools.

The information just analyzed highlights the major market structure horizon to be focused on. As Chairman White said at the Fourteenth Annual Area Power Conference on November 3, 1967:

One of the thorniest problems facing the industry today is the fact that in some parts of the nation, systems have been unwilling to engage in meaningful coordination arrangements crossing ownership lines. The result is waste, duplication, friction, bad feeling, and outright hostility. And the public is the loser, both in terms of the cost of electric service and in terms of the reliability of that service.

The contrary position is reflected in Donald Cook's statement:

... that governmental effort and encouragement to perpetuate the continued existence of obsolete and uneconomic small systems by requiring, under the guise of promoting coordination, that the larger systems establish some kind of preferred position for the small systems is entirely unsound and unfair. It is an economically unsound allocation of national
resources, it is unfair to the larger system's customers and shareowners, and it is contrary to the public interest."

Of course, the juxtaposition of the views of these two spokesmen reflects the core problems associated with the future structure of the electric industry. In the same speech, Cook foresees "that ultimately twelve to fifteen fully integrated systems, each under a single management, would eventually be brought into being in this country."

**Influence of Reliability on Composition of the Industry**

While engineers have stressed that reliability concerns the ability of a utility system or group of systems to maintain the supply of power, another focus would reveal that it also has significant implications for industrial organization.

The impact on industry organization in the quest for greater reliability can be determined in the various cases involving the requests (or complaints) associated with interconnection that have come before the Federal Power Commission. Since the Shreduddy case when the commission under Section 202(b) of the Federal Power Act ordered the New England Power Company to interconnect, a discernible pattern has been emerging. In the Crisp County case, the commission found under Section 202(b) of the Act that it is necessary in the public interest to order an interconnection and prescribe terms that will encourage greater electrical coordination between Crisp County and Georgia Power, inasmuch as such coordination will lead to increased reliability and a more efficient use of resources for electric generation in the region.

In the Opinion, the commission cited the disadvantages of small isolated systems which generate all of their own energy, and the need to encourage interconnection for more economical operations as well as greater reliability.

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In the Alabama Electric Cooperative case, the commission deferred a final determination on the reasonableness of Alabama Power's ratchet clause in their rate schedule, but ordered an investigation under Section 202(a) of the Federal Power Act. This case illustrates the interdependence of rate level and reliability considerations. The co-op claimed they were discouraged from taking emergency back-up service from Alabama Power because of the impact of the ratchet clause. The commission held the final decision on reasonableness of the ratchet in abeyance, but expressed considerable concern relative to the reliability of the co-op's service to its customers. Commissioner Ross in a separate statement indicated that in his view the use of the emergency powers under Section 202(c) was warranted. He would have ordered the necessary interconnections as necessary to assure reliable and continuous service. In the City of Gainesville case, the commission again ordered interconnection and stressed that each system will gain financial and engineering benefits from the arrangement. In this case, both Florida Power and Gainesville accused each other of engaging in wasteful duplication of service. The commission found merit in the staff's view that interconnection may provide the mechanism for decreasing the duplication of distribution facilities of the parties and may eventually work towards the reconciliation of their differences.

Continuing this same line of coordination implementation, the commission in the Elbow Lake case ordered the Otter Tail Power Company to interconnect with the Village of Elbow Lake. In this proceeding, the commission declined to make a determination under Section 202(c) of the Federal Power Act as to whether an emergency existed. In addition, they did not reach the question raised by Otter Tail with respect to wheeling power for Elbow Lake since no such wheeling was ordered. The rationale provided in the Commission Opinion was:

From the evidence presented, we conclude that there is a shortage of installed reserves in the municipal distribution system to meet an adequate standard of reliability for firm power supply.

In this case, the commission raised a very serious problem facing all municipalities, and that is whether to install their own generating equipment or purchase from alternative public or private sources. They stressed that the solution should be premised upon avoidance of the installation of inefficient small generating plants if interconnection with more efficient sources of energy is available. In this way, economic waste could be avoided which in this instance might require the removal of existing distribution plant and the construction of duplicate facilities. I stress this particular facet of the commission’s decision at this point (the alternatives available to small systems will be discussed subsequently) because it is indigenous to a broad area of decision making for small electric systems.

The last case in this line of commission decisions while following the same trend has some unique features. In the City of Paris case, the commission faced the question of a request by a municipal to have power “wheeled” for them by a private company (Kentucky Utilities Company) which they contracted to purchase from a cooperative. In the first instance, the commission ruled that it had no jurisdiction over the activities of a municipal or over the co-op which they held to be a government instrumentality and, therefore, they found that it could not compel Kentucky Utilities to transmit the power of East Kentucky Rural Electric Cooperative Corp. They ordered the interconnection under Section 202(b) of the City of Paris with Kentucky Utilities Company and the sale of power to the municipal.

Upon appeal to the D. C. Circuit Court, City of Paris, Kentucky v. F.P.C., 399 F.2d 983 (1968), the case was remanded to the commission and the court held that REA-financed cooperatives as presently administered are not government instrumentalties. The court pointed out that the commission could, therefore, reach the question whether it would be in the public interest to order Kentucky Utilities to “wheel” East Kentucky energy to the City of Paris.

Pointing to the legislative history, the commission on remand, concluded that Congress in fixing limits of its jurisdiction pursuant to Section 202(b) prohibits wheeling. In the discussion, the commission said:

If wheeling means the obligation of one public utility to make its transmission facilities available to “facilitate” a power supply contract between two other unconnected electric companies, and nothing more, we think the Commission lacks the power to order it, because Congress considered and affirmatively rejected a provision . . . .

This is the first instance of the commission’s self-imposed limitation on the use of its authority under Section 202(b). The implications of this restriction could have far-reaching effects in terms of future industry-institutional arrangements.

Working in tandem with these decisions to strengthen the commission’s reliability program and indirectly tending toward stabilization of the existing corporate relationships, the commission proposed an Electric Power Reliability Act to set up regional coordinating mechanisms throughout the country. This legislation would require the establishment of regional coordinating councils to assure timely planning and construction of bulk power facilities on a coordinated basis and specifically provides for representation of municipals as well as various privately-owned systems on the councils. Of course, the rationale for the legislation initiated with the Northeast power failure in November 1965 and subsequent blackouts has provided the continuing justification for the commission’s concern with reliability.

The press reported that the industry in June of 1968 established its own National Electric Reliability Council. This consists of 12 regional utility organizations made up of 174 utility systems operating the major generation and transmission facilities in the 48 contiguous states. The groups represent all segments of the industry and Robert H. Gerdes, chairman of the Pacific Gas and Electric Company, as well as president of the Edison Electric Institute, characterizes the council as a significant industry development. In the same article, The New York Times states that “. . . close observers felt it represented an attempt by the industry to forestall the imposition of legislation that would enable the Federal Power Commission to watch closely electro(ic)-power reliability and, possibly control expansion programs.”


The chairman of the commission in a speech before the American Power Conference in assessing the establishment of electric power industry regional and subregional coordinating councils said:

The effectiveness of the form and scope of coordinated planning conducted by regional or area planning councils and groups has not yet been demonstrated. We are concerned that the objectives may not be clearly formulated or may be short of what is needed. So far, little has come to the Commission voluntarily from the industry in the way of in-depth analyses of planning—analyses in which consideration is given to all of the factors that demand investigation today, including reliability, economy, and environmental effects.19

To summarize, the commission’s efforts through decision making and administrative implementation to meld coordination economies (recognizing the potential price benefits) and reliability of service within the given institutional framework have been challenged by a large section of the industry desirous of promulgating planning as an internal matter. This reflects the present state of industry-government interaction and sets the stage for a consideration of the institutional alternatives appropriate for the organization of the electric power industry.

Merger and Antitrust Aspects

Merger activities now taking place in the electric power industry through acquisition, and the formation of new holding companies, require a new and broader assessment by the state commissions, the FPC, and the Securities and Exchange Commission in line with the basic implications concerning industry composition and the pricing benefits of diversity.

In the Northfield case, the Massachusetts Municipalities contended that the investor-owned power companies were engaged in practices which violated Section 10(b) of the Federal Power Act. This section relates to the prohibition against any combination, agreement, or arrangement to restrain trade, limit the output of electrical energy, or to fix, maintain, or increase prices for electrical

energy or service. In the Northfield case, as well as Gainesville, the issue of restraint of trade was raised but the commission did not find a violation of the act. This question is more frequently being raised and is found in a complaint filed January 11, 1968, by the City of Danville, Va. (Docket No. E-7416). They allege that the interconnection agreements between Appalachian Power Company and four other private power systems (Carolina Power and Light, Virginia Electric Power, Duke Power, and Ohio Power) result in undue prejudice and disadvantage to Danville under its present contract with Appalachian. Danville is requesting a form of coordinated operations similar to those agreements in effect with the four private companies, instead of its present purchasing power agreement with Appalachian.

Detailed comprehensive and accurate information relative to consolidations and mergers in the electric power field is difficult to obtain. A limited number of applications are filed with the Federal Power Commission under Section 203 of the Federal Power Act but many companies that merge do not file on the assumption that they are not “public utilities” as defined in the act. Therefore, many mergers occur that do not come to the commission’s attention. In addition, companies that are electric utility holding companies seeking to merge or acquire an independent company or electric companies seeking to merge with a subsidiary must file for approval with the Securities and Exchange Commission. In light of the reporting difficulties, the discussion of merger, of necessity, must deal with trends rather than absolute numbers of consolidations.

There is evidence indicating that the number of mergers and acquisitions by investor-owned utilities has been increasing in recent years. The data pertaining to FPC approved mergers indicate that for the fiscal period 1964 through 1967, six mergers of Class A investor-owned utilities occurred and for the same period, 17 other investor-owned utilities were absorbed. For the fiscal period 1964 through 1968, 18 municipal systems and two cooperative utility systems were merged. Reports submitted to the Federal Power Commission show that in the ten-year period 1955 to 1965, approximately 150 municipal utilities have been merged.

The recent trend indicates that it is not just the small systems that are being merged, but fairly large utility companies are involved—such as Commonwealth Edison's acquisition of the Central Illinois Electric and Gas Company. One of the mergers per-

mitted by the SEC was the formation of Northeast Utilities in 1966. The consolidation of Western Massachusetts Companies, Connecticut Power and Light, and The Hartford Electric Light Company required the issuance of over $500 million of Northeast Utilities stock to the two latter companies. In the following year, Northeast Utilities acquired Holyoke Water Power Company.

Recently, the American Electric Power Company filed with the Securities and Exchange Commission (Administrative Proceeding File No. 3-1476) to acquire the Columbus and Southern Ohio Electric Company. An article in the Wall Street Journal reported that the present merger proposals filed before the SEC are at a rate of six to eight a year and an SEC spokesman noted that this is more than double the pace of a decade ago.

A review of proposed acquisitions indicates that in the recent past the Federal Power Commission has not denied an applicant’s request to acquire facilities under Section 203 of the Act. In two recent cases, the City of Rushville and the City of Allegan, the question of the need for a closer inspection of future acquisition of municipals was raised. In the Commonwealth Edison case, the commission indicated a framework to judge potential anticompetitive effects of a proposed merger. It is important to realize that the continuation of the trend toward increased corporate concentration may have a serious effect on pricing alternatives, particularly with regard to the inelastic services in the electric industry.

Alternatives for Organizational Alignment

It is important to realize that many times small systems do not have the means or the awareness to explore all the alternatives available to them in addition to merger. This was pointed out by Commissioner Ross in the City of Rushville case and by the commission in the Commonwealth Edison case. It is possible that coordination and cooperation in many instances may be more beneficial to the consuming public than acquisition or merger. In this regard the undertaking proposed in the outline of the updated National Power Survey may be of assistance. This new section to be developed relates to how a number of relatively small electric systems have been able to obtain certain coordination benefits as members of coordinating groups, as power pool satellites, and through bilateral agreements with adjacent systems. In addition, power supply problems indigenous to small systems, problems relating to limitation of size, financing, and legal and institutional arrangements may be considered.

An examination of the recent activity with respect to organizational changes indicates a diversity of response to various alternatives. Before citing some of the specific factors, it is necessary to keep in mind that the facts will support either a continuing trend toward concentration or a pull in the opposite direction toward pluralism. For example, recent merger activity is illustrated in the proposed consolidation of the New England Electric System and Eastern Utilities Associates. Additional examples include the proposed plans of eight major electric and combination utilities in Ohio, Pennsylvania, and Kentucky to undertake negotiations looking toward the establishment of a holding company. I have already alluded to the proposal of the American Electric and Power Company to acquire Columbus and Southern and there would be little purpose served in detailing additional merger proposals.

An alternative to consolidation is reflected in the current plan by Iowa Electric Light and Power Company to build jointly and share the ownership of a proposed new 550 MW nuclear plant with Corn Belt Power Cooperative and the Iowa Power Cooperative. Another option is reflected in the agreement by the Iowa Power and Light Company and Consumers Public Power District of Nebraska. The Power District will construct, own, and operate an 800 MW nuclear unit in Nebraska and will sell power to Iowa Power and Light under a long-term power purchase agreement. Another response is reflected in the recent announcement by the North Carolina Municipally-Owned Electric Systems Association, which is composed of seventy-two municipally-owned systems, to build jointly needed electric generating and transmission facilities. The motiva-

tion given by the association is the need to build large scale power plants similar to the investor-owned utilities to meet increasing requirements which they could not afford to build individually.26

Two suits recently filed in the U.S. Court of Appeals by municipals reflect their desire to participate in two privately financed nuclear power projects. Both suits allege that the Atomic Energy Commission improperly licensed these projects without considering the antitrust implications or the broader public interest issues involved.27 These suits clearly point to the fact that smaller systems which cannot afford to build nuclear plants for their own use are seeking a means to develop a claim for participation with the large private utilities.

Of course, this is one of the essentials contained in the Aiken-Kennedy Bill (S. 2564). This proposed legislation seeks to assure that both large and small power systems will share in the benefits of nuclear power consistent with antitrust laws. It would assist the small systems by directing the Atomic Energy Commission to provide a means which would allow the small system to own a fair and reasonable portion of any proposed nuclear plant. In addition, it proposes that the output from nuclear plants be available for sale on fair and nondiscriminatory terms and requires that transmission from nuclear plants be provided under reasonable terms to its owners and purchasers. Lastly, the bill requires that the size and operation of the plant be designed with the best development of the region’s natural resources and power needs.

To focus more sharply on the avenues open to small systems, it will be helpful to again refer to Donald Cook’s speech before the Federal Bar Association. He contends that the small system can obtain the benefits of scale economies by purchasing its power requirements from the larger systems and in this way obtain its fair share of the economies of scale. The small municipal system he finds may still be in a difficult position and, therefore, suggests the possibility of merger. As for the small investor-owned systems he states: “the future lies in either merging with one another or with larger systems to create the most efficient and economical systems the state of the art permits.” He concludes that: “The suggestion that compulsory coordination offers the solution to the ills of the small electric power system is wholly unsound, because the small system has nothing affirmative to bring to the achievement of coordination.” The statements by Cook raise the essential questions concerning the benefits, or lack thereof, of reinforcing competition in the power field and the implied pluralistic power system, as well as the problems associated with concentration of economic power.

One of the important aspects affecting intra-industry relationships concerns the terms and conditions of commission-ordered interconnection. Obviously, the rates charged the small municipal or co-op for the power to be obtained from the larger system is of crucial significance. This is still an outstanding issue in the Crisp County case (where a complaint was initiated on August 6, 1963); it still remains an issue in the Alabama Electric Cooperative case, and also the permanent relationships to be determined for the Village of Elbow Lake.

Central to the determination of rate relationships between the smaller interconnected systems and the larger utilities is the question whether the proportionate cost of interdependent facilities to be borne by each system is to be premised on the proportionate burden each system places upon the interconnected network, or whether the benefits each expects to receive is determinative of the rate obligation.

This issue of benefits versus cost as a decisive approach to rate making also has its counterpart in the opportunity of small systems to be accommodated in pooling arrangements. This problem surfaced in the Northfield case.28 The Massachusetts Municipalities had applied for membership in the Electric Coordinating Council of New England (ECCNE) but were denied entry because the council was limited to investor-owned utilities. The commission concluded that the municipals and the staff had not demonstrated that the denial of participation would have important adverse consequences. The commission issued the license for construction of the Northfield project without any condition. In a separate statement, Commissioner Ross indicated that he would have conditioned the license to require that the municipals or any other electric systems could not be prohibited from future regional power planning.

In the interim between the time of the issuance of the original

commission opinion and the order denying rehearing, the prospective plan cited by the majority providing for the participation by the municipals in the New England power pool was more fully developed. The order denying rehearing cited that the licensee (Western Massachusetts Electric Company) was working toward the creation of a new interim planning committee whose membership would be opened to municipal and cooperative electric systems.

The shift from exclusion to restrictive conditions was anticipated by Commissioner Ross in Northfield. His statement pointed out that the NEPOOL agreement may not meet the needs of the smaller municipals and investor-owned systems. An examination of the proposal filed December 20, 1965, by the NEPOOL Committee has a provision relative to the sharing of benefits from generating units larger than the normal unit, which would measure capacity and energy costs in relation to the benefits received by the smaller systems, and not as a proportionate relationship of the costs of installing the larger facilities. Under many arrangements, the smaller and medium size systems would have to pay a differential into the power pool depending upon the theoretical benefits of being members of the pool. The essence of this arrangement is not to bar small systems’ entry to a pool, but to make it less attractive if not prohibitive to become a member of NEPOOL.

The issue concerning the anticompetitive effects of corporate concentration can legitimately be raised with respect to the regulated electric utilities. This problem is posed in a brief by the Dayton Power and Light Company in the hearing before the SEC concerning the AEP proposal to acquire Columbus and Southern. They opposed the acquisition on the basis of:

(a) the injury to the consumers of and investors in Dayton because of the adverse effect of the acquisition on the future growth and development of Dayton; and (b) the consequent impairment of Dayton's ability in the future to compete with the AEP system in those areas in which competition between public utilities is permitted and encouraged.

They further indicated that Dayton and its neighboring utilities, Columbus and Southern, and Cincinnati Gas and Electric Company have cooperated since 1961 in the planning and construction of commonly-owned large electric generating and transmission facilities. In addition, Dayton detailed the contractual arrangements by the three companies to construct jointly at four locations all their major new generating units through 1975, and it indicated that it was studying plans for future generation and transmission beyond that period.

The Dayton brief makes the point that "if Columbus were acquired and integrated into the AEP System, it would destroy this promise of the creation of an independent utility system capable of providing the type and extent of service demanded by the growth of the industry." Dayton contends the offer by AEP to extend integrated cooperation between Columbus and the AEP System to Dayton and Cincinnati "will inevitably be to destroy the independence of Dayton and Cincinnati and to make these companies in fact, if not in name, a part of the AEP System."

The basic question relative to the alternatives for organizational alignment concerns whether it is necessary to compromise scale-related economies and potential pricing benefits in order to provide industrial pluralism and a competitive environment. I do not think that this question must be answered in the form in which it is formulated. More correctly, we should ask whether it is possible for small systems through specific organizational arrangements to be accommodated in new bulk power supply pools so as to take advantage of the economies of scale.

The question still remains why is the alternative of purchase power agreements for small systems less efficacious than direct participation in bulk supply arrangements? Obviously, this poses the question of rate level and the basic determination of whether lower incremental costs will be the basis for the price to the smaller systems or whether fully allocated costs are to provide the rationale. If it is the latter, unambiguously, the small system will be placed in a deleterious position if it must purchase power on an average-cost basis in an industry where incremental costs are lower than average cost. To align the options so that the small system cannot enter the power supply arrangement on equal terms but must purchase power, forces the choice between the construction of smaller less efficient units, or purchasing power at higher levels of cost than if access were available to the pool. In addition to the problems of quality and the reliability of service which may still be in question if the small system were denied entry to a pooling arrangement, it poses the choice of installing less optimal facilities and possible irrational resource commitment as well.

The operational problems faced by the firm concern whether
future financing can be arranged, as well as the costs of financing, if they are to discontinue construction of generating and transmission plant. In addition, this may have a detrimental impact on future earnings of small private firms in terms of rate base considerations. Lastly, it is not difficult to discern that exclusion from pooling may prompt greater receptivity to the idea of acquisition.

We are now at the threshold; the mechanisms currently being formulated will either reinforce or dampen further concentration in the electric industry. The present proposal to transfer all authority over electric utility mergers from the Securities and Exchange Commission to the Federal Power Commission may allow for a more expeditious evaluation of merger activity. This should permit an evaluation of merger proposals so as to allow those consolidations that will rationalize the industry on an economic premise and still pursue the need to maintain competition and pluralism. Hopefully, merger proposals will not be evaluated on a piecemeal basis but as part of an overall view of industrial organization and performance effectiveness.

II. Natural Gas Pipeline Industry

Introduction

Natural gas is now provided to all the forty-eight contiguous states and the virgin markets of the past no longer exist. The mature aspect of the industry's development reflects inter-industry competitive pressures from alternative energy sources and intra-industry competition as well. This two-level competition has prompted technological innovations providing many opportunities for continued growth and price advantages for the industry.

In the past, the estimates were related to the average growth of gross national product in the range of 4-6 percent annually. There is evidence that environmental considerations involving pollution control as well as other economic factors will result in a near-term growth rate significantly higher. The latest figures released by the American Gas Association indicate an increase in gas sales of 8.1 percent in 1968 over 1967 and 6.1 percent in revenues.30 In addition, the natural gas industry spent a record $3 billion in 1968 for plant expansion and improvement.

While the technological innovations have not been as dramatic as in the electric industry, nonetheless, there have been many significant developments. The industry has steadily increased the installation of 42-inch main transmission line. This will result in further scale economies and current efforts are being made in the development of larger size pipe which can be accommodated to the resulting pressures. The development of corrosion-resistant plastic pipelines is making significant inroads, particularly with respect to distribution company requirements.31

On the marketing end, the development of total energy installations which are gas fueled also provides important growth potential. Research is being sponsored by the gas industry and the Group to Advance Total Energy, Inc. (GATE) was organized to promote the total energy concept.

In this connection, Northern Natural Gas Company has filed a new promotional rate with the FPC for sales to its utility customers for resale to total energy consumers. These proposed reduced rates, recommended for approval by the examiner, were submitted by Northern Natural to "permit more vigorous competition between natural gas and electric utility industries."

There are important related developments with respect to technological breakthroughs in the gas supply area. The development of offshore technology has permitted the discovery of new reserves; and new deep onshore drilling promises significant additions to our gas supply. Additionally, Project Gasbuggy used a nuclear device for the first time to explore the possibility of freeing gas in the tight formations underlying the Pictured Cliffs area of the San Juan Basin in New Mexico. There have been significant strides made with respect to reducing the cost of gasification of coal and research is continuing on obtaining gas from oil shales and tar sands. Lastly,

it is important to note the acceleration in the use of liquefied natural gas. These important developments with regard to alternative supply sources and competitive fuels have been significantly altered by the changing technology in the industry. These developments, in turn, have profound effects on the competitive structure of the pipeline industry and the pricing alternatives for the future.

Offshore Certification of Pipeline Facilities

Because of the importance of the offshore South Louisiana area for future gas supplies and the relative high costs of offshore construction, the commission has evolved a pattern for rationalizing future certification. Prior to issuing a policy statement, the commission directed the staff, in approving an application for offshore facilities by the Michigan Wisconsin Pipe Line Company (Docket Nos. CP68-36 and CP68-212), to initiate discussions with the pipelines operating in the offshore Louisiana area with the objective of influencing the 1969 construction programs. In this way, the commission hopes to further the minimization of transportation costs in moving gas to onshore delivery points.

In the Statement of Policy (Order No. 363) issued June 4, 1968, the commission required that applicants who apply for certificates for offshore South Louisiana must file on or before the first of September preceding the proposed construction year, so that the commission can consider them jointly, as well as individually.” A concomitant action by the commission was the establishment of a Technical Advisory Committee on Transmission Facilities for offshore natural gas. The purpose of the committee as outlined in the order (issued June 19, 1968) was to assist the commission in a study and development of standards and specific proposals for transporting natural gas from offshore fields so as to “present economically optimum means for transporting offshore gas to onshore delivery points.”

The applications filed under the commission’s new policy statement for authority to construct offshore facilities in South Louisiana by pipeline companies total over $300 million. The proposed projects include two joint ventures and individual proposals for offshore expansion by Texas Eastern Transmission (Docket No. CP69-52), Southern Natural Gas (CP69-45 subsequently granted on January 17, 1969), Transcontinental Gas Pipe Line (CP69-51, subsequently granted January 24, 1969), and Michigan Wisconsin Pipe Line (CP69-44, subsequently granted January 17, 1969).

The joint venture by United Gas Pipe Line Company and Southern Natural Gas incorporated as Sea Robin Pipeline Company (CP69-48), proposes to construct offshore facilities estimated to cost $82.4 million and would provide a maximum delivery capability of 613,000 Mcf per day. It is interesting to note that some of the offshore line proposed includes 36-inch pipeline as well as 30-inch line.

The joint venture proposed by Tennessee Gas Pipe Line Company and the Columbia Gas System, entitled the Blue Water Project (CP68-231 and CP69-50), relates to a modified Tennessee certificate and additional offshore facilities to form a 30-inch header arrangement to onshore facilities and is estimated to cost $97 million. This latter proposal will provide full initial capacity of 916,000 Mcf per day. The applicants stress that the Blue Water Project could be expanded by the addition of compression and/or extension of the proposed 30-inch offshore header so as to provide additional capacity and reduce transportation costs.

An examination of the individual applications cited above for offshore construction indicates proposals of transmission construction that do not conform to the sizing and other terms of the Commission’s Policy Statement. This is illustrated by the Transcontinental application (CP69-51) in which the company proposes a 20-inch extension in the Ship Shoal offshore area. They contend that although Michigan Wisconsin and Trunkline both have authorized lines in the same general vicinity, the joint arrangement that had been considered was rejected because approximately the same facilities would be required on the Michigan Wisconsin system as on the Transco system. In addition, Transco contends that any joint transportation arrangement with Trunkline showed no advantage over the long term.

Recently, Columbia Offshore Pipeline Company filed an application (January 29, 1969) to intervene in the Sea Robin joint venture of Southern Natural and United Gas Pipe Line. They requested a comparative hearing contending a portion of the Blue Water Project they propose (with Tennessee Gas) and the Sea Robin Project are “mutually exclusive” and that both are accessible to the
same reserves and traverse similar routes offshore. They further assert that preliminary studies indicate a joint venture which would include Columbia Offshore, the Sea Robin parties, and Texas Eastern (application for certificate in CP69-52) would permit the construction of a 36-inch line to bring their respective gas onshore at substantial savings of capital and operating costs because all have reserves in the same offshore area. This insistence by the pipeline companies to construct their own facilities provides another pointed illustration of the Averch-Johnson thesis—that there is an incentive for the firm to inflate rate base which will result in misallocation of resources under normal regulatory rate of return constraints.\(^{32}\)

A staff engineer in assessing the offshore applications said in an address before the Mid-Continent Oil and Gas Association:

Considered individually, these projects demonstrated various degrees of feasibility when measured by conventional standards of investment costs, costs of service, magnitude of reserve deductions, and other tests. Collectively, however, they disclosed apparent duplication of facilities, cross haul, low utilization factors and excess capacity.\(^{33}\)

One of the factors which was of major concern was the antitrust implications of these joint arrangements. This problem has been mitigated by the recent approval by the Antitrust Division of the Blue Water venture (letter to applicants dated January 16, 1969, signed by Edwin M. Zimmerman, Assistant Attorney General). In this correspondence, the point is made that compliance with the Federal Power Commission's request for submission of cooperative proposals for offshore lines to achieve joint efficiencies associated with economies of scale is not possible by an individual company project. The letter specifically highlights the fact that the Blue Water application for a certificate provides for capacity being made available to third parties on equitable terms (and assumes that the certificate issued will so require) and expands the capability to its potential limits when necessary to accommodate the applicant's needs and/or the need of third parties.

The approval by the Justice Department of the Blue Water Project eliminates an important obstacle which will permit rationalizing offshore construction but it also places the burden on the commission to guard against anticompetitive arrangements as it reviews the applications for construction of optimal scale facilities.

The question can legitimately be raised whether the commission, under the Scenic Hudson doctrine should find the public interest alternative so as to encourage either joint arrangements or common carrier alternatives in order to optimize construction of offshore facilities by eliminating duplication and reducing transmission costs and provide the benefits of potentially lower prices.

An important new tool to assist the commission and the pipeline industry in evaluating proposed construction is the Network Analysis Technique developed for the Federal Power Commission by the Office of Emergency Planning. In the foreword to the report prepared for the Federal Power Commission, Chairman White pointed to the significant contribution of the study to pipeline network design.\(^{34}\)

The report emphasizes that if this new technique had been available five years earlier and if sufficient data concerning the location of offshore reserves had been available then a system could have been designed which would have substantially lowered the construction cost of the present offshore arrangements in the Gulf of Mexico. They foresee that the application of the technique to the presently proposed offshore construction in excess of $300 million will result in "immediate savings of many millions of dollars."

There is no doubt that the utilization of the new Network Analysis Technique will work towards optimal construction which will maximize scale economies and provide the opportunity for significant savings for gas consumers. A small example is already evident in the modification of the Sea Robin Project in which the applicants propose to revamp their offshore system after receiving assistance in using computer analysis techniques. Using the network analysis technique they propose to redesign the system to provide 800,000 Mcf per day, an increase of about 90 percent over the original proposal, and new onshore delivery points which will result in a saving of approximately $7 million in initial construction cost.

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\(^{34}\) *Design of Economical Offshore Natural Gas Pipeline Systems*, Report R-1, National Resource Analysis Center, Systems Evaluation Division, October 1, 1968.
Interpipeline Competition

In the last few years, there is marked evidence in a number of significant certificate cases of the commission's decision to promote interpipeline competition. Rather than work with the concept of an exclusive franchise for a pipeline supplier, it is evident that the commission has opted, where feasible, for greater competition in a number of markets.

An examination of the certificate cases will reveal that the nature of interpipeline competition can be divided into a new supplier competing for incremental load as distinguished from base load. The former has its genesis in the Lynchburg case where the commission permitted a second supplier to serve Lynchburg Gas Company and set in motion the rationale for further competition when they said: "We by no means intend to grant any company an exclusive right to a designated area, or to deny to consumers the benefits of more than one source of supply." They went on to say that they would protect against any "unjustifiable harm" to the existing supplier and the customers of the latter.

In subsequent cases involving approval of a second supplier for incremental market requirements, the commission certified Transcontinental Gas Pipe Line Corporation to serve Washington Gas Light Company and Commonwealth Natural Gas Co., Southern Natural Gas Company to serve the City of Chattanooga, and Tennessee Gas Pipeline Company to serve the City of Hartford.

In the City of Hamilton and the City of Corinth cases, the commission replaced the existing suppliers, after their contract had expired, with new pipeline suppliers for their base load. The commission stressed the savings to consumers that would result from the shift. In both cases, the commission indicated that the loss of the load of the original supplier would be offset by normal load growth on its system.

As to the position of the "middleman" pipeline, which was raised in both Hamilton and Corinth, the court in reviewing Cincinnati Gas and Electric Company's appeal of the former decision indicated that the substitution of a direct supplier and the elimination of a middleman would be of material benefit to the ultimate consumer.

While this conclusion comports with the objective of providing gas at the lowest possible cost to consumers in a given market, it does not answer an important equity question raised by Commissioner Carver. In his concurring statement in Corinth, he asked whether the certification of Tennessee Gas and the replacement of Alabama-Tennessee Pipe Line as the city's supplier would result in an undue burden on the remaining customers because of the abandonment of facilities built specifically to serve the city. The question posed reveals the need to distinguish between general purpose pipeline facilities which can be utilized for normal load growth, as distinguished from special purpose facilities, and the potential burden on the remaining customers resulting from the loss of a market. Even in the latter instance, the overall benefits may still outweigh the additional costs which may have to be borne by the existing customers on a pipeline system.

At this point, it may be helpful to pause and underscore one of the basic issues that must be considered in weighing the benefits and costs and the resulting rates associated with interpipeline competition. This relates to the need of avoiding the duplication of facilities. This problem has two dimensions: one, the need to ascertain the future market growth and the projected requirements so as to weigh the economic feasibility of two suppliers, and two, the beneficial competitive effect of two or more pipelines supplying the market. Obviously, it is the specific factors that are indigenous to a given market that will permit intelligent decision making in resolving these issues.

Up to this point, the discussion has centered on pipeline competition and the pricing implications among existing transmission companies. In this mature market, it is much more difficult for new entrants to justify initial certification. This is illustrated by the Oklahoma Illinois Gas Pipeline Company proposal to construct a

35. Transcontinental Gas Pipe Line Corporation, 21 FPC 399, 404.

$62 million project from the northwest and southeast Oklahoma supply regions to serve the City of St. Louis, Missouri. In addition, the proposal of Gulf Pacific to construct a new line to serve Southern California was rejected by the commission.

The Great Lakes venture is the only recent project in which a new entrant was certified to serve a major market. The anti-competitive aspects of this joint venture and the related questions raised by the District Court of Appeals will be discussed subsequently. An examination of the factors behind the organization of this pipeline can only lead to the conclusion that the American Natural Gas System was desirous of controlling new entry in the markets served by its pipeline subsidiaries.

Antitrust and Pipeline Certification

In 1969, the U.S. District Court for the District of Utah implemented a divestiture requirement of El Paso Natural Gas Company to dispose of the Northwest Pipeline Corporation facilities which were initially merged in 1959. Without reviewing the complex legal processes which ultimately resulted in the Supreme Court reversing the District Court and finding that the acquisition by El Paso of the Pacific Northwest Pipeline Corporation was in violation of the Clayton Act, it is important to note the underlying rationale for the divestiture. The Court in agreeing with the Justice Department that the acquisition was in violation of the Clayton Act stressed that the merger significantly reduced competition in California and the Northwest.

The previously mentioned Great Lakes case is another recent decision involving a pipeline in which important antitrust issues were raised. In its decision, the Court stressed that the commission is obliged to weigh antitrust policy and found that it did not give adequate consideration to the antitrust laws in certificating the Great Lakes project. The Court concluded that the joint venture

would have substantial anticompetitive effects on the marketing of gas in Michigan and Wisconsin and that the commission ignored the potential price benefits of increased competition. The Court said:

Indeed, by permitting American Natural to buy a half interest in the Great Lakes pipeline, the Commission enabled American Natural to protect its Michigan and northern Wisconsin markets from any competition by an independent competitor, even though there were no apparent economies of scale to be gained.

In this carefully reasoned decision, the Court elaborated upon the degree of concentration in a number of pipeline markets and distinguished between various measurements such as "tight oligopoly" as opposed to "partial monopoly" in an effort to delineate the advisable competitive alternatives open for commission evaluation in seeking the best means for the protection of the consumer in these markets. Stressing that competition can play an important complementary role in the regulated industries the Court said:

And when new facilities must be built, the competitive advantages afforded by a new entrant might often be more meaningful than any economies of scale which could be attained by permitting the present monopolist, or dominant market force, to construct the new facilities and fulfill the increased demand. Even limited competition would seem to encourage suppliers of natural gas to become more aggressive in proposing new rates and services, and thereby increase the effectiveness of regulation by the Commission.

Another important dimension of regulatory responsibility highlighted in this decision concerns the commission planning function. On this point, the Court said:

Moreover, the duty imposed upon the Commission by Section 7 of the Natural Gas Act is not merely to determine which of the submitted applications is most in the public interest, but also to give proper consideration to logical alternatives which might serve the public interest better than any of the projects outlined in the applications.

This regulatory obligation has profound implications for efficient resource allocation and rate making decisions.

Trend Toward Conglomerate Structure in Pipeline Industry

The trend and pace toward conglomerate corporate structure in American industry today has no precedent in our past experience.
The tendency of pipelines to diversify has its counterpart in other regulated industries as well as manufacturing enterprise. A recent study by the Federal Trade Commission indicates that conglomerate mergers set a new record and accounted for 83 percent of the number and 80 percent of the assets acquired in 1967. In the regulated industries, it is apparent that the various regulatory agencies, as yet, have not formulated any policy with regard to the implications of conglomerate merger for the regulated business.

In a recent decision involving the North Western-Milwaukee merger, an examiner recommended that the Interstate Commerce Commission institute a general investigation on the profitability of the railroad operations in a conglomerate structure. A recent article discussed favorably the evidence that electric utilities may become limited conglomerates. The article pointed to Southern California Edison’s participation in the home building business and the recent change in Philadelphia Electric’s charter so that it may go into new business areas.

Undoubtedly, the intensity and scope of conglomerate mergers prompted Congressman Hastings Keith (Massachusetts) to introduce a resolution (January 29, 1969) which would authorize a joint study of conglomerate activity in the regulated industries to be conducted by the six federal regulatory agencies.

The degree of pipeline diversification by major pipelines that has taken place in recent years has markedly increased. The revenues received from gas sales as a percentage of total revenues by the twelve diversified pipelines have declined in the eight-year period 1960–1967 from approximately 75 percent to 65 percent. The most dramatic change concerns Tenneco, Inc. whose gas revenues went from 45 percent of total to about 22 percent in this period. While a large number of these diversified pipeline companies are in related businesses such as oil and gas production, petroleum refining, and chemicals, an examination of the unrelated areas indicates pipeline companies owning businesses as widely diversified as rocket manufacturing, banking, electronics, plastics, shipbuilding, and barge operations.

III. Conclusions

It is important that regulatory commissions recognize the broad benefits that can result from a competitive institutional structure as a complementary force to regulatory decision making. Public policy should seek through all reasonable means to preserve, supplement, and strengthen competition in the electric power and natural gas pipeline industries.

In the electric power field, where new entry is generally precluded, the benefits of innovation and scale economies which result in price benefits may not be realized unless the regulatory commissions in their licensing and rate making functions recognize the importance of a competitive pluralistic industry. In addition, the regulatory commissions must devise a means of providing entry by small systems into power pools under terms and conditions which permit equitable rates to both large and small systems. In this way, consumers of all power systems can benefit from low cost scale operations. By broadening the membership of the power pool, the focus is shifted away from the needs of the large system members to regional requirements. This should permit the construction of new plant utilizing scale frontiers that are greater than the limits set by restricting power pool membership.

In addition, regulatory commissions should view merger proposals within the broader context of the desirability of maintaining a competitive industrial structure. In some instances, there will be a clear indication that it is un-economic to continue an isolated or small system but in others, if alternatives are available to provide economical power then the benefits of competition should sway the decision in favor of retaining the small system. Lastly, whether it is necessary to seek new legislation to assure the small systems access to power pools is an open question. Perhaps, the commission’s authority under Part II of the Federal Power Act, which requires the filing of all rate schedules (this would include pooling agreements) is adequate. If not, the Aiken-Kennedy Bill can be modified or other legislation introduced to assure the small systems access not just to nuclear power but ownership in the larger conventional units as well.

The major technological innovations and related scale economies in the natural gas pipeline industry have played an important part in the certificate decisions of the Federal Power Commission. The offshore joint ventures indicate an effort to construct optimum pipeline facilities to bring supplies from given offshore locations to onshore points. While this reflects a greater degree of concentration in pipeline operations, it is related to lateral construction as distinguished from concentration in the end market.

Another recent development in FPC certification concerns the infusion of a greater degree of interpipeline competition for incremental and base load. The awareness by pipelines of the commission’s receptivity to competition and entry into new markets should encourage greater scale operations and result in price benefits.

In two recent cases, the courts have underlined the importance of competition for consumer protection. In the El Paso case, a horizontal merger was voided, and in Great Lakes, the court insisted on the commission applying antitrust criteria before reaching a decision on other regulatory grounds. Another important outgrowth of this latter case was the delineation of commission responsibility requiring the determination of the public interest alternative in certification matters.

Lastly, another significant challenge to regulation is posed by the conglomerate trend in pipeline company acquisitions. Of legitimate concern is the possibility that the diffusion of management interests will impair the incentive for future innovation in the regulated business, thereby foregiving the potential economies and related price benefits. The question of the effect of diversification on the price to gas consumers and the quality of service raises many uncertainties as to the safeguards necessary for the regulated enterprise.
Comment

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Dr. Schwartz favors a competitive, pluralistic organization of the electric power industry, as evidenced by the following statements:

"Public policy can best accomplish these objectives (efficiency in resource allocation and consumer welfare) by encouraging a competitive industrial structure. By promoting competition, where feasible, the pecuniary incentive for the business enterprise will induce technological innovation, scale economies, and provide the basis for potential price reductions." (p. 257)

This policy is feasible because there already exist "... important countervailing competitive factors within and outside the industry." (p. 257) "A competitive institutional structure (would serve) as a complementary force to regulation." (p. 288) "Regulatory commissions should recognize the importance of a competitive pluralistic industry." (p. 288) "Public policy should seek through all reasonable means to preserve, supplement, and strengthen competition." (p. 288)

These statements, and particularly the last sentence, are consistent with the American tradition and with our declared national policy. The title of Schwartz's paper, however, suggests that technology may force some modification of, or departure from, this policy.
In order to avoid possible misunderstanding with respect to terminology the meaning of competition as used here must be explained. Neither Schwartz nor I use it in the restrictive technical sense of textbook price theory or market analysis. Rather it is used, after the fashion of institutional economists, in a structural, institutional, environmental sense—to denote a social milieu, in which diverse organizations compete for public favor and support on the basis of relative performance of some economic function. This system may be termed institutional competition, to distinguish it from price or market competition. It is a socially contrived arrangement designed to serve a variety of public purposes and values; the rivalry of organizations and techniques does not operate like free market competition but it achieves by indirection somewhat similar results in circumstances where free market competition is not practicable. Since, in such a system, both ends and means are variable and relative a society committed to promoting competition by means of institutional competition has many options available to it. Schwartz undertakes to explore and evaluate some of the options by which he hopes to make the electric power industry more competitive and pluralistic, and less monopolistic.

At the very outset, however, he severely limits his range of options, and thereby handicaps his projected analysis, by accepting, without proof or careful analysis, the currently popular dogma that efficiency requires big technology and big technology requires big organizations. It follows from this that production must be concentrated in a few huge plants. This proposition is an immutable, inexcusable law of necessity—a technological imperative beyond human control—to which man must submit even though submission destroys his economic freedom and renders monopoly inevitable. He can do no other unless he is prepared to sacrifice efficiency and revert to a primitive type of economy. This specious doctrine of technological determinism is so compelling and persuasive to the uninitiated that it has become the principal rationalization for monopoly in our time, and the principal enemy of competition. It makes it appear that monopoly is predestined, inevitable, and highly beneficial to society, while competition is almost criminal in its wastefulness and inefficiency.

Having thus entrapped himself in this artificial dilemma, Dr. Schwartz tries manfully but unsuccessfully to escape. He wants competition, diversity, and pluralism, but the prospect of inefficienc
sumed technological imperative, Schwartz is unable to recommend institutional changes capable of achieving his professed goals—to preserve, supplement, and strengthen competition, and to create a competitive, pluralistic organization of the industry. The best he can propose for the competitive elements in the industry (that is, the small organizations—private, public, and cooperative) is that they be not excluded from the banquet hall of Dives; he would “accommodate” them, to use his own word, by giving them admission tickets which would entitle them to gather crumbs from the table. This might keep them alive and provide some consolation of spirit but it is a far cry from making them free, responsible “institutional competitors.” The 12-15 giant monopolies, envisioned by the technological extremist, would bestride the narrow world like a Colossus, to use the symbolism of Cassius, and these small organizations would, like his “petty men,” peep about to find dishonorable graves. Clearly much more in the way of institutional change will be required than is contemplated by Dr. Schwartz if we are to create a competitive, pluralistic electric power industry.

What Schwartz advocates is essentially the pattern of organization recommended by the Federal Power Commission in its National Power Survey; that is, concentration of production in a few giant plants, these to be interconnected by high voltage, long-distance transmission lines, and the whole to be operated by large private monopolistic corporations. If there is any difference between Schwartz and the commission, it lies in his greater concern for the survival of small producers, for their effective participation in the industry, and for their equitable sharing of potential gains. The commission report was gravely deficient in this respect and its strong endorsement of big technology and big organization was seized upon by aspiring monopolists as justification for the final liquidation of all residual competition. Schwartz is aware of this danger and seeks to avert it by devising alternative arrangements to preserve institutional competition by accommodating it within the framework of a predominately private monopolistic system. His purpose is laudable but his efforts fail because monopoly and competition are incompatible and irreconcilable. One does not preserve institutional competition by accommodating it to monopoly; one does something about monopoly.

There are several institutional reforms that might serve to make the electric power industry more competitive, or less monopolistic.

These are:

1. Expansion of the private, non-utility sector of the electric industry. Historically, the best way to break a privileged monopoly has been to destroy it from the outside—for example, the railway monopoly of 1907-14. Individualized production of electricity has always been important and still is. It might well become still more important if government would support research and development in the area of small-scale techniques and protect the users of such techniques against monopolistic aggression. The freedom and technical capability of individuals to supply their own needs is still the best defense against monopoly.

2. Curtailment of special privileges. Monopoly in the electric power industry rests squarely on a foundation of special privileges granted over the years by federal, state, and local governments. These privileges enable the grantees to suppress competition and to create monopolies; that is their purpose. A selective reduction of this accretion of privilege, particularly those that operate directly to frustrate new techniques and new organizations, would lessen monopoly and increase the possibilities for competition.

3. Redirection of public regulation. Aside from the monopolists themselves, the most assiduous promoters of monopoly and suppressors of competition are the regulatory commissions, both state and federal. Originally created to protect the people against the aggressions of monopoly, they have been gradually changed into agencies for protecting the monopolists against the people. In Walton’s definition’s perceptive phrase, “regulation of monopoly has become sanction for monopoly.” This preposterous, upside-down situation can be corrected by rewriting the legislative mandate of regulatory commissions to insure that they promote competition, not monopoly.

4. Separation of functions. The retail distribution of electricity, in most situations, lends itself to small-scale organization and local policy determination. No economies of scale, or of big technology, can be anticipated in respect to the distribution function; on the contrary, the practice of loading distribution with huge overhead costs of corporate giantism insures that distribution costs will be artificially inflated. Experience has demonstrated that small-scale, local organizations can distribute electricity cheaper than huge unwieldy corporations. Here is an institutional reform which would
inject a large measure of institutional competition into the industry with beneficial results to the consuming public. Thus, even if it should prove true in the long run that big technology is superior and requires concentration in production, a large measure of competition in distribution could be had by separation of functions. 5. Vigorous public support for small organizations. One of the most foolish aspects of our public policy in the last fifty years has been the failure of government to protect and support the small organizations—private, public, and cooperative—that have by their presence provided competition and pluralism in the electric power industry. Government has permitted monopolistic aggressions against these small organizations and, in addition, has permitted its regulatory commissions to harass them and obstruct their operations. Under this combined assault hundreds of small organizations have disappeared and hundreds more have had their usefulness impaired. After fifty years of this we are now told that something needs to be done to make the industry more competitive and more pluralistic! 6. Control of the technological process. In this country the technological process—the discovery, perfection, and innovation of new and improved technologies—is largely controlled by big business under some degree of monopolization. Naturally they direct this process with a view toward aggrandizing their economic power and increasing their profit. In recent years their large outlays for research and development have been supplemented by far larger outlays by the federal government under the contract research system, with discoveries accruing to the corporate contractors. If in a given situation, big technology is more efficient than small technology no metaphysical explanation is required; it is true because big business, with governmental support, made it so by years of research and large allocations of material and scientific resources. By contrast only trivial outlays have gone into the perfection of technologies suitable for small scale application. Here, again, a major shift of policy is needed; if we would promote competition and pluralism we must develop techniques appropriate for competitive use. 7. Control of the social power of corporations. The economics of monopoly—that is, its utilities and disutilities—is important but in the long run perhaps less important than the social power of giant monopolistic corporations, particularly when the latter are privileged. Such organizations, if free to do so, can exercise a powerful influence over public opinion, social attitudes and values, moral and ethical standards, national economic policy, and politics. A giant corporation as a monopolist can only levy material tribute upon the people of the community, but as a wielder of great social power it can destroy the community itself by subverting the values and institutions that hold the community together and permit it to function. The latter is the greater evil. Thus, the search for a more competitive and pluralistic electric power industry should be concerned primarily with preserving a free democratic society, and only secondarily with getting electric bills reduced. Conclusion Institutional reforms of this character, however essential for achievement of competition and pluralism in the industry, are impossible so long as the social will is paralyzed by technological determinism. The best to be hoped for is some minimal degree of "accommodation" for competitive, pluralistic forces within the monopolistic context of giant technology and organization. If I interpret his views correctly, this is about all that the suggestions of Dr. Schwartz offer. The present situation is analogous to that confronted by an earlier generation, between 1907 and 1933, when it had to cope with an older determinism—the theory of natural monopoly. The electric power industry, it was then said, was a natural monopoly, by virtue of a combination of economic, social, and technical factors that precluded competition. This being the case, society had no choice other than to legalize monopoly and suppress any adventitious competition. Laws were duly passed and commissions established to implement this policy. Thus, from 1907 to 1933, the industry was hustled along the road toward almost complete monopoly by the combined pressure of government and business, under the banner of natural monopoly. So long as people accepted this result as predetermined and inevitable nothing could be done to avert it. When the system collapsed in the early 1930s,—a most unnatural thing for a natural monopoly to do—it was discovered that these monopolies were not natural, inevitable, or predetermined but rather, they were artificially contrived structures created by promoters with the active assistance of privilege-granting, corrupt gov-
government. These disclosures destroyed the credibility of the theory of natural monopoly and paved the way for a bold series of institutional reforms. Such competition and pluralism as now exist in the industry are largely the product of this reform movement of 1933-1940. The foundations laid then have proven strong enough to withstand the attacks of post-war reaction.

Now, however, the monopolists have contrived a new, and even more formidable, mythology to rationalize their quest for power. This is the theory of technological determinism—the notion that technology is a force external to man and beyond his control; that, obeying physical rather than man-made law, it determines human destiny and dictates the organizational structure of society. The imperatives of modern technology require big technology and big organizations for economic efficiency and, conversely, the elimination of inefficient small technologies and small organizations. The monopolists are the leaders of this inevitable technological revolution. The thrust of this propaganda has a powerful and baleful impact on public opinion and on government. Being widely accepted as true, its effect is to stifle all institutional reforms, hasten economic concentration, direct technological change toward giantism, and justify monopoly. This is the prevailing system of thought and policy against which Schwartz must contend in his effort to get more competition and pluralism into the electric power industry. If his proposals appear inadequate, as I believe they are, one should in all fairness recognize that he, like many others, is trapped by the doctrine of technological determinism and forced to be content with small gains.

But already events portend the ultimate demise of technological determinism. A rising tide of criticism reveals its true nature as an artificial, self-serving rationalization invented by aspiring monopolists and seekers after special privilege to justify their seizure of power. It cannot withstand objective criticism any more successfully than did the theory of natural monopoly two generations ago. The same process of attrition that destroyed this earlier bulwark of monopoly is now beginning to undermine and discredit technological determinism. This movement will continue until men regain their sense of intellectual freedom from contrived, deterministic dogma, and reassert their mastery over their institutional life, including control of technology and its uses. Then, and only then, will they be prepared to reorganize the electric power industry.

Comment

R. H. Malês

Commonwealth Edison Company

Introduction

To comment adequately on such a complete and wide-ranging paper as Dr. Schwartz's I would need to invoke the equal time ruling: but this ruling applies to another regulated industry. Therefore, I will limit my comments to only two aspects: the first dealing with the pipeline companies' supposed over-propensity for capital; the second dealing with organizational structure and technological change in the electric power industry.

Gas Pipelines

In Schwartz's paper he lists and discusses in great detail the offshore pipeline proposals. He finds the industry has not come close to optimal economic development. Specifically he states, "This insistence by the pipeline companies to construct their own facilities provides another pointed illustration of the Averch-Johnson thesis."
Unfortunately, I know little of the specific cases. In fact, let me begin by disclaiming any expertise in the natural gas field. However, assuming these are not optimum expansion plans, is this an illustration of the Averch-Johnson hypothesis? The answer—it is not.

The Averch-Johnson hypothesis itself is incorrect. It has been used to justify irrational behavior all too frequently without a critical analysis. The theoretical foundation suffers from three flaws. The first is a problem in definition of terms, the most important of which is differentiation between incremental and average cost of capital. The second is a problem with unrealistic assumptions, primarily that the manager of a regulated firm will plan on the allowed return being higher than the long-run cost of capital. The third is the requirement that demand be inelastic.

If this is not an Averch-Johnson propensity for use of capital, what other factors could be operating? Other forms of regulatory constraints could well be motivating factors. For example, the Federal Power Commission itself recognized one such factor. They attempted to get blanket antitrust exemption from the Justice Department on all such joint ventures. If the FPC seek antitrust regulation is an impediment to such planning, should not the pipelines think the same way?

Another example might be found in the electric industry. Interconnections have been used as a basis for bringing electric operating companies under Federal Power Commission regulation. Could it be that the pipeline companies worried that joint planning might bring other agencies into their regulatory picture?

Finally, it is difficult to measure the value of political and economic independence. It is possible that the pipeline companies see a higher value in this than would the Federal Power Commission. However, it is interesting to note that one of Schwartz’s basic arguments against mergers among electric power companies is the high regard he places on maintaining the political and economic independence of the existing companies.

These are merely a few reasons, other than Averch-Johnson propensities, why firms may not choose the optimum expansion pattern. One important regulatory function is to avoid being such a cause. This is especially important as technological change brings the need for new approaches.

Electric Power Industry

Schwartz’s premise regarding the electric power industry is that “... relevant public policy must foster a competitive industrial organization and those relationships that promote the introduction of new technology and scale economies ... and the distribution of these benefits through the price structure. ...”

While I agree wholeheartedly in principle, I must quibble with details. Coming from a region where one of the hottest interfuel competitive battles rages, I can say there remain no uncontested markets. Every kwh must be fought for: the new building markets and the existing markets—residential, commercial, and industrial. On a more limited scale there exists a battle among suppliers to attract and retain industrial customers. Both these battles are waged on a price-quality basis. They provide the incentive for more efficient operation, technological change, and risk taking.

However, the industrial competition does not provide such incentives. The “yardstick” concept, Schwartz refers to, is known to be rubbery. The war is waged in a battle of words over taxes forgone, equity or risk capital cost, subsidized financing, and so forth. The preservation of this system is a costly anachronism and more important is inconsistent with technological revolution. What are the economic factors at play?

Economies of scale in generation, transmission and, to a lesser extent, distribution and general business operation are the technological base of today’s electric system progress. Thousand MW generators, 765 kv transmission, mechanized fleets, computers such as these are the sources of economies. These can be supported only by large scale systems. Are there advantages in creating large systems by a loose pooling of independent utilities as opposed to a more formal integration of such a pool?


Schwartz lists three advantages: 1) continued ideological competition, 2) diversity of pricing policies, and 3) diffusion of economic power. I have already commented that the first is a dubious competition. The second seems unimportant in an industry which is regulated in pricing policy, under full pricing disclosure, and subject to continuing public and competitive pressures. The third appears of little consequence when viewed against the regulatory backdrop. It has been my impression that regulators have operated more efficiently and more encompassingly when dealing with the larger utilities. In addition, a merger, such as the one being discussed between Central Illinois Light and Commonwealth Edison, if consummated, would add only slightly to the size of the system. On the other hand, certain substantial economies can be achieved only by such a merger. Even the ultimate proposal, such as Donald Cook's, would imply a growth by a factor of less than two for the largest utilities of today. The resulting systems, while large in absolute terms, would not be large in contrast to many industrial firms.

There are disadvantages to a loose pooling of entities. These more than offset the three advantages just discussed. These disadvantages are: 1) complication of equitably sharing the continuing benefits among pooled systems, 2) inequity in the sharing of advantages among consumers, 3) conflict in economic incentives among systems, 4) loss of other economies, 5) diminished risk taking, and 6) decreased incentive to do research.

The first disadvantage is the complication of sharing the benefits. There are two levels. For a static model made up of large and small systems it is extremely difficult to write a joint venture contract in which each entity benefits no more or no less than any other. For example: what reserve should each system have? Who should pay for what transmission line? Who should operate what? How should joint operating costs be allocated? For the second level, a dynamic model stretching thirty years or so into the future compounds the problems. In a nuclear unit, for example, which neutrons get used by whom? It is fine if one can predict accurately for the next thirty years, but let one partner want to derate the unit and delay refueling while the other does not. While such problems are not insoluble, they will result in less than optimum economic compromise.

The second problem is the inequity among consumers. Current suggested pooling arrangements call for the sharing of only the new units under construction. For those systems without generation today it means low cost power for some time in the future. On the other hand, systems which already own generating capacity would have to carry alone the higher cost older capacity. In addition, if small utility systems are allowed to share directly in generating capacity, why should not larger industrial and commercial customers also be allowed such entry? And if them, why not every sized customer? The result, of course, would be higher rates for some customers and substantially lower rates for others, if not complete chaos.

The third disadvantage has to do with conflicts in economic incentives. If systems with very different capital costs were to share in a project, there would be different solutions as to whether to increase capital investment so as to lower operating costs. Publicly financed systems with capital costs in the order of 5 to 8 percent would be much more prone to invest in additional facilities than privately financed systems with capital costs in the order of 12 to 15 percent. A publicly owned system with a 6 percent capital cost would be willing to invest twice as much as its partner utility with a 12 percent capital cost. In such a situation systems could never simultaneously arrive at an optimum economic solution to a problem. One or the other, or both, would be forced to a non-optimum compromise. It is a curious fact that the use of a given set of resources may or may not be economic depending on the ownership tag.

Fourth, such pooling arrangements do not provide for the achieving of economies in distribution and general management areas. While it is conceptually possible to have joint distribution forces or to share in computer facilities, I am sure further economies can be realized under a single management. In the Commonwealth Edison -Central Illinois Electric and Gas case in addition to the substantial economies available in generation and transmission, there were large economies in the pooling of engineering services, computer services, administrative services, purchasing activities, research activities, and other such functions.

Finally, the fifth and sixth reasons are decreased risk taking and incentive to do research. It has been difficult to get the cooperation of a small number of large systems on new projects or research projects. Perhaps the difficulty is not directly proportional to the square of the number of members in the venture—but it is very close.
My list is not exhaustive but I believe the point is clear. Dr. Schwartz has suggested a method of reaping the benefits of technological change. He has done this while maintaining the supposed virtues of the pluralistic configuration of today's power industry. But this can only be done at the price of losing substantial potential economies available to the industry.

Regulation can provide equal incentive to those stemming from ideological competition. Regulators, rather than striving to perpetuate today's ownership configuration, should be striving to develop techniques to replace whatever incentives might be lost by the almost certain change in industrial organization.

IV

Regulatory Policies and Pricing Practices

Actual public utility prices and rate structures are a function of management decision making subject to regulatory review. The review process is significant for it is at this point that any adjustments or corrections necessary to establish compatibility with the public interest or social objectives must be made. The traditional criticism directed at regulators has been that commissions have been preoccupied with the determination of total revenue requirements or the general level of earnings, and have allowed rate structures to be determined by management.

Regardless of the validity of this criticism, it has generally been true that management and regulators have initially approached the topic of pricing from diametrically opposed viewpoints. For management seeking maximum flexibility, the value-of-service concept has always been attractive. For regulators seeking objective criteria by which to judge prices, cost-of-service has seemed to be an appropriate point of departure. In practice, the former tends toward variants of price discrimination; the latter tends toward full-cost pricing. Of course, neither demand nor cost is the exclusive determinant of price, and a final resolution must consider both factors. It is important to see how
regulation perceives pricing problems in order to understand how these divergent views can be reconciled.

Charles R. Ross and Kenneth A. Cox, former commissioners with the Federal Power Commission and the Federal Communications Commission, respectively, reflect on agency pricing decisions in the electric, gas, and communications fields. These papers deal with the need for regulatory guidelines, the broader framework within which pricing decisions are made, and the interdependence of prices with other welfare judgments.

James D. Little presents a critique of FPC pricing policy, particularly as embodied in the Atlantic Seaboard formula. This presents a classic illustration of the conflict between management and regulation in the search for standards and the desire to promote equity in the treatment of all parties. Harold J. Barnett's comment contrasts the Ross and Little papers with Cox's paper on a number of aspects of pricing and regulation. Francis X. Welch's comments provide observations on regulatory pricing policies based on a lifetime of intimate contact with applied public utility problems.

Regulatory Pricing: An Academic or Intuitive Exercise

Charles R. Ross

University of Vermont (formerly with FPC)

One would think that someone who has ten years of regulatory experience, both federal and state, should be able to make a substantial contribution to a collection on regulatory pricing. However, the last ten years have taught me that there is a lot to learn about how regulatory pricing should be done.

On the state level, the problems were many and varied. For example, how does one price for power line extensions? Is the second home or vacation home market something to be encouraged by the means of utility pricing? Or should a state commission seek to influence the farmer's work habits by approving the imposition of demand charges which would inhibit the use of milking machines, barn cleaners, hay dryers, washing machines, lights, clothes dryers, and air conditioners, all at the same time? Actually, the problem of pricing at the state level is more apparent and the success, or lack thereof, more obvious.

On the federal level, I must confess that many times our decisions
were less than candid. Often, the result, being a compromise, had to be couched in language that would satisfy all concerned. The cases to watch were the ones with a good dissent. Furthermore, while everyone might agree as to the final result, the goals of each commission might be entirely different. Often, and usually most of the time, the language of the majority opinion was written for the express purpose of insuring victory in the event of appeal, the members of the FPC being quite expert in recognizing the advantages and disadvantages of certain appellate courts.

Many pricing decisions were not based on economic reasoning but were more the result of the individual make-up or characteristics of the several commissioners, the result was decided by amount of preparation done by an interested commissioner, or sometimes, the result was dictated by a particularly smooth oral argument. It is apparent that a course in regulatory pricing should include a section on group executive decision making. If the commissioners were to resort to pure economic logic in their oral discussions as to the proper rate of return, the commission staff would not eagerly look forward to the weekly commission meetings as they do. They often said that it was one of the best acts in Washington.

Now that I have confessed, let me assure the reader, however, that I am not advocating giving up teaching courses in the economics of utility pricing. To the extent that the universities seek to expose the tendency of commissions to cover up and to the extent that "bodies" are discovered, much good is done. Furthermore, commissioners are fair game to the one who can carry away with the argument that monopoly profits are no longer possible or probable or that the profits are not really excessive, and say "let's forget the whole thing." There is more to regulation than merely overseeing the reasonableness of profit levels. The public looks to the regulators and wants to know first of all why they have not or cannot get as good and as good service as they want and would be willing to pay for. The public knows that they cannot adequately assess the reasonableness of the utility's explanation, but they expect the so-called expert staff and commissioners to do so. They also expect the commissioner to use the whole arsenal of weapons necessary to assure adequate service.

With that caveat, I would like to discuss several matters involving regulatory pricing which are receiving considerable attention these days.

In my former position as state commissioner, it was almost impossible to keep up to date with the academicians who theoretically could advise a green but willing regulator how not to destroy the public utility industry. There were few economists at that time who had even given it much thought other than those seeking to justify the exemption of natural gas producers. I tried, however, and was given the additional task of acting as the agent of the state to seek interstate wholesale electric power sources for the state, essentially New York Power Authority power. I soon learned a quick lesson in economics. When the seller is a large public power authority, not subject to state regulation and somewhat contemptuous of federal regulation and is the only available supplier, a small buyer needs help and plenty of it. You can almost predict a regulator’s performance by determining whether he has been on the buying side more often than on the selling side. Frankly, I went running for help to the Federal Power Commission and was told, “Don’t come to see us; we have all we can do to try and comply with the Phillips mandate.” In fact, I was told there was no such thing as an interstate wholesale power rate staff. Thus, I soon became acquainted with economies of scale together with the terms “firm,” “secondary,” “secondary firm,” and “interruptible.” At least I was acquainted enough to be able to talk the right language when I was appointed to the Federal Power Commission.

There I had the benefit of the Office of Economics, but that does not do much good if the commissioners do not understand the language or if the legal staff failed to take economics while in college.

I wish I could say during the seven years I was on the Federal Power Commission that economics dictated the results, but that was not the case. From the beginning, I was urging and promoting our own economic office, hoping that the very difficult job of establishing prices and seeking just the right amount of capital spending could be made easier by some intelligent economist. It was a good idea but not too productive. It seemed that even the economists could not agree, or if they did, the commission would not accept it. Or if the economists agreed, and the staff agreed and the commission agreed and the courts agreed, then the industry executives would not understand the situation. The latter would immediately commence a vigorous campaign to see to it that someone with more understandable economic theories would be named as a successor commissioner.

There are two major factors that inhibit greater acceptance of traditional economic reasoning, one of which was particularly apparent in the water resources field. I might add that even in the unregulated industries, traditional economists are having problems. I refer specifically to the failure of both regulated and unregulated industries as well as government to give proper consideration to the deterioration of the environment as a result of their activities. I have been told that it was impossible to quantify such factors. This was a policy area and a political problem that commissioners had to solve. Judgment thus became more embroiled in the already complicated situation.

It also became apparent that as Professor Lewis has said, regulation is essentially negative in character. The commission was constantly saying “no” but generally seemed to lack the tools to do more. Being essentially an activist at heart, and drawing upon my experience as a state commissioner, and the Federal Power Act and Natural Gas Act as sources of power, I was more than willing to join my cohorts (usually two, seldom three, and rarely four) in seeking new ways to rectify this error. For example, it seemed clear to some of us that there were serious problems about whether the power industry was exploiting economies of scale and technological progress. There was an associated problem which caused concern, seemingly contradictory but not so, namely that in many cases utilities were carrying excessive reserves. As a result of our intuition, expertise, knowledge of the industry, what have you; in any event, it was decided to launch the power survey, in reality an economic and technical base from which to move. The results of the survey gave an economic foundation or underpinning to related moves which were to be made under Section 202 of the Power Act. It is true that additional legislation is desired and needed, e.g., the Reliability Act or the Aiken-Kennedy Act on which hearings were held in 1968, but Section 202 did give the commission some leverage.

The Shrewsbury, Crisp County, Gainesville and other cases were instances in which, right or wrong, the commission sought to achieve a measure of utility performance which would secure the optimum use of resources for the benefit of the general public. The commission was able to secure a broader interpretation of what constitutes a public utility since all efforts would be in vain without being able to regulate substantially all those companies affecting interstate commerce. Jurisdiction over pumped storage projects was also secured. With all this, we really did not need more at the time but we got it, or the industry did. That is the blackout. Another major blackout and all the rules will change. To those who say regulation is not necessary and that there exists sufficient interfuel competition, carefully study the electric industry's performance over the last fifty years and judge whether its showing in seeking economies of scale in both transmission and generation, and the necessity to be prodded in the field of research and development, are not the characteristics of the typical monopolist.

The same problem presents itself in the natural gas transmission field. The Federal Power Commission has now zeroed in on the economies possible in offshore transportation. This is not the first instance of the commission's concern with cross haul and duplication of facilities. However, I wish the staff and the commission could have been a little more concerned about duplicating lines leading from the Delaware Basin north. In Northern Natural Gas Company, Opinion 519, issued March 30, 1967, I said:

There comes a time when it is no longer advantageous to the public to permit individual parties to use or condemn land without consideration of more economic and socially desirable alternatives. For the electric industry, the Scenic Hudson case, with its emphasis on transmission line routing and alternative sources of power, marked the timeliness of a complete approach, including all reasonable alternatives, in considering the licensing of projects in the public interest.

The same approach is now equally applicable to the gas pipeline industry, particularly in the certificate area.

Chairman Lee White's comments regarding the possible advantages and the staff's initiative in making the offshore study illustrates the absolute necessity of regulation using every possible measure of influencing utility behavior. Speeches, comments, and staff studies all have the merit of not necessarily being a case of negative regulation. On the contrary, they represent an attempt to supplement the commission's pricing power in a manner designed to accomplish some of the objectives of proper competitive pricing. Mere price-fixing by itself is by no means sufficient if regulation is to seek to effectively duplicate workable competition.

In addition to using such powers as Section 202 of the Power Act, for example, and surveys and independent staff studies, a regulatory commission has a further tool to be judiciously used, namely controlling the entry of additional members to the club in order to let new pipelines compete for what traditionally has been a protected market. It even has the authority under Section 7(a) sua sponte to encourage otherwise unenthusiastic utilities to compete with each other. Regulators, like industry executives, pay great lip service to competition. It is extolled until someone is pinched. (See the series of cases involving new competition in Cincinnati and Washington, D.C.) The commission has embarked upon a delib- erate program of increasing competition at the city gate and in my mind, this could be as effective as rigorous price-fixing. However, the commission should not capitulate under pressure. If industry really is as interested in paying homage to the competitive system, they should welcome this opportunity to show that they can transport gas more efficiently than the neighboring pipeline.

Often one gets the impression that regulation is supposed to protect not challenge industry. I cannot help but be reminded of the discussion regarding marginal pricing. As Shepherd says, it is not necessarily because someone has "read Hotelling, Oort & Nelson" but usually because of practical reasons that the issue of marginal pricing arises. For example, I spoke to the Legal Seminar at the American Public Power Association regarding marginal pricing and used the language I did in the decision re Southwestern Public Service because of practical reasons. I felt that marginal pricing, recognizing the difficulty of application in a decreasing cost industry, would again lead to the most efficient use of resources by encouraging larger, more efficient units. It seemed to me that certain segments of the industry were willing to go to large units provided the right members of the club were the purchasers. Some industry executives, however, seemed motivated by the desire to capture

there are attempts to muzzle them.

The most challenging job, and the one which should be the easiest to find help from economists, is the task of determining the proper level of investment in capacity. To hear the industry’s complaints, one would think that the only problem was that of the vanishing rate base. This immediately makes one suspicious and the regulator is convinced that Averch and Johnson were correct. The average commissioner knows of a number of instances where it seems obvious to him that gold plating was the theme of the day and that unnecessary facilities were being constructed. In fact, as the interest rates started to escalate, I encouraged our economics office to try and determine whether the higher rates operated as a constraint and served to force a more efficient use of capacity. I was told it was impossible; but certainly this ought to be an area for study.

There is another area where the industry’s investment pattern is suspect. Storage versus an increase in transmission capacity raises questions as to whether the commission’s or the industry’s pricing policy is working. To the best of my knowledge, there is no definite answer. In view of the fact that the Atlantic Seaboard formula is embedded in the problem, there probably will be no answer. I used to think the commission was eventually going to face-up to it. For example, in the United Case, Opinion 430, June 2, 1964, I said:

This was to be the case—finally—when the Commission in all due solemnity, would perform the last rites for the Atlantic Seaboard “formula.”

But the condemned method, whose obituary was heralded in Southern Natural (Op. No. 379) has miraculously survived to officiate at what was to be its own funeral—to the surprise of all including the intended executioner.

Inertia, the natural instinct to defend an established policy, the fear of upsetting established pricing practices, and the easy rationalization that it would prove better for the household user now points to the fact that logical as it may seem, it will never come to pass. Perhaps if the commissioners could be forced to spend time figuring out the issue, or if the academic profession could convince them that they should attempt to arrive at a more rational procedure, there might be progress. I am only saying there has to be some incentive for a public officer to act as a rational conservator of resources when these resources are scarce.1

The Federal Power Commission is in an excellent position to experiment with producer regulation, without the necessity of caving in completely. For example, setting the price of natural gas at the wellhead is not a particularly easy task. Since the country has been divided into areas, there has been one area in which there is a conspicuous amount of inactivity, namely the Appalachian area. Why not free that area and let the price find its own level? It will be operating under the influence of existing area prices, but let the economist predict now what the price would be to see how accurate they are. It is not such a large area that it could do much harm, and it is an area where there is more chance for competition between producers. It is operating near the market and could serve as a constraint upon excessive capital spending for transmission lines. It would be interesting to know whether and to what extent price would be an incentive for additional drilling.

Although regulatory pricing, with all its innuendoes, is a subject which could be discussed at length, let me conclude simply by saying that it is my earnest desire that the economics profession must pay greater heed to the job that regulation is doing. With the growing concentration in industry, together with the increasing importance of the federal government, the public is ripe for exploitation. Utilities have always been a popular target and in many cases, rightly so. Give the public the best advice as to whether regulation is doing the job or how it can do it better. We might be forced to give up regulation only to have it turn up under a different name. If regulation is truly no longer necessary, then it is again the economists' job to see to it that competition is truly effective. There can be no holding back on antitrust enforcement. There can be no partial relief for the inefficient producer who seeks relief in Congress from the blows incurred by his competitors, domestic or foreign. Economists must do their job well as the guardians of our economic system. This means they may have to get their feet wet; and that they in turn may be accused of being a politician or lose some good consulting jobs or the prestige of government contracts or employment. It could even involve the university in life on the outside and serve as a constraint in attracting capital for the next year's building program. This is the economists' choice. I know I got sick and tired of regulating by the seat of my pants and it was not because I did not try. Give my successors something better. But do not expect performance under regulation to be better than what the so-called real world can do.

An Appraisal of Regulatory Pricing Policies in Communications

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I. Introduction

Throughout most of the history of common carrier regulation in the communications industry, explicit regulatory policies directed toward the pricing practices of the industry and its firms have not always been evident. Traditionally, pricing problems have not been at the forefront of Federal Communications Commission activity; even today such issues as the fair rate of return, revenue requirements, and jurisdictional separations standards tend to take precedence over issues raised by particular pricing problems. Under the statewide theory of rate making, state commissions rarely address...

*This paper was delivered at the conference on pricing and regulation held by the Institute of Public Utilities, Michigan State University, on March 25–26, 1969. Mr. Cox was then a member of the Federal Communications Commission and the views expressed in this article reflect his position at that time.
problems relating to the specific pricing practices of the communications common carriers. It is only within the last decade that the FCC has found it necessary, on an increasingly more frequent basis, to examine particular pricing problems. In the past, these regulatory problems have been addressed on an ad hoc basis after the filing of specific complaints alleging that the carrier is charging unreasonable rates or there exists an undue rate discrimination. Although FCC pricing policies have been described in the cases decided from time to time, the problems of selecting appropriate economic measures of cost and demand factors and of obtaining the necessary data to implement these factors have been serious ones. At the present time the FCC is approaching the end of its investigation into the rate making principles and factors that are to be employed in evaluating the rate levels of AT&T's primary interstate service classifications. Once established, it is anticipated that these standards will provide a basis for continuing studies that will enable the commission to rule promptly on future pricing policies that come before it. Before discussing the specific pricing policies of the FCC, I shall outline briefly some broad objectives of regulatory policy which will fix the framework within which any particular set of pricing policies must be applied, and describe the basic policy areas within which the commission influences common carrier pricing practices.

II. Basic Policy Objectives

In fulfilling the regulatory responsibilities of the Communications Act, the FCC must recognize the great social value of rapid communications for all citizens and the necessity of a nationwide communications network that is built upon the coordination of the many suppliers of communications facilities and services. Regulation should encourage a level of industry performance that, when judged by public interest criteria, is superior to that which could be expected in the absence of regulatory intervention. In fulfilling this broad objective, regulatory pricing policies can play an important role in several respects, particularly when the pricing policies are coordinated with policies of the commission in other areas. Regulation necessarily requires the imposition of some restrictions on the actions of the management of communications common carriers and upon the actions of potential competitors and consumers. In recent years the FCC has generally taken the position that the restrictions on the competing suppliers of communications services and upon consumers should be minimized subject to the maintenance of the integrity of the communications system and the efficient supply of communications services. Such an overall policy is designed to promote innovation, encourage the introduction of new technologies, and stimulate the full development of service offerings that meet changing consumer demands.

III. Regulatory Policies Influencing Common Carrier Pricing Practices

FCC policies that influence common carrier pricing practices may be classified in the following broad categories: (a) policy relating to the allocation of the radio frequency spectrum; (b) policy relating to the interconnection and foreign attachment provisions of carriers' tariffs; (c) policy relating to the licensing of communications carriers; and (d) policies relating to specific carrier pricing practices. In implementing the objectives in each of these areas, restrictions on the freedom of activity of communications suppliers or consumers are imposed either by the commission in its policy decisions or by a carrier in its tariff provisions. If regulatory policy is to meet the objective of encouraging the efficient use of the nation's communications resources in serving the public interest in a dynamic economy, it must be subject to continual re-evaluation in light of changing market conditions. Otherwise, the beneficial restrictions of yesterday's technologies serving yesterday's markets may impede the efficient adjustment to change in the regulated industry.

Allocation of the Radio Frequency Spectrum

Although the radio spectrum is not a resource that is generally bought and sold in the open market, it is an immensely valuable resource of considerable scarcity. Restrictions on its use are reflected in the commission's allocation criteria which are intended to bring about an orderly and efficient use of radio frequencies. As a result, the radio frequencies that provide greatest efficiency in the

Kenneth A. Cox
supply of point-to-point service by microwave have been reserved for the communications common carriers.

Within the past decade there have been significant policy developments in the direction of liberalizing the regulatory restrictions on the use of certain portions of the radio frequency spectrum by private microwave users. Commission decisions in 1961 and 1966 provided significant steps toward minimizing regulatory restrictions in the use of private microwave for point-to-point communications systems after due consideration of the development of private systems, the availability of frequencies, the needs of the common carriers, the special needs of users for private systems, and anticipated future developments. The commission's initial significant decision toward the liberalization of its frequency allocation policy for private microwave suppliers created concern on the part of the Bell System about the potential competitive threat from private microwave and was a key factor in prompting Bell to file a pricing response to this potential competition.

Tariff Restrictions on Interconnection and Foreign Attachments

Tariff restrictions on interconnection and foreign attachments have characterized the tariffs of communications common carriers throughout the history of communications. These restrictions have severely limited the options available to both suppliers of communications equipment and consumers, but were deemed necessary by the carriers for the protection of the communications network. Recently, however, the commission has had occasion to examine some of these tariff restrictions and found them to be unduly restrictive. In its decision in the recent Carterfone case, the commission acted to significantly minimize the tariff restrictions on interconnection and foreign attachments. As a result, the opportunities of many suppliers of communications equipment and the options of many communications consumers correspondingly have been expanded. With an anticipated increase in the level of competition in the supply of communications equipment, some prognosticators are already predicting reduced costs for many terminals within the near future. Moreover, the Carterfone decision already appears to have had an influence on Bell's pricing practices. Bell has recently altered its private line tariffs to permit customer sharing of circuits, a tariff change that tends to reduce the cost of communications to private line users while at the same time providing for increased efficiency in the utilization of communications circuits. It is clear that commission policy relating to the carrier's tariff restrictions on interconnection and foreign attachments influences the carrier's pricing practices and so conditions the environment in which regulatory pricing policies must be applied.

 Licensing of Communications Common Carriers

The licensing authority enables the commission to exercise control over the number of firms providing service in particular communications markets and so restricts freedom of entry into those markets. Here, also, some restrictions are necessary to encourage the most efficient conditions of supplying various communications markets. But the extent of the restriction depends upon the conditions under which the market can be supplied efficiently. In some instances, efficiency can be achieved only by a single supplier; in other circumstances, markets can be served most efficiently under conditions of competition. In the future, the commission will be called upon more frequently to determine, in particular cases, whether pre-existing monopoly conditions or competitive market conditions will best serve the public interest.

At the present time the commission has before it an important case relating to conditions of entry that may significantly influence FCC policy in this area for years to come. An application for entry into a domestic interexchange communications market as a special service common carrier has been filed by Microwave Communications, Inc. (MCI), which is seeking to establish point-to-point microwave radio facilities for interstate common carrier communications service between Chicago and St. Louis. MCI proposes to
direct its efforts primarily toward the evolving market for data communications. Although its proposed service offerings differ in several respects from those presently offered by the landline common carriers, MCI would compete most directly with the private line services of the landline carriers.

An application has been filed recently for a similar carrier between New York and Washington. In addition, developments in the CATV field, in data communications and teleprocessing, and in domestic satellites may well require special deliberations by the FCC on the ramifications of alternative regulatory policies toward entry in communications markets and the licensing of communications carriers. And it is certain that whatever steps, if any, the commission takes to increase opportunities for entry into communications markets, the policies adopted will influence the pricing practices of the carriers and require timely and effective regulatory pricing policies.

*Regulatory Pricing Policies*

Regulatory pricing policies generally relate to restrictions that may be classified into two categories: (1) those imposed by the commission on the pricing practices of the carriers; and (2) those imposed upon the consumers by a carrier in its tariffs. The commission has the regulatory responsibility of insuring that rates are reasonable and not unduly discriminatory. Thus, it is concerned about the problem of interservice subsidy where one class of users may be paying unduly high rates so that another class of users may obtain unduly low rates. In this situation the carrier could adopt a policy of pricing below cost in competitive markets and substantially above cost in monopoly markets. This could provide it with an overwhelming competitive advantage in the competitive market and foreclose competitors in markets where the competition would, perhaps, be more efficient. In addition, the commission must ad-

*Editor's note: For the subsequent FCC decision, see Microwave Communications, Inc., 18 FCC 2d 933 (1969), aff'd 21 FCC 2d 190, under appeal sub nom American Telephone & Telegraph Company v. FCC, Cases Nos. 23959 and 23962, CADC.

dress any specific discriminations, preferences, or restrictions that may exist in the tariffs for the carriers' various service offerings.

In essence, regulatory policy must restrict the carrier from using monopolistic pricing practices that violate the public interest objectives of regulation.

At the present time, the commission is involved with pricing problems relating to both tariff structures for specific services and possible subsidy of one service category by another. The most complex investigation of a common carrier undertaken by the commission is currently in process.** The current phase involves the rate making principles and factors that the commission should employ as standards for determining whether there is any interservice subsidy. This current phase, in part, as a result of our investigation into the domestic telegraph industry5 wherein the Bell System, at the insistence of the commission, provided for the first time a fully distributed cost study of the various classifications of services involving its total interstate investment. The results of the study indicated that the Bell System had been pricing substantially below cost in markets where potential competition exists and substantially above cost for its monopoly services. This is of particular concern not only to the FCC but also to Western Union, whose survivability may hang in the balance.

When the significant interrelationships among the four basic regulatory policy areas are recognized, regulatory pricing policy takes on added importance. The effective implementation of commission policy in the areas of frequency allocation, interconnection, and licensing requires effective regulatory policies over carrier pricing practices. Otherwise, the pricing practices adopted by the carrier may blunt the effectiveness of commission policy in these other areas.

4. In the Matter of American Telephone and Telegraph Company and the Associated Bell System Companies, Charges for Interstate and Foreign Communications Service, Docket No. 16258. For the decision in the first phase of this case, see 9 FCC 2d 30 (1967).

*Editor's note: For the subsequent FCC decision, see American Telephone and Telegraph Co. and the Associated Bell System Companies Charges for Interstate & Foreign Communication Service, Docket No. 16258 (FCC, July 29, 1969).

5. Domestic Telegraph Investigation, Docket No. 14650.
It was the Bell System’s pricing response to a particular policy decision of the commission relating to radio frequency allocations that prompted Western Union and Motorola to file objections with the commission, and led the commission, in turn, to examine Bell’s pricing practices and its own regulatory pricing policies.

IV. FCC Pricing Policies

Framework of the Pricing Problem

The interrelation between the areas of the commission’s concern can perhaps best be illustrated by outlining the series of developments that has taken place over the last decade in the FCC’s approach to regulatory policies. Since 1949, the FCC has licensed private microwave systems for the purpose of supplying specific communications requirements that could not be met by the service offerings of the communications common carriers. Licenses were granted so that communications by microwave could be provided in remote areas that were not served by the common carriers or to provide the control of communication systems that is necessary to meet the safety requirements of right-of-way companies such as pipe lines, railroads, and electric and gas utilities.

In 1966, the FCC instituted a proceeding as to the allocation of radio frequencies in the bands above 890 megacycles. The commission reviewed its frequency allocation policy with a view to permitting expanded use of these frequencies because developments indicated that certain restrictions on the use of a portion of the radio frequency spectrum could be relaxed somewhat without creating congestion problems, while at the same time permitting the satisfaction of communications demands that were impeded by existing frequency restrictions. The common carriers opposed any liberalization of the frequency allocation provisions, claiming that they were fulfilling all communications needs and that an expansion of private microwave development would not be in the interest of an efficient communications system. On the other hand, potential users of private microwave systems, as well as the manufacturers of microwave equipment, argued that there was an unfulfilled need for private microwave communications.

After extensive proceedings the commission found that there were definite communications needs that could be best served by private point-to-point microwave systems, and that provision for expanded eligibility would provide for more effective frequency utilization. Hence, it established a policy that both liberalized industrial eligibility requirements and permitted private microwave sharing in the frequencies above 890 megacycles by government agencies, right-of-way companies, and other regulated entities. Moreover, the decision emphasized that the commission would not consider the availability of common carrier facilities as a condition of eligibility for private users. This 1969 commission decision observed, however, that the impact of this development upon the existing common carriers was not expected to be significant because: (1) common carrier costs should be much lower than the cost of private microwave; (2) common carriers provide communications service availability on a nationwide basis while private microwave systems cannot; and (3) common carrier restrictions on interconnection would provide a severe restriction on the development of private microwave. The commission viewed the limited extension of the opportunity to use private microwave as a small step in the direction of liberalizing the restrictions on the use of frequencies above 890 megacycles that would increase the efficiency of using radio frequency resources and afford a competitive spur in the manufacturing of equipment and in the development of the communications art. Moreover, it viewed the imposed limitations relating to the sharing of private systems as possibly a first step looking toward even fewer restrictions. The commission noted in its decision:

First, the number of cases involved in this [sharing] limitation appears to be sufficiently reasonable to afford us a good basis upon which to make meaningful observations as to the desirability and impact of such arrangements. Second, it is evident that any economic benefits flowing out of such arrangements will assuredly flow directly back to the public, either as taxpayer or ratepayers, for good use.

After observing private microwave development and its impact upon consumer needs, the development of common carrier services, and the utilization of available frequencies, the commission followed up its Above 890 decision seven years later, in 1966, by expanding

6. 27 FCC 359, 408.
the sharing privilege above 10,000 megacycles to include virtually unlimited sharing of private systems.

According to the Bell System, it was the threat of potential competition raised by the commission's Above 890 decision that prompted the carrier to drastically alter its private line tariff structure. It is interesting to note that the apparent potential competition of private microwave prompted a pricing response on the part of the Bell System that far overshadowed any price changes resulting from competition between Bell and Western Union or any other communications common carrier.

Bell's response was the creation of a separate category of private line service known as TELPAK, which was designed to meet the potential competition of private microwave by providing extremely large quantity discounts for "bulk" communications purchases of private line service. In essence, TELPAK provides these substantial discounts for the purchase of packages of circuits between two points rather than the purchase of the private lines as individual circuits. Inasmuch as TELPAK provides for the grouping of circuits for pricing purposes only and not for the actual provision of service, it is in essence a means of discriminating in charges among the users of private line service.

Bell's TELPAK tariff was designed to match the cost characteristics of private microwave systems. However, the most important aspect of the tariff was the tremendous reduction in charges that was provided. TELPAK was structured into four subclasses. TELPAK A involved the purchase of 12 voice-grade circuits at charges that reflected reductions of more than 50 percent from the charges for an equivalent number of individual private line circuits. TELPAK B provided for the purchase of 24 circuits with reductions in charges on the order of 64 percent from the ordinary private line tariff. TELPAK C permitted the purchase of 60 circuits at reductions in charges on the order of 77 percent; and TELPAK D involved the purchase of 240 circuits with reductions in charges on the order of 86 percent.

The ability of any communications user to realize the benefits of the lower charges from TELPAK depends significantly on his ability to group his private line circuit requirements with those of others and so obtain a bulk purchase that is shared by several users.

However, the right to share under the TELPAK tariff was restricted by AT&T to those users who had the right to share private microwave systems as a result of the FCC's Above 890 frequency allocation decision.

As a result of the creation of TELPAK, a portion of the total market for private line communications was reclassified in the new TELPAK service category. Perhaps the most significant effect of the TELPAK tariff offering was felt by Western Union. In addition to providing greatly reduced charges for purchases of base capacity quantities of private line circuits, the TELPAK tariff structure created an overwhelming incentive for private line users to purchase all of their communications requirements from a single common carrier. Since nearly every consumer of private line communications requires private line telephone service, it was inevitable that virtually all private line purchases that met the conditions of the TELPAK tariff would be purchased from the Bell System. Although Western Union filed a TELPAK tariff that matched Bell's tariff, it brought the company little, if any, TELPAK business. Further, to the extent that TELPAK was priced below the competitive alternative of private microwave, the commission policy of expanding private microwave development was thwarted.

Both Western Union and Motorola filed objections with the commission during August 1961 requesting suspension and investigation into the lawfulness of the TELPAK tariff. The commission instituted an investigation of the TELPAK tariff on September 7, 1961.

Guidelines for Pricing Policy

The general regulatory pricing policy that the FCC applied in its TELPAK decision was a policy that has been generally applied by many regulatory agencies. Since TELPAK was a pricing response to competition that Bell attempted to justify on the basis of "competitive necessity," the commission charged Bell with the responsibility of demonstrating that the proposed greatly reduced private line

7. 38 FCC at 379.

8. The number of voice-grade circuits in a particular TELPAK category: 12, 24, 60, and 240 for TELPAK's A, B, C, and D respectively. Under the TELPAK tariff, it may be economical to purchase a base capacity even though the customer can only use a portion of that capacity.
charges under the TELPAK tariff were compensatory in relation to the cost of furnishing TELPAK, and that users of AT&T’s other services would benefit and not be burdened by the application of the reduced charges under the TELPAK tariff. As general principles for guiding regulatory policy, these criteria are sound. They are intended to prevent the subsidization of one service by another and the supply of non-compensatory service that does not have special commission approval. But they are not intended to prevent the carrier from offering service that is compensatory and for which the carrier is the most efficient supplier. The difficulties lie not so much in the general criteria that form the guideline to regulatory policy but in the implementation of the guidelines—the facts and measurements that ultimately determine the disposition of specific cases. Hence, effective regulatory policy requires adequate information on which a commission can implement its pricing guidelines. And when a carrier proposes to discriminate in its pricing practices, the burden of proof clearly lies with the carrier.

In the TELPAK case the commission found the services furnished under the TELPAK tariff and those furnished under other private line tariffs to be “like” communications services. TELPAK did not change the characteristics of the service offerings, but only the charges to those who could obtain private line service under the TELPAK tariff. The commission also concluded that there were no significant cost differences attributable to furnishing a number of channels to one customer under TELPAK as opposed to furnishing the same number of channels to several customers under the other private line tariffs. It was also concluded that there was no justification for the TELPAK A and B categories in terms of competitive necessity inasmuch as the record showed that the rates for the equivalent number of channels offered under ordinary private line tariffs were reasonably competitive with the costs of private microwave systems.

With respect to the TELPAK C and D categories, it was concluded that there was “apparent justification” in terms of meeting competition from private microwave systems having channel capacities comparable to those offered under these TELPAK classifications. However, the commission was unable to determine on the record that the rates for TELPAK C and D were compensatory or that they did not result in a burden being thrown on users of other services. The commission ordered the unlawful discrimination found to exist between the TELPAK A and B classifications, on the one hand, and private lines on the other, to be eliminated, and in addition ordered AT&T to submit for the record additional cost data that would enable the commission to determine whether or not the rates for TELPAK C and D were compensatory. I found it necessary to dissent on two aspects of the TELPAK decision: (1) deferring by nine months the requirement that the unlawful discrimination found to exist with respect to TELPAK A and B be eliminated; and (2) reopening the record for the purpose of receiving further evidence as to whether or not the rates for TELPAK C and D were compensatory.

Having found that a discrimination which had existed for nearly four years was unlawful, sound regulatory practice, in my view, required that the discrimination be terminated forthwith. Regulatory pricing policies that permit such delays create opportunities for the carrier to employ illegally discriminatory pricing practices at the expense of the commission’s own public interest determinations. Had the commission required termination of the discrimination immediately, considerably more incentive would have been provided for the prompt conclusion of the cost studies and the rate adjustments that might have been indicated. With regard to the TELPAK C and D classifications, the fact that the commission was unable to find on the basis of the record that these reduced charges were compensatory was certainly not the fault of the commission. Rather, the interested parties had failed to sustain the burden of proof when given ample opportunity to establish their case. If preferences and discriminations cannot be justified, they should not be permitted to continue while the parties attempt to correct deficiencies in their proof. In this instance, the commission permitted continued favored treatment for certain large users to the presumed disadvantage of their smaller business competitors, of the other users of facilities and services of AT&T, of the competing carrier Western Union, and of those concerns interested in providing private microwave equipment in competition with the common carriers. To this day, the commission has still been unable to reach a decision as to whether or not these TELPAK service classifications are compensatory and whether or not they are a burden on users of other services. Hopefully, a decision will be reached on this issue in the investigation of AT&T that is now underway. But it must be emphasized that the TELPAK discrimination has been in existence
for more than eight years and remains unjustified. I find fault here not with the criteria by which the commission attempted to judge the proposed rates, but rather with the regulatory practice of permitting the carrier an inordinate amount of time to gather information upon which to attempt to justify the discrimination.

The lesson of the TELPAK experience for regulatory pricing policies is one that nearly all regulatory commissions have experienced many times. It represents, perhaps, the most significant problem tending to thwart the implementation of effective regulatory pricing policies. In my dissent to portions of the TELPAK decision, adopted in December 1964, I expressed my concern as follows:

I discern a very disturbing pattern in connection with all the bulk rate tariffs which have been filed in recent years. AT&T offers new services which are very attractive to large users of communications. Protests are filed by competitors who claim that the tariffs are discriminatory and will result in damage to their business. The Commission suspends the tariffs, but they go into effect at the end of the statutory 90-day period. Customers are attracted and come to rely on these services. If and when, months later, we find the tariffs to be unlawful, we are besieged by users complaining that it would be unfair to withdraw the benefits they have come to value. Some of these users are very substantial concerns whose operations no one would wish to disrupt. And where does this leave the Federal Communications Commission and the public it is charged to protect? In a very difficult position, to say the least. I think we can reverse this trend only by expediting our proceedings in such cases as much as possible, and then effectuating our conclusions at once.7

The FCC has taken significant strides toward the reversal of this situation over the last four years. The thorough and far-reaching investigation into the rate making principles and factors that will be used by the commission for evaluating carrier pricing proposals will evolve a set of workable, implementable rate making standards. These standards will establish a framework of analysis that should facilitate problems of information gathering, carrier justification, and commission examination in such a manner that the regulatory process will be expedited and the quality of commission decisions will be improved. In addition, within the past few years the Common Carrier Bureau has been able to expand its in-house capability for examining pricing problems and hopes to be able to maintain continuing analyses of important rate making problems. Further,

steps are being taken to establish an increased level of interaction between commission staff and carrier personnel on technical matters relating to such problems as the methodologies of measuring the cost and demand characteristics of communications services, so that periodic studies important to the solution of pricing problems will be undertaken and continually updated as part of the commission's normal information base.

The commission is working toward a regulatory environment in which the carrier would be able to file its full cost and demand justification with its proposed tariff changes. The commission would be able to expedite proceedings, and regulatory decisions would be effectuated promptly. In such an environment, commission policies and practices relating to pricing problems will not provide incentive for the carrier to use unlawfully discriminatory and preferential rates as a means of restricting efficient and effective competition for extended periods of time.

Relatively recent commission decisions reducing restrictions on the use of the radio frequency spectrum for private microwave and on the requirements for interconnection will tend to make commission policy relating to pricing practices, the classification of service offerings, and tariff restrictions more and more important to the development of communications markets. In addition, the commission's inquiry into the interdependence of computer and communications services and facilities10 has disclosed a concern on the part of the computer industry about the pricing policies of the communications common carriers. With demands for data communications expected to mushroom over the next decade, the potential for areas of competition between various portions of the computer-data processing industry and the communications industry becomes significant. In encouraging the efficient development of these markets, the commission will be paying increased attention to its regulatory pricing policies and proposed changes in the tariffs of the carriers.

Conclusions

In conclusion, I would like to emphasize that regulatory pricing policies do not stand in isolation in their treatment by commissions,

9. 37 FCC 1111, 1120.

but must be viewed within a broad framework of policies that includes the areas of frequency allocation, interconnection, and licensing. Policy developments in these areas in recent years by the FCC have generally been in the direction of reducing the restrictions upon the opportunities of suppliers and consumers. This could make the communications industry more responsive to changing conditions of technology and consumer demands—provided that the commission continues its efforts to develop and maintain effective policy guidelines relating to industry pricing problems. These policy guidelines should encourage economic pricing responses on the part of the carriers; at the same time they should prevent the carriers from employing pricing practices that are destructive to competitors or that require monopoly services to subsidize competitive services. The broad standards that the FCC has used to evaluate pricing responses on the part of carriers permit regulatory decisions on pricing problems that are consonant with these objectives.

Effective regulation in the pricing area will require the increased attention of the commission and entail increased responsibilities for the carriers. If the carriers are required to file complete justifications for proposed tariff changes at the time they are made; if the commission maintains a continually updated body of information relating to developing industry and market conditions; and if the commission can establish a program of continued research and analysis on specific pricing problems—then regulatory pricing policies should become truly responsive to the dynamic developments that now characterize the communications industry.

The Atlantic Seaboard Formula and Pipeline Rate Design

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The Federal Power Commission’s pricing policy regarding natural gas pipelines has largely tended to be one of relying on an allocation of full cost of service utilizing an inflexible classification of costs as a basis for rate design with departures from rates based on classified costs only under special circumstances. For many years, the allocation relied on was, and may turn out to still be, the so-called Atlantic Seaboard formula.

Thus, rates based on a mathematical translation of fully classified and allocated costs have tended to become embedded as just and reasonable rates and the burden of other proposed pricing approaches has been placed on those who would depart therefrom, with the Seaboard formula as the basis for measuring proposed deviations.

This is not to say that the industry has been necessarily limited in the rate forms it has been able to utilize as opposed to the design of specific rates. For example, there are two-part rates with various
combinations of features, volumetric rates, off-peak rates, special peaking service, and winter season rates.

What is meant, however, is that rates have generally been approved and their reasonableness tested in later proceedings based on the results of an allocation of the pipelines’ full cost of service. The most common exception has probably been the various winter service and storage service rates. Even here, the exception is one only of degree since these rates are generally based on a full allocation of certain segregated facilities and costs.

Since the Seaboard formula has played such a large part in rate design since the early 1960s, it may be worthwhile to briefly review it. The formula involves for an assignment of costs to functions, such as transmission, storage, and so forth, and then a classification between demand costs and commodity costs. Commodity costs include variable costs and differing portions of the fixed costs of the system depending on the particular functional grouping under consideration. Demand costs are the balance of the fixed costs. The definition of demand costs and commodity costs has been inflexible. As to the fixed plant costs of transmission and storage, these are classified equally between demand and commodity and the equivalent production and gathering function costs are classified entirely as commodity. Fixed operating costs, with some exceptions, follow the same classification as the plant costs.

The basic concept underlying the adoption of the Seaboard formula was the belief that customers (and, specifically, non-jurisdictional customers) making use of a pipeline system during off-peak periods should not bear the responsibility for charging in the fixed costs of that system, which would occur if all such costs were allocated on the basis of coincidental peak demands.

This concept can be recognized in one of two ways. First, the peak responsibility method of allocation, which had been used extensively in the industry for allocation of fixed costs, could have been modified or abandoned. Second, the commission could have modified the classification of the fixed costs. It chose the latter approach. The first step in this direction was actually taken in a Colorado Interstate case in 1943 (3 FPC 32) as to return and income taxes, and extended to other transmission fixed costs in Mississippi River Fuel et al. (4 FPC 340).

A necessary premise of the formula is the functionalization of the total system, i.e., separating a pipeline into various components: transmission function, production and gathering function, and so forth. The rationale for this is that certain facilities and functions serve certain uses. For example, transmission fixed costs are classified equally between demand and commodity because the transmission system not only delivers gas all year around, but must also be capable of delivering peak demands. On the other hand, a pipeline’s production activities have been considered to be for the purpose of furnishing annual quantities of gas with no appreciably greater quantities forthcoming during peak periods, and the costs thereof have consequently all been classified as commodity.

Another belief that could be considered to underlie the formula is that it involves the assignment of fixed costs to customers who make more intensive use of a pipeline’s facilities should pay more of the fixed costs of that system. Obviously, as fixed costs are shifted to the commodity component and a volumetric allocation and away from a peak responsibility allocation, a shifting of costs from low load factor to high load factor customers takes place. While it may be debatable whether or not this thought initially was part of the Seaboard formula rationale, it was expressed with approval in an El Paso case decided in August 1959 and has been the subject of much controversy over the years.

The major area of controversy, however, that has been generated by the use of the Seaboard formula for rate design has been the problem of interruptible industrial sales, both direct and indirect, and this directly involves commodity costs and the commodity component of the usual two-part rate form. Direct industrial customers are, of course, affected by the allocation of costs to non-jurisdictional sales and indirect customers by the translation of commodity costs into a commodity rate. In the Colorado Interstate case mentioned previously, with reference to the question of allocating some fixed costs to interruptible customers, the Supreme Court said in 1945 that to do otherwise “the industrial customer would obtain to some extent free transportation of gas.” It is this “free ride” language that has been cited many times by the FPC in justification of its Atlantic Seaboard formula. It is interesting to note that no attempt has been made to measure the propriety of the magnitude of the fixed cost assignment to commodity, other than in terms of considerations of equity and fairness. Unfortunately, this problem of interruptible sales has become more acute over the years since the Seaboard formula was first adopted,
due in large part to the substantial increase in the field price of gas. This has resulted in the contention that Seaboard tends to price gas out of off-peak markets even though a lower rate may be readily justified by an incremental approach.

Perhaps the best explanation of the commission’s views on Seaboard was in an American Louisiana-Michigan-Wisconsin case decided in May 1963 (29 FPC 932). In this case, it was stated that classification of costs “... has the primary objective of assuring that off-peak sales bear a fair share of the pipelines’ constant costs which would otherwise inequitably burden the domestic consumer.” Further, “Seaboard classification of costs protects the domestic consumer from excessive fixed costs, affords the commission a fair and definite point of reference in regulating pipeline rates, and provides the pipeline a known and consistent standard for developing their rates and markets.”

Because of the commodity rate and cost problem, it is not surprising, therefore, that rate design cases, subsequent to Seaboard can largely be expressed in terms of “tilt,” i.e., the shift of some fixed costs back from commodity to demand. The one common element has been the effect of competition, with the commission willing to lower the commodity rate where it was felt that the company, or its customers, had made a sufficient showing that this was necessary to meet competition. The commission’s thinking was probably well put in a Michigan-Wisconsin rate proceeding decided in September 1959 (22 FPC 605). The commission stated “... it would appear to be in the public interest, generally, for distributor companies to make off-peak and interruptible sales.” In this same case, the commission pointed out that such sales could operate to reduce the distributors’ cost of service for space heating customers in state cases.

In some instances, the commodity level, rather than being influenced by competition with other fuels, was influenced by the commodity level of a competing fuel. In an October 1962, decision in a Natural Gas Pipeline Co. proceeding (28 FPC 731), the commission authorized a deviation from Seaboard because of competition with Midwestern Gas Transmission and the potential shift of volumes to Midwestern if Natural’s commodity rate was set at the mathematical Seaboard level. Reference was also made to the potential loss of sales to coal and to the possibility that loss of interruptible sales might throw fixed costs on the distributors’ firm customers.

The criticisms leveled against the Seaboard formula and the increasing competitive problems appear to have culminated in commission statements in Opinion No. 379, (February 1963) Southern Natural Gas Company, and Opinion No. 430, (June 1964) United Fuel Gas Company et al. (31 FPC 1342), that the formula classified too much of a pipeline’s cost of service as commodity costs, and that other formulas might be appropriate. In Southern Natural, the commission was unwilling to depart from the formula in any fundamental manner. The commission did authorize a two-part commodity rate with a lower block for use in excess of ten days per month of the CD to help Southern maintain its interruptible markets. Total commodity revenues, however, equated with commodity costs which minimized any shifting of costs to load factor firm customers.

In the United Fuel Gas and Atlantic Seaboard proceeding, the commission appeared to wash its hands of the Seaboard formula. After dealing with interruptible sales, it went further and indicated that Seaboard formula rates assessed too much of the cost of unused capacity against high load factor customers and did not adequately encourage storage development and peak shaving. Finally, the commission requested the industry to come up with its own allocation formula and not leave the matter up to the staff. Subsequently, by a decision in September 1965, commissioning Midwestern and Natural Gas Pipeline (34 FPC 973), when no new formula had been forthcoming, the commission stated “until alternative methods of rate design are devised to overcome Seaboard infirmities, we will continue to look to the formula as at least a starting point while we continue to search for a better method.”

In response to the commission’s invitation in United Fuel, the commission staff undertook the search for a better method. The problem, of course, is in developing a formula for allocating a full cost of service that can be applied in a reasonably relevant manner to companies with differing operating characteristics. The magnitude of the problem is further enhanced by the fact that any such formula will tend to become embedded as a basis for rate design in the same manner as did the Seaboard formula even without a conscious decision on the commission’s part to so use it. The first staff
attempt, called the relative use method, introduced a third factor, the non-coincident peak, into the allocation procedure, along with the coincidental peak and annual sales. The non-coincident peak was adjusted to give credit to interruptible customers for their non-preferential use of the system. The three factors were averaged and such averages were generally applied to fixed costs. This formula was soon abandoned, two major reasons evidently being the lack of actual non-coincident peak data and the difficulty of determining the proper credit to the non-coincident peak when interruptible sales were involved.

The staff subsequently developed and is now using what is known as an actual-use method. The actual-use method also involves a three-part classification and allocation. Substituted, however, for the non-coincident peak have been the heating season volumes. The rationale appears to be that certain costs are incurred as a result of seasonal fluctuations in sales and such costs should be recognized in a classification and allocation procedure.

As first introduced in an Atlantic Seaboard proceeding (June 1966) (RP65-49 et al.), the actual-use method took the following form:

The fixed costs of transmission and production and gathering were classified 25 percent to the system peak, 25 percent to the heating season, and 50 percent to annual sales.

The fixed costs of storage and demand costs paid pipeline suppliers were classified equally between peak and seasonal.

Variable storage costs were classified as seasonal; all other variable costs were classified as annual.

This method has been applied by the staff with various modifications in numerous cases since then; it has not, however, been the subject of a commission decision in a contested proceeding.

Insofar as the problem of loading the commodity rate with too many costs is concerned, it will be seen that the major change initiated by the actual-use formula is in the production and gathering and storage functions. Those companies which have little or no production and/or storage, or whose storage is dedicated to service under specific rate schedules, will find small comfort from substituting the actual-use formula for the Atlantic Seaboard formula. In fact, more fixed costs may be allocated to direct interruptible customers, chiefly because of the shifting of 25 percent of fixed transmission costs from peak to seasonal. Insofar as indirect interruptible customers are concerned, the prospect is not so clear. If such costs are recovered in part through the commodity rate, such rate may very well be higher than under the Seaboard formula, depending again on the individual company’s situation vis-à-vis storage and production. Or, if a seasonal charge is included in the rate to correspond with the three-part classification and allocation, a greater assignment of costs to indirect interruptible customers may result than under Seaboard.

Further, if the actual-use formula is translated directly into three-part rates, the resulting demand rates will, in many cases, represent a radical departure from historical demand rate levels and may be so low as to have a serious impact on the feasibility of present and future peak shaving installations of purchasing companies. However, a direct translation of classified costs into a three-part rate has not, to my knowledge, been proposed for, or by, any company presently operating under a standard two-part rate.

Certain considerations should be kept in mind in dealing with the advisability of an industry-wide formula for rate design and allocation.

First, no single inflexible formula for classifying and allocating costs and designing rates can be appropriate for all companies or for any given company at different points in time.

Second, any procedure which purports to apportion common costs is inherently arbitrary and reflects conclusions of policy and/or equity and must be recognized as such rather than treated as an actual cost finding.

Third, other costing principles should be considered.

Fourth, an allocation of full costs does not give consideration to value of service, or to competitive problems.

Cost classification is a necessary first step, but costs should be classified between those directly assignable and those which are common. For all practical purposes, this is a fixed-variable classification. Classifications such as demand-commodity only hide the true nature of costs and result in allocations that are not meaningful. Further, from a cost standpoint, a rate should (a) cover the costs directly assignable thereto (the marginal costs which may, or may not, be the variable costs), and (b) make as substantial a contribution to the common costs as factors, such as competition and
historical rate design, would justify, and it would seem that the crucial rate, at least for the short term, will continue to be the commodity rate, where competitive pressures are the greatest.

Finally, it should be kept in mind that the design of rates is essentially a matter of informed judgment and encompasses many considerations outside the scope of cost allocation.

Comment

Harold J. Barnett
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What I find most interesting about these papers are the sharply contrasting views expressed by Messrs. Ross and Little on the one hand and Commissioner Cox on the other. I'll first explore these, and then offer a few comments of my own.

An essential part of Little's contribution is the finding that regulatory policy in the gas transmission industry places these utilities in a straitjacket. Detailed accounting blueprints and pricing formulae have been developed for the industry as a whole. These have been applied wholesale to the individual companies and operations. The result is that each company has been treated by formula as if it were identical in essential characteristics to every other company and as if it were essentially unchanged through time, with no respect for individual differences or for changing environmental circumstances. In addition to the errors from these premises is the fact that the accounting formulae were arbitrary from the start. The utilities are like the Greek travelers through Eleusis, who stopped at the castle of Procrustes. They are individually made to lie in a bed of fixed size, which ultimately they always fit—the giant stretches...
or amputates their limbs as necessary to assure this. In place of flexible price regulation which would provide incentives to utilities to shave costs, and to customers to shave peaks, there are substituted bookkeeping procedures—the substitution of rate for reason. What is needed, Little says, are operational policies and regulatory guidance which have purpose, and therefore have sense and meaning related to purpose; not great, vaulting generalizations, but criteria for intelligent decision making. He also makes some modest suggestions—policies of flexibility, marginal cost pricing, and opportunity for utilities to engage in price competition with other industries.

Ross takes a very different route to the question of regulatory policies for pricing. Many of his reflections relate to the fact that statutes do not closely guide the commissions on operational policies. And further, attitudes toward pricing policies of individual commissioners inevitably tend to vary according to their individual make-ups or characteristics. They go in various directions according to individual instinct and intuition, seeking the public interest or to serve the public welfare. Their progress toward agreed purposes, or use of operational criteria to guide economic decisions and incentives to sharpen them, or employment of the tools of science and economics to give meaning to vague generalities, are perhaps at the rate of glacial drift. What is needed, says Ross, is the construction of operational policies and criteria, so that pricing in regulated industries may rest upon significant purposes and be impelled by substantial means and incentives. He is concerned about policies with respect to such policies the questions of natural resource conservation, scale economies from interconnections, the desirability of competition in utility markets, and experimental efforts to improve our information base.

Thus it is apparent that Ross and Little have an important agreement. Ross is concerned about capricious, erratic, or irrational commissions’ regulatory behavior, and Little is concerned about regulation by bookkeeping recipes. Both deplore the absence of policies intermediate between the extreme of vague or ambiguous generalities and the extreme of accounting rules and ask that progress be made in this middle ground.

Cox’s view of the regulatory world is quite different from the somewhat troubled one of Ross and Little. He believes there are effective, guiding, and operational regulatory policies, some of them at hand and others just around the corner.

Why do we have this wide variance between the Ross and Little views and the Cox views? Why do Ross and Little feel that operational policies in public utility pricing are in poor condition, while Cox appears to be satisfied?

First, it might be answered that this is because gas (and transportation generally) have had pricing structure problems for a long time, while (according to Cox) communications has only had them for the past decade. But I doubt that there were no pricing structure questions in telephone till just recently. They have been there in large number; but they were concealed from the FCC by its restrictive general policies and the short and narrow vision of both the FCC and AT&T. For example, until 1960 the FCC could not have had the pricing structure problems of AT&T relative to private companies because the FCC did not license private companies before 1949, and from 1949 to 1960 licensed them only in non-competitive cases. When in 1960, spectrum availability was liberalized, pricing problems entered, even though as Cox says, "... the impact of this development upon the existing common carriers was not expected to be significant..." by the FCC. It was only after opening frequencies to competitors and after Bell responded that the magnitude of the FCC and AT&T prior errors in failing to provide private circuits in bulk at attractive prices became visible. Bulk private circuits and low prices have now generated economic innovations of great national significance among consumers of such communications services and their customers and suppliers. And the TELPAK and competitors’ discounts and cost data suggest that in at least some cases there had been very major overcharges per circuit authorized by the FCC and levied by Bell, and that there were very important cost reductions possible from new facilities. How could the FCC have expected to know of pricing structure problems if the commission chose neither to look for these nor to permit entrance of competitors?

A second reason to account for Cox’s optimism that all is well is that he apparently views regulatory pricing for communications common carriers as apart or different from that of other public utilities. I suggest, to the contrary, that most of the dilemmas and difficulties which have plagued pricing structures in other utilities are present in one form or another in communications as well, and ultimately will become visible despite AT&T’s pervasive monopoly.
in long-distance communications, if they are not concealed by other policies. Imagine, for example, the many pricing problems which will become visible if the FCC were to come to the conclusion that the present severe foreign attachments restrictions should be greatly relaxed or eliminated; or if telephone companies begin to provide broadband services to CATV firms and individual wire broadcasters at attractive rates and conditions.

The third reason for the difference in the Cox view, as compared to the Ross-Little view, is that Cox finds workable what I would think are vague or too general or ambiguous policies. So far as I can tell these policies could provide operational guidance and criteria in each individual case only by the addition of FCC authority, subjective interpretations, or allocation of the burden of proof. Examples of this appear at a number of places in Cox’s paper. For example:

... guidelines should encourage economic pricing responses on the part of the carriers; at the same time they should prevent the carriers from employing pricing practices that are destructive to competitors. ... The broad standards that the FCC has used to evaluate pricing responses on the part of carriers permit regulatory decisions on pricing problems that are consonant with these objectives.

I would prefer more objective statements, in which definitions are clearer and specific purposes and specific avenues for their achievement have been spelled out.

One final comment on the essential difference between the Ross and Little papers and the Cox one. In Ross and Little, one gets the impression that the function of the regulatory authority is to provide incentive to the firms and elementary protection to the public, but not to manage the utilities. In the Cox paper, a different picture emerges. There are words relating to freedom and economic advance. But they are then virtually emasculated. Cox sees innovation as a predictable, orderly process, and competition as a gentlemanly one, with no one getting hurt, or even disturbed. These are not the economist’s views of the process whereby the marketplace

enforces efficiency, provides alert response to consumer demands, and fosters significant innovations.

Several affirmative comments should be made. The first is the suggestion that we should start to “think small” about regulation of public utilities. We regulate primarily because of a natural monopoly notion—that there cannot be competition because there is not opportunity in the relevant market for multiple suppliers at efficient scale. But demand has grown and technology has changed, as has factual information on costs. In many cases the economic sector of decreasing cost has diminished greatly. In electric power the large companies face power demands which require multiple generating plants; and interconnection and power pools provide power from foreign plants as well. The natural monopoly may now be merely the distribution system, and competition may be quite possible in generation and transmission. Reference has been made to satellite communications as a natural monopoly. Perhaps the satellites proper are natural monopolies, but the bulk of investment and costs will be at ground stations, and therefore it may be possible to have competitive ground stations, and these of varied characteristics. Private microwave has shown that intercity communications could be opened to competition—genuine, strenuous competition. If parallel pipelines now run to or near cities, competition could enter in the provision of gas to local distribution systems, as Ross suggests. The points I emphasize are two. Unless scale economies are very substantial, it might be better to forego them and have competition among slightly less efficient-size suppliers than to have a regulated monopoly and the inefficiencies and regulation of monopoly. And we should be alert and actively prepared to reassess periodically where there are substantial scale economies and where not, and to open the latter cases to free entry and competitive supply. The record is clear that these dividing lines shift greatly as a result of demand growth and innovations. And the record also shows that efficient coordination among independent firms can take place—for example, in telephone, railroads, airlines, and power pools. There may also be needed an end to prohibitions against resale, where the prohibitions preserve unnecessary monopolies and discriminatory rates.

Second, commissions should recognize that important innovations usually have widespread and unpredictable effects. Such effects can also occur from major price reductions and supply in-

1. James O. Bonbright, Valuation of Property (1937) 1170, quoted by J. Jackson (dissent) in FTC v Hope Natural Gas, 290 US 646 fn. (1944). "... the vice of traditional law lies ... in its tendency to permit shifts in meaning that are inexact, or else that are ill-defined because the judges that make them will not openly admit that they are doing so."
creases. In general, the business and consumer economy have a strong tendency to adopt the cost-saving, income-increasing, pleasure-generating aspects of innovations and to reject the adverse ones. Our crude economic measures indicate that innovations have contributed as much to economic growth as have increases in the stock of capital goods and the labor force. Commissioners, commissions, and timid utilities tend to insist on exact blueprints for the effects of each new promotional rate, each new device, each novel offering; but the fact is that some of the direct effects will usually be missed, and the indirect effects will always be grossly underestimated. Who could have foreseen, for example, that the bulk provision of telephone private wires at low costs would generate such a rush to wire reservation systems, central inventory mechanisms, and shared time computers and data banks—to say nothing of the prospect of a chain of bookie joints operating tote boards and closed circuit TV's!

Comment

Francis X. Welch

Public Utilities Fortnightly

The papers of Messrs. Cox, Ross, and Little, though superficially quite dissimilar in scope and coverage, have three common denominator aspects which go to the very heart of regulatory pricing policies. First, there is the recognition that regulatory control of utility pricing, per se, is not only here to stay but will be an increasingly important part of the commission's responsibility henceforth. Cox makes this point quite clearly. In earlier years, rate cases commonly stopped with the determination of the overall return allowed, mainly because the commissions lacked tools and expertise to get into mechanical details of the rate structure. This left management with the task of devising appropriate tariffs to meet the revenue requirements indicated, except in those cases involving ad hoc complaints of discrimination. Today, the impact of these rates structures on trend and development of the entire economy is so pervasive that they can no longer be left to the limited goal of revenue production alone.

The second common denominator is the trend towards marginal
pricing, although much remains to be done and acceptance is by no means uniform. Both Ross and Little were quite persuasive here. I use the term marginal pricing in its broadest sense, not only as a means for balancing the demand load for better use of utility plant resources, but also for encouraging new or different customer use of service. In this respect, I have in the past somewhat facetiously compared a marginal rate with a miniskirt—just enough of a rate to cover all the bare essentials while at the same time attracting a new class of attention to the end product.

Third, all three papers reflect the importance of protecting the customer's choice and his use of the service. This does not always square with objectives of marginal pricing, but this is the age of the consumer and the situation points up the need for the utilities to do a better job of marketing their services.

In the communications field, Cox gives a very interesting picture of regulatory authority easing traditional policy restrictions on competition for the telephone companies, in order, as he said, to promote innovation, new technologies, and stimulate full development of service offerings to meet changing consumer demand. Judging by the response, the FCC has certainly succeeded in this, notably in the Carterfone case, allowing the connection of customer-owned equipment to telephone facilities, and in the MCI case, allowing the establishment of microwave service in competition with point-to-point long-distance telephone service. As to the former case, there are a variety of new candidates for direct competition with the telephone system networks: putting in their appearance, namely, dataphone and computer, teleprocessing, and others. Because of my own editorial concern with all members of the utility family, I was much interested in one recent development involving a telemetering device which can be attached to any gas, electric, or water customer's meter. It works while the customer sleeps, sending a meter reading message over his telephone circuit to the utility company billing office, thereby eliminating the meter reader and all the utility headaches about missed readings, dog bites, broken shrubbery, and so forth. However, according to a complaint by the telemeter manufacturer in a response filed with the FCC, the telephone company will not connect such equipment without a protective device, called an interface, which the manufacturer says would cost so much as to make it impractical. Actually, I think this impasse might be only a dickering phase. If the issue gets down to the point of new business either lost or gained, I think the Bell system is likely to come up with the fastest, sharpest pencil in town. I only mention this item in passing to point up the important and varied consequences we may expect from the FCC's new policy of stimulating competitive enterprise in this area.

Perhaps the FCC has not always been consistent in looking out for the customer's needs. In its final report of December 1966 (Docket 14650), a committee of three FCC commissioners, including Cox, expressed concern about the steady decline in Western Union service and made a number of suggestions designed to help it continue as a viable record message service, notwithstanding any customer's preferences for alternate services offered by long-distance telephone. First, it favored an exclusive pre-emption of record message service by Western Union even to the extent of pressuring American Telephone and Telegraph to sell out its rival teletype service to the telegraph company and such a sale is now going forward. Second, it encouraged promotional rate experiments by Western Union. Third, as to competitive services, it recommended minimum rates based on fully distributed costs to prevent rate cutting by the telephone company. Obviously, the whole thrust of that report was to provide a shelter for the telegraph company against the erosion of business due mainly to customer preference of the alternative telephone service.

In this situation, the FCC has good legal reason to feel that it is under an historical mandate to preserve competition, as between different types of communication. I am only raising a practical question here, as to whether it will work. I do not think any kind of rate tinkering is going to help if enough customers decide, as they are apparently doing, that they prefer the two-way telephone conversations.

In 1927, when Congress enacted the old Federal Radio Act, Section 17 prohibited the merger of cable telegraph and cable companies with each other, or with radiotelegraph or telephone companies. Remember what happened as a result of ruinous compe-
tition between Western Union and the old Postal Telegraph Company. Finally, when one of the rivals was broken and the other badly bent, Congress passed a law permitting the two domestic telegraph carriers to merge, but it was too late to help much.

Although it is not yet officially released, the recent report of former President Johnson’s Special Task Force on Telecommunications is generally understood to have suggested that Western Union might be saved if it were given desk space, so to speak, in the U.S. Post Offices throughout the country. This seems to be based on the idea that the merger of two cripples might result in a sound survivor.

As to marginal rate tendecies, it appears that the FCC in its attitude toward TELPAK rates, described by Cox, is most concerned with protecting monopolistic message service telephone subscribers from subsidizing rate cuts to newer classes of competitive business. The telephone company’s argument was made that as long as long-run incremental costs of the TELPAK services are covered, it is not discriminatory but, on the contrary, beneficial to all subscribers that the telephone company should get new business, making more economical use of its toll facilities.

The hearings before the FCC on rates for interstate services of the Bell Telephone system, give some interesting insights into the application of cost allocation which has such a definite bearing on any effort toward marginal pricing in communications rates. A Bell system witness, James C. Bonbright, pointed out to the FCC the arbitrary nature of fully distributed total costs. He compared the effort to allocate total costs among various classes of services with an attempt to “divide a pie among members of a dinner party, leaving no residue for the kitchen.”

The FCC has made its decision on some phases of TELPAK, but we can still look forward with interest to its decision in the general Bell rate investigation on the question of when such service classification rates are compensatory.

In Ross’s paper, there exists a somewhat more sympathetic FCC attitude on marginal rates for gas and electric companies subject to FPC jurisdiction. In his 1966 address to a legal seminar of the American Public Power Association, he came to grips with an old skeleton concerning marginal pricing which had long been hidden in the closets of FPC precedent. In that address he broke publicly with previous FCC decisions, such as the South Carolina generating case (1966, 15 PUR3d 280), in which the commission expressly rejected the value-of-service approach in competitive pricing and required consideration of cost-of-service allocation in rate making.

Ross then predicted, on the basis of a few of the more recent FCC decisions, notably the St. Michaels case, that the FCC was working towards a more liberal attitude for competitive pricing based on marginal costs. “So long as the costs of any particular service are covered, the existing customers of the utility are protected,” he said, adding, “Application of marginal cost principles would thus set a floor for differential rates.”

At that time, he gave a stimulating picture of what the electric industry might accomplish once freed of cost-of-service rate restrictions: space heating, year-round climate control, electrical stimulation of fruit trees and plants, and mass transit, if only the energy were available at low enough rates.

In his present paper, Ross expresses some concern about artificial inflation of the rate base, or “gold plating,” as he calls it. Despite much talk about this in academic circles, I have never observed any evidence of the Averch-Johnson syndrome regarding the deliberate infusion of unnecessary plant investment. And in these days of high-price-financed financing, I think a utility executive would have to be a little insane to try it. In addition, utility pricing trends seem to be moving away from strict adherence to the rate base.

Cost of money, rather than any percentage return on rate base investment per se, has been the real determinant in rate cases in recent years. With the advent of area pricing for gas producer rates, the FPC broke away from the individual company rate base factor. And, as Ross has noted, such factors as competition, promotional


3. Editorial reference is made to this in 78 Public Utilities Fortnightly 6, December 8, 1966.

4. St. Michaels Utilities Commission v Eastern Shore Public Service Co. (FPC 1966) 63 PUR3d 337. In this case the FPC approved as nondiscriminatory a wholesale rate of a power company to an IRA cooperative yielding slightly less than the allocated return on rates to other customers.
and incentive rate making, as well as the increasing economies of scale, tend to dilute the impact of rate base allocation.

I am puzzled by Ross's reference to the lag of electric companies in embracing the economies of scale. Without getting into figures, my impression is that they are going forward very rapidly. Recall the prediction made by Donald C. Cook, president of the American Electric Power Company, that eventually some twelve to fifteen fully integrated power systems will be supplying the entire nation.5 This trend toward larger system coordination has been moving forward so rapidly that some of the smaller municipalities and cooperatives are alarmed that they are being left behind. Ross apparently does not share the fear that continuation of the so-called pluralistic power industry is in danger. One danger of such a pluralistic industry is where the consumer has a choice between contributing either to a corporate profit or to a taxpayer's deficit.

It is interesting to note, here, that some of the old public versus private ownership controversy seems to be receding or at least re-aligning in terms of the Bigs versus the Smalls. Larger public ownership agencies which have stayed on top of scale economies are joining in pools with investor-owned utilities.

I mention this in connection with Ross's view that the Electric Reliability Act and the Aiken bills, along with Section 202, would give the FPC leverage to achieve a better industry performance, perhaps avoiding more blackouts. In my view, centralization of authority is the wrong way to go about this because it would build from the top down instead of the bottom up and frankly, with all due respect, I do not think FPC expertise is all that good. (The FPC could preside over as big a blackout as the one that started in Canada, as far as the law goes.) We have to expect that a reliability bill of some sort will eventually be enacted; but it might be more realistic to base it on voluntary combinations of companies in all areas of the country which are already very much in progress.

Finally, the discussion of both Ross and Little on protecting the customer's choice as to which utility service he wants to use, and how he wants to use it, suggests that there may be limitations to rate forms which drive the customer in this or that direction, sim-

V

The Environmental and Regulatory Setting

The existence of externalities can have an impact on the attainment of social optimality in terms of prices, output, and investment. The externality problem centers attention on new dimensions of regulation and can introduce complex issues transcending a simple balancing of consumer and investor interests.

A basic question must be answered. Is the pricing structure of a public utility an appropriate means to recognize and influence the pattern and incidence of social benefits and costs, the redistribution of income, and the financing of public goods? Expressed somewhat differently, are public utility prices and public utilities per se vehicles for reform?

This is the topic that Warren J. Samuels considers in his paper in this section. Joel B. Dirlam and John F. Roberts, Jr. serve as discussants and present two critiques of the Samuels paper. Dirlam argues that public utility pricing can be a greater force for social change; Roberts argues that management has already assumed significant burdens in many of these areas.

In the second paper, Oliver E. Williamson explores the possibility of improving regulatory control of certain crucial variables, thereby facilitating the attainment of more effective pricing practices and policies. He considers how
the control agency, i.e., the commission, may intervene in the system to influence the behavior of the regulated firm. An agency audit and an institutionalized regulatory lag are among the recommendations offered. Henry M. Boettiger comments on Williamson's use of a control system and the application of the concept to the field of public utility regulation. Leland E. Johnson comments on the effectiveness of an agency audit and an institutionalized lag as a means for improving regulation and the conduct of the firm.

Externalities, Rate Structure, and the Theory of Public Utility Regulation

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This paper concerns topics and problems of speculation and policy that lie in a complex and often intractable area formed by the convergence of several major and numerous lesser fields. The major fields include: (a) the abstract and theoretical treatment of externalities; (b) the theoretical and practical problems of making public utility rate structures; (c) the theoretical and political questions of the place of utilities in the scheme of things politico-economic; or the theory of public utility regulation; and (d) the theoretical, practical, and political aspects and difficulties of solutions to certain increasingly important social problems.

The important social problems which this study takes as a frame of reference are air and water pollution, the provision of minority (largely, but not entirely Negro) employment, the provision of recreational facilities, and urban redevelopment. These problems
are not homogeneous either analytically or practically, though they all involve externalities from the position of the utility. But they are interrelated or interconnected, which is to say that there are externality relationships between them. It is not an exaggeration to say that the quality if not the continuance of America as a civilization depends upon the resolution of these problems. (Since urban redevelopment encompasses the others, insofar as urban areas are concerned, it may be used as a paradigm in considering the following conclusions.)

Given the complex area defined by the four fields enumerated above, any one or any combination of those fields could be profitably pursued. This paper, however, will focus upon the significance or impact of externalities upon the public utility rate structure and the theory of public utility regulation, or, more accurately, the general significance or role of public utilities and public utility pricing to the problems posed by externalities. In other words, what should be the role of public utility tariffs and the public utility institution itself in the quest for solutions to these problems?

It has become increasingly clear that the significant relation of the externalities herein considered to public utilities was not critically a matter of rate structure of pricing per se, but rather a matter of the theory of public utility regulation. However, it is also clear that placing the matter of rate structure and pricing into perspective would underscore the greater significance of the theory of public utility regulation. The major subjects to be discussed in this paper are, primarily, the relation of public utilities to the solution of the social problems considered in an externality context, and secondarily, the impact thereof upon public utility pricing.

II

Externalities. Although there is considerable variety of usage in the literature of welfare economics, externality in this context refers to situations in which one economic actor imposes costs and/or confers benefits upon another without the former including those costs and/or benefits in his cost and benefit (revenue) or operating calculations. In short, the former economic actor is able to operate without bearing all the costs which he creates and/or without accruing to himself all the benefits which he creates. These situations will include both those cases in which the real-cost conditions of production of the latter economic actor are alone affected and those in which the pecuniary costs alone are affected (i.e., both the technological and the pecuniary or market cases) and will also include both those cases in which the price system is the mechanism of transference and those cases in which the price system is not (though not necessarily unalterably) the mechanism of transference.

Several aspects of this broadly inclusive definition of externalities may be noted. First, the term externality is derivative of the general concept of interdependence that characterizes the modern industrial economy. Next, epitomized by the well-known input-output matrix, the behavior of one economic actor has more or less intensive and more or less extensive impact upon the opportunities and fortunes of other economic actors. Whether the context be that of the transmission of cyclical forces throughout allied industries or the economy in general, or the derivation of derived factor demands, or the diffusion of the benefits (and costs) of technological advance, externality relationships arise because of mutual dependence. With interdependence so pervasive and increasing, externalities are ubiquitous and proliferating, encompassing new and new external "goods" and "bads." Generalized scarcity, interaction, and interdependence means the incurring of opportunity costs and therefore the creating of externalities.

Second, the concept of externality throws some light on the meaning of freedom in such a situation of general interdependence. If voluntary freedom is defined as the opportunity or capacity to choose between alternatives, and volitional freedom as the opportunity or capacity to determine the alternatives between which one may choose, then the difference between voluntary and volitional freedom, for present purposes, is the impact of the operation of choice by others (given generalized scarcity). This is simply another way of saying that one economic actor is limited or constrained to bear the costs in various form imposed by other economic actors jointly and severally. The impact of others' decisions and choices is transmitted as externalities to the one actor whose range of alterna-

tives is thereby circumscribed so that his freedom is voluntary and not volitional. What this means is that one will eliminate constraints on choice when one takes care of externalities (i.e., internalizes costs and realizes benefits), but rather that in taking care of them the structure of freedom is in part determined. This has significant implications with respect to urban redevelopment and the problems of cultural minorities (notably under the doctrine of participatory democracy), particularly but not solely in light of the fact that solutions to one externality situation tend to create or impose new externalities. With respect to freedom, as Bentham argued, every law both increases and decreases freedom, though typically for different people; consequently, it is a matter of whose freedom is to be promoted, or who will be allowed to impose externalities on whom.

Third, this definition of externality underscores the importance of the structure of relationships. Externalities are each external to some locus of decision making; such that a change in the pattern of decision making will tend to mean a change in the pattern, indeed, the existence, of externalities. Thus, instead of the two economic actors in question being in an externality-transmitting and an externality-receiving pair of positions, the structure of relationships or the structure of decision making might be altered such that they are both merged into one new economic actor, i.e., the internalization of the pre-existing externality in one or a new unit, including a contractual arrangement between the two parties. Although with respect to a third economic actor, an externality relationship might (either still or newly) exist vis-à-vis the new unit. A and B may simply unite or contract so as to shift the costs to C. In other words, given the same technology and other market and extra-market conditions, a particular externality may or may not exist depending upon the structural relations involved, i.e., the structure of organization. This is true whether the structure is market or non-market, competitive or non-competitive, regulated or non-regulated. Moreover, just as one can speak of vertical and horizontal-integration strategies and/or structures, one can speak of externality-integrating strategies and/or structures involving the reorganization of hitherto or otherwise independently acting but nevertheless interdependent units, or the creation of new units, for the purpose of internalizing the costs or realizing the benefits of particular externalities. The realization or capture of hitherto lost external benefits is part of the

logic of most if not all economic and political units. The structure of organization or of decision making is in part a function of law and in part a function of organizational technology including the costs of organizing.2

From the list of social problems given as the frame of reference of this paper and from the extensive contemporary discussion thereof, it is clear that the subject of externalities, however abstract, is no mere logical exercise. It is, rather, one way of considering the nature and implications for the policy of important social phenomena. It is also true that externalities are ubiquitous and proliferating, and that, given scarcity of resources and energies and the elementary interdependence of the interacting parties (a broader analysis would include what Heilbroner calls ideology and the structure of privilege as the "limits" of the system), choice must be exercised with respect to which externalities or sets of externalities will receive remedially-constructive, institution-altering attention. One aspect of this will be examined in this paper, but it may be again noted that policies pertaining to externalities will tend to create externalities somewhere in the economy. The existence of what the sociologist calls the unintended, unanticipated, or unforeseen consequences of action in such a situation is considered by welfare economists to require the deliberative contemplation of the range of probable externalities involved in any action and the deliberate weighing of costs and gains to enable the choice of some optimal combination of externality-solving and externality-creating policies. What is important is the creative choice. Thus the recent FPC report on air pollution emphasized

that steps taken to reduce pollution from one specific operation or group of operations may bring about another set of pollution problems.

. . . any single solution to a part of the pollution problem must be reviewed in conjunction with many other problems before general environ-


mental improvement is achieved. An analysis of the side effects must be made in addition to a review of the purely economic effects of any proposed solution.4

It must be considered whether the costs and benefits of partial improvements or, more generally still, whether the danger of prolongation and delay is greater or smaller or more relevant than the danger of undue haste and impetuosity. The problems of externality solution are partially compounded because of the multiplication of levels on and through which the externality is generated and felt. Ronald Ridker has distinguished three different levels or stages of effects relevant to the measurement of the costs of deterioration of air quality. The first includes certain direct and immediate effects, such as paint damage, throat irritation, and elevation of certain age-specific mortality rates. Second, Ridker states that these effects give rise to certain adjustments which individuals and firms make so as to reduce the direct impact of the pollutant on them. An asthmatic may adjust by moving from the area, a spinach grower by shifting to another crop, a homeowner by painting more often, and so forth. These adjustments serve to reduce the cost of the direct effects of the increased pollution, but can be quite costly in their own right. Third, these adjustments involve actions that affect others. When spinach is likely to be affected, some jobs are created and others destroyed. Such social interaction effects can also be quite important consequences of the initial rise in pollution.5

The meaning of externality solving may be made clearer. The traditional Pigovian approach to externalities is to establish two paradigmatic cases: first, marginal private costs are less than marginal social costs, with the externality involving costs thrust upon others, which would tend to be met with taxes whose rationale is to internalize the costs hitherto shifted to others; and second, marginal social benefits are greater than marginal private benefits, with the externality involving inadequate or suboptimum output by the private producer inasmuch as his maximizing procedure will be guided by marginal private and not marginal social benefits, which would tend to subsidize the private operation to enable the realization of the larger social benefits. The Pigovian analysis requires proof that the opportunity costs of either the tax or the subsidy not preclude their externality-solving use.6

Notice again the main consequences of the Pigovian paradigms. In the cost case, there is a tendency for overproduction of the economic good in question since some of the costs are shifted to others and the maximizing firm will be guided by marginal private costs which are less than marginal social costs, leading the firm to overexpand production. Whereas the cost case is one of over-expansion, the benefit case is one of suboptimization: less of the good in question will be produced than is optimum because it will not be in the interest of the private producer to expand production, given that his marginal private benefit is less than the marginal social benefit. Under these conditions, as E. J. Mishan said, "one can no longer take it for granted that the market price of a good is an index of its marginal value to society. The imposition of a tax will tend to reduce over-expansion in the one case and the grant of a subsidy will tend to increase output in the other. The suboptimization conclusion in the case of the benefit example is reinforced by the somewhat parallel thrust of the theory of public goods. Public goods are generally (a) goods from whose enjoyment costs externally imposed on A into account, but A's behavior must be modified so as to ensure that he will take the costs 'externally imposed on B into account.' James M. Buchanan and William C. Stubblebine, "Externality," Economics, vol. 26, November 1962. Reprinted in William Breit and Harold M. Hochman, eds., Readings in Microeconomics (New York: Holt, Rinehart and Winston, 1969), p. 487. Also see, Coase, "Problem of Social Cost," reprinted in Readings, p. 454.

6. According to some writers, bilateral taxes should be imposed: "Not only must B's behavior be modified so as to insure that he will take the
it is not possible to exclude others, so that the provision of the good for some (even if only because of prohibitive costs of exclusion) necessarily allows the enjoyment thereof by others, and (b) such enjoyment by others is at zero marginal cost. The inferences immediately relevant from the theory of public goods are: first, that there will tend to be a suboptimal provision of the good in question, as generally, each party will tend not to reveal their preference and wait for the provision of the good in question by others, in whose enjoyment they may participate freely; and second, that as a consequence of the foregoing there will be a disproportionate sharing of costs by the parties concerned. Generally speaking, both the realization of the benefits and the distribution of the costs will depend upon the organization of the parties involved. Where the number of parties at interest is very large, the greater will be the suboptimization, and the smaller the fraction of advantage or benefit accruing to the largest member of the group, the greater will be the percentage of cost borne by the largest member of the group. As one of the developers of this analysis has remarked, "... in small groups, there is ... a surprising tendency for the 'exploitation' of the great by the small." 10

With respect to both the cost and the benefit cases, the capacity to adopt externality-solving policies will depend upon the number of the parties at interest. But this is just another way of saying that the creation and realization of externalities is a function of the organizational structure of decision making. Moreover, one may have very asymmetrical results. In one situation, the number of parties at interest may be small, so that organization to create optimum conditions in place of cost- and/or benefit-externalities may readily be formed; whereas in another, the number of parties at interest may be large, so that organization is difficult and sub-optimization continues. 11 One solution (in addition to outside coercion of the tax-subsidy variety) to the latter impasse is the provision of some non-collective benefit (non-public good) to create incentive for membership, which will at the same time enable the realization of the collective benefit (public good) as well. 12

Still another approach to externality-solving is to create market systems wherein the parties at interest may negotiate mutually accommodating solutions taking advantage of gains from trade. The logic of this approach is to harness externality-integrating or internalizing strategies and create arrangements or structures internalizing costs and realizing benefits. Here, however, transaction costs, particularly in the case of large numbers, may be so great as to either preclude the formation of such arrangements or to allow only partial and possibly disproportionate cost sharing and even a further shifting of costs to parties outside the negotiation. 14

A final approach to externality solving, in addition to the tax-subsidy, non-collective benefit, and market-creation approaches, is to use new (non-market) institutions which can organize production of social benefits and elimination of social costs exceeding private or internalized costs by optimizing the flow of information and the institutionalization of cost-benefit calculations to the end of optimizing output. This is yet another form of externality-integrating strategies and structures. In a world, however, of ubiquitous and changing external goods and habs, no single institutional arrangement can unequivocally and permanently assure internalization and therefore accountability and realization of external costs and benefits. Moreover, the picture is worsened when the likelihood of such strategies and structures creating further externalities of their own is considered. But the possibility of institutional creations and/or readjustments—market and non-market—remains. This is part of the adventure of improving the organization of production which is in turn part of the organization for social living. As always, the quest takes place within limitations and constraints imposed by

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10. Olson, Collective Action, p. 3.
12. See Olson, Collective Action.
14. A further difficulty, particularly when this analysis is applied to problems of public utility regulation and pricing, is that externality analysis, especially in the context of Pareto optimum considerations, requires firms to adjust to competitively determined prices. See Buchanan and Stubblebine, "Externality," in Readings, p. 487. Even prices set under marginal cost pricing are insufficient. This and other issues really place the matter in the area of second-best theorizing, which is beyond the scope of this paper. See H. Rees, "Second-Best Rules for Public Enterprise Pricing," Economica 35 (August 1968): 260-73; and Lerner, "Conflicting Principles," pp. 65-70.
the status quo institutional structure and the vested interests therein and their inertia (not all of which is a function of maximizing behavior necessarily), as well as motives and pressures for movement and change in other directions than those capable of realizing particular externalities, all of which involves organizational and transaction costs.

Given the list of social problems with which this discussion is concerned, e.g., urban redevelopment, much of the foregoing is put into relief when it is realized that population growth is a major source of externalities. The analysis is much more complex than can be or need be developed here. But it may be pointed out that population increase per se is a direct imposer of external costs. Following Malthus, if the average per capita income is above the minimum of subsistence, increased population will engender forces—with external costs imposed on others—tending to lower the average per capita income to the minimum of subsistence. Second, technology may enable a society to overcome this tendency as it has in the West. But technology itself gives rise to externality problems such as air and water pollution, urbanization (and urban deterioration). So population imposes externalities through per capita incomes, and technology, which may counter those externalities, imposes its own externalities which may conjoin with the population-induced technologies to create a vast and complex array of difficult and explosive problems. Yet, thirdly, the per capita income directed externalities are not the only—and may not be the most important—secular externalities engendered by population growth: population growth may create the proliferation of quality of life directed externalities through the greater density of population and the greater magnitude of human interaction, requiring, among other things, greater necessity to resort to more elaborate and more formal modes of social control. This well may prove to be the greatest and most profound externality due to population growth. But there are the externalities wrought by technology and the passage of time as well. Garrett Hardin, a professor of biology, stated that population growth is a situation in which the marginal private cost is greater than the marginal social cost, leading to over-expansion, just as in the case of goods in general. As Hardin also emphasizes, the population problem has no technical solution, meaning by technical solution "one that requires a change only in the techniques of the natural sciences, demanding little or nothing in the way of change in human values or ideas of morality," such that solutions must be found or imposed which involve institution-creating and changing activity. The questions of optimizing the creation of social costs and the realization of social benefits—always considering the alternative uses or opportunity costs of scarce resources—must be conjoined with another pair of questions, questions which are more typically the critical ones in the formulation of policy. These questions are: who is to bear the costs that are incurred and who is to share the benefits created? Unfortunately, the welfare economic analysis of externalities and related subjects has not been successful in penetrating very deeply the complex difficulties involved, though at least some of the difficulties are well known, e.g., the difficulties of making interpersonal utility comparisons, and the normative character of distribution rules. Several points can be made, however, which will be of value in subsequent discussion.

First, it should be clear that the problem of externalities itself arises because the free market does not assure compensation for costs visited upon other parties, nor does it automatically reward for gains accruing to others. As John McGee has written in an article on public utility pricing,

Whatever else may be claimed for it, the free market is a poor instrument for the production of social vengeance and redress. To many economists this is a virtue; but economics is neither monolithic nor the only force in political life. Although the free market offers both powerful incentives and mechanisms for improvement, it does not either define or pay compensation for wrongs that took place in the past. It will not pay back-wages to those who once were slaves, or automatically transfer resources from those who have many to those who have few. What it will do is to allocate and ration existing resources in a predictable and essentially efficient way.16

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16. Ibid., p. 1243, 1247. Interestingly, Hardin also interprets the population problem in terms of freedom, with a thrust equivalent to the discussion presented above. See Hardin, pp. 1247, 1248.

This reasoning is significant not only with respect to externalities but also, as McGee points out, with respect to the fact of public utility regulation per se.

Externalities solutions, whether market or non-market, directly require policies as to who will bear costs and who will share gains or benefits. Indeed, the history of public policy discussion in matters of urban redevelopment, air and water pollution, and so on, not at all dissimilar to the history of public policy discussion in matters of tax structure and levels, is a history of jockeying for position to avoid the imposition of costs and to receive the benefits of programs. This suggests that one profound externality is the spill-over into collective questions of modes of reasoning and valuation characteristic of market maximizing behavior in individualistic matters; but such individualistic maximizing behavior is characteristic of the civilization as a whole and, moreover, the character of collective values as opposed to individual values is a complex and difficult subject and, of course, beyond the confines of this paper.

This is, in turn, further complicated because of the redistributive character of the policies involved. In every case, there tends to be a redistribution of costs and a redistribution of benefits, or at least possible redistributions. The most obvious examples are urban redevelopment and the provision of minority unemployment-manpower retraining (particularly in the face of what is frequently called cultural deprivation). Perhaps the best and most direct way of stating the problem is to refer to Bentham’s principle of the greatest happiness for the greatest number. What that principle states, however, is less a solution than a problem: the “question which is really to be maximized, the number or percentage of (more or less) happy people, or the intensity of the happiness of those most largely benefited.”

The last point to be made concerns the importance of organizational structure for externalities. The general principle may be recognized that the policy choices (i.e., the decisional outputs) of a decision-making process will be at least partially and certainly most critically a function of the structure of the decision-making process or distribution of power. The structure of power or decision making will not only determine which externalities arise in the first place but also what externality-solving decisions will be reached and thereby also the distribution of costs, benefits, and real income and economic welfare generally.

Externalities and Public Utilities. Enough has been indicated of both the nature of externalities and some of the connections between externalities and public utilities to forcefully suggest that public utilities are in a significant position in the economic structure to serve as vehicles, levers, or instruments for the effectuation of externality-solving policies and programs. Certain aspects of their significant position should be identified.

First, public utilities and public utility policies including pricing policies are consequence-laden for others, i.e., are creative of important externalities. For one thing, public utility prices, like all prices, operate to structure costs and benefits—in sum, opportunities—for others. Changes, for example through externality-solving strategies and/or structures, in public utility prices mean alterations in the structure of costs, benefits, and opportunities. For another, it seems to be universally recognized that public utility services such as power, communications, and transportation have significant externalities with respect to the direction, structure, and rate of economic development both in terms of per capita incomes and the quality of life. Studies on the Watts area in Los Angeles suggest that transportation service is a major factor in labor mobility and therefore income-earning opportunity and so on. Power and telephone expansion facilities in anticipation of the direction of population development will also tend to influence that direction; and the influence of rail facilities upon land utilization is also clear.

Second, it is widely understood that public utilities themselves are beneficiaries of externalities in the form of free goods or opportunities provided to or available for them. On one level of analysis, there are hydroelectric power sites and radio frequency spectrums; on another, the right of eminent domain, notwithstanding the practice of compensation; and on still another, the industrialization-derived demand for public utility services. Regulation per se may be considered as providing gains accruing to the regulated utilities, though company management will generally scoff at the suggestion, at least publicly.


Indeed, it is certainly possible to argue that consideration of the externality involvement of public utilities is an additional ground or rationale of regulation itself. That is, in addition to such time-honored grounds as intensive regulation of concentrated power, common necessity, capacity to discriminate, increasing returns, and so on, there is also the externality-laden position of public utilities in the modern economy.

One conclusion which emerges is that public utility pricing in general in the light of externality considerations has to expand the formula of simply balancing consumer and investor interests. What is involved are considerations far more complex than have thus far been considered. Recognition of externality considerations means recognition of a wider range of consumers and a wider range of investors and their myriad interrelations and interdependencies.

The last point to be made at this stage will be amplified in section 4, so it will only be touched upon here. It has already been seen that public utilities are significant with respect to the existence of externalities per se. There is a second and related respect in which utilities are significant, namely, externality-solving strategies and structures. Assuming that it is meaningful to write of organization for production of externality solutions (as above), the position of public utilities in that organization for production may have critical functions or critical opportunities. Harvey Leibenstein has written of the juxtaposition of X-efficiency to allocative efficiency, meaning by X-efficiency something like the quality of organizational performance which has motivational (and also knowledge) factors in it but is not strictly and certainly not definitionally motivational alone. 20 We may speak, then, of the organization for production, meaning thereby the direction of resources and interest to production per se, to emphasize the organization of forces for production as distinct from traditional allocative efficiency considerations. If we can speak of organizing to produce externality-solutions, it would seem that the combination of structural and functional characteristics of public utilities places them in a strategic position to either reinforce or weaken efforts atorganization for the production of externality solutions. This includes first, their status as regulated monopolies; second, the services which they provide and their market characteristics; and third, their capacity to serve as leverage points in the organization for producing externality solutions and in the production itself. Finally, there remains the fact that utilities provide non-collective benefits which, following Olson, could be a basis for organizing the production of public goods in the case of large numbers of parties at interest, however much this may be limited by redistributional and other problems.

III

The purpose of this section is to state certain conclusions with respect to the impact externality considerations should have for public utility rate structure and pricing policy. The thrust of these conclusions will depend both upon the materials reviewed in the preceding section and on my assessment of the current state of pricing practice as well as the probable needs of pricing within externality-solution requirements, constraints, and objectives. Present Difficulties and Complexities. The role of principles in orderly, rational, and equitable decision making is unquestioned. There are principles of public utility regulation, including principles of rate making, but these principles are plural, and therein lies the necessity of choice which marks existing public utility rate making. Thus, Bonbright lists eight criteria of a desirable rate structure:

1. The related, "practical attributes" of simplicity, understandability, public acceptability, and feasibility of application.
2. Freedom from controversies as to proper interpretation.
3. Effectiveness in yielding total revenue requirements under the fair-return standard.
4. Revenue stability from year to year.
5. Stability of the rates themselves, with a minimum of unexpected changes seriously adverse to existing customers. (Compare 'The best tax is an old tax'.)
6. Fairness of the specific rates in the apportionment of total costs of service among the different consumers.
7. Avoidance of "undue discrimination" in rate relationships.
8. Efficiency of the rate classes and rate blocks in discouraging wasteful use of service while promoting all justified types and amounts of use: (a) in the control of the total amounts of service supplied by the company; (b) in the control of the relative uses of alternative types of service (on-

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peak versus off-peak electricity, Pullman travel versus coach travel, single-party telephone service versus service from a multi-party line, etc.).

He goes on to say that three of these criteria are "primary, not only because of their widespread acceptance but also because most of the more detailed criteria are ancillary thereto." The three primary criteria are the revenue-requirement or financial-need objective, the fair-cost-appointment objective, and the optimum-use or consumer-ratign objective. The present important point is that, as the literature and practice of the subject amply allows, these criteria—either the eight or the three—are in widespread though at times limited conflict. While on occasion several reinforce each other, the prices or rate structure which will satisfy one requirement or objective frequently will not satisfy another. The process of choice, trading off one for the other, is further aggravated because the "criteria are broad and ambiguous," and "are by no means always sharply distinguished" from each other, and "overlap without offering any rules of priority in case of conflicts." Moreover, Bonbright's criteria are further limited by the rate-of-return constraint on utility earnings per se.

Going beyond the difficulties and complexities raised by noting these conflicts of criteria, there are also difficulties of measurement and appportionment (including separations questions). There are plural criteria for grouping and booking customers, use classification, place classification, identifying cost variables, measuring cost elements, and apportioning or separating cost elements. Needless to say, different criteria produce different quantitative results, which produce different rate structures, and which in turn produce different patterns of externalities.

The earlier difficulties arising from the conflicts of criteria can also be approached and extended by recognizing that prices have multiple functions and that just as externality solutions themselves may create serious externalities, so too the prices performing one function may not be the prices which will perform another. In both cases, the necessity of complex calculations and the existence of goal-conflicts create difficult and agonizing choices. William Baumol has identified some of the multiple functions of utility rates and rate structures, arguing that "attempts to regulate away one sort of problem are all too likely to give rise to other difficulties," and that "it is this list of difficulties which . . . constitutes the basic assignment of the regulatory agency." He then analyzes some of the policy problems arising from the conflicts generated—as Bonbright, for example, had done several times earlier. Baumol's list includes:

1. The prevention of monopoly profits without at the same time precluding the profitable operation of the company.
2. The reduction as far as can reasonably be expected of the mislocation of resources and the distortion of demand patterns resulting from the administratively determined rate for the various company services.
3. The provision of some strong motivation for operating efficiency and innovation.
4. The prevention of predatory competition in those product lines which are not provided under monopolistic conditions.
5. The protection of the consumers of company services whose demands are inelastic from the burden of inefficiencies in other portions of the company's operation.
6. The elimination of the motivation for uneconomic investment as a means of expanding the rate base.
7. The preclusion of the use of other socially undesirable means to expand the rate base—of methods such as the encouragement of price rises by equipment suppliers and the elimination of competitions as means of providing new investment opportunities.

As in Bonbright's list, these criteria are broad, ambiguous, and often in conflict. Baumol points out, "any one of these measures may well lead to unanticipated side effects that are undesirable in themselves, or produce some unforeseen consequences that are..."
ilitically unpalatable.” An example of the results of conflicting criteria of functions of public utility prices is the current issue between Western Union and AT&T over the pricing of the latter’s TELPAK service.

Much the same conclusion can be reached by examining the substance of the goal of rate simplification. As James Nelson has pointed out, “the very idea is ambiguous. The simplest rate is a single price per unit of service—to all customers, for all uses, at all times, in all places. This kind of rate would be anathema to all utility suppliers and to all commissions.” But does simplification mean “(1) fewer blocks in a given rate charged a given consumer; (2) fewer ancillary charges (e.g., meter rents) associated with the rate charged to this consumer; (3) fewer choices of rates offered to this consumer; (4) fewer functional rate classes (e.g., residential, commercial, industrial); (5) fewer volume rate classes; (6) fewer rate classes based on explicit measures of time or place or density of use?”

Thus a bald reference to rate-simplification must itself be a simplification. The six points listed above may be combined in all sorts of ways; or some may be pushed in one direction and others in another. But in standard American practice, it would seem fair to say that ‘simplification’ would normally be taken to mean:

1. Other things being close to equal, the lesser metering the better. Therefore one inclusive rate is preferable, although not conclusively so, to an array of different rates offered for different uses of the services to the same customer.

2. This rate should be as simple as possible, in the sense of relying on a criterion, or criteria, which the consumer can understand without elaborate explanation, and correlate, in a rough sort of way, with the amount of the service that he feels he is ‘using’.

3. For small customers, the rate should be differentiated as little as possible, or not at all, by geographical area or by time of day (telephone rates fit this description less well than other utility services). A related idea is that the rate should also be as stable as possible over considerable periods of time.

Nelson goes on to declare that simplicity ‘over any reasonably long-run period is likely to be an enemy of marginal cost pricing.’

28. Ibid., p. 112.

If ease of marginal cost pricing were the case, then one might be somewhat optimistic about the difficulties of pricing under the constraint of externality solutions. But such ease is not the case. Kahn has stressed that if the marginal cost pricing rule is specified to include “each individual sale of each separate service,” as it should be ideally, then, “In practice, administrative and other practical considerations dictate all sorts of qualifications of this rule.” As examples he cites:

a. Customers and kinds of service have to be placed in functionally meaningful groupings for purposes of price-making. It is impossible to put a separate price on each sale.

b. Sales have to be grouped also over some time period, for purposes of costing and rate-making, with rate schedules held relatively stable during such periods.

c. Prices ordinarily have to be related to long-run rather than short-run marginal costs—again in the interest of rate stability—with long-run being defined over some more or less arbitrary planning period.

d. Inescapable uncertainties in the estimation of cost responsibility for various classes of service necessitate a good deal of averaging and blurring of the principle.

e. The principle itself must be qualified in the light of ‘second-best’ considerations.

He goes on to state that,

Society may decide, occasionally, to violate the rule for non-economic reasons—considerations of fairness, regional development, income distribution, national defense and the like. Confronting these the economist can only emphasize the efficiency costs of departing from the marginal cost rule and the preference, in Pareto-optimal terms, of accomplishing these social purposes in other ways.

And, furthermore,

The presence of joint costs, of practically unassignable common costs and of increasing returns, short- and long-run, may all require the further departure of price-discrimination if total costs are to be covered; the various classes of customers may therefore have to make varying proportionate contributions to unallocable overhead, over and above their identifiable long-run marginal production costs.

His major point is that "these rules . . . really say nothing about inducements to superior performance." Kahn's summary of the marginal cost question seems in accord with the general view of the question held more or less widely by specialists. It is undoubtably the case that, as William Shepherd has pointed out, there is considerable room to expand the scope of marginal cost pricing and that the costs of not doing so are considerable.31 Yet the difficulties involved, and the costs of doing so, are considerable, too. From another perspective, Ralph Turvey has identified the following obstacles to the practical application of the marginal cost principle: ignorance coupled with the cost of overcoming same, even where possible; complexity; financial objectives; and political considerations.32 The relevant point is that innumerable choices between competing considerations and criteria have to be made under conditions of substantial ignorance (with respect to cost measurements and consequences), complexity, and private finance, as well as the usual uncertainty. All of this is, again, well known, but it nevertheless has to be taken into account if a realistic appraisal of the possibilities and desirability of using public utility prices as instruments of externality-solving strategies is to be made.

Suffice it to say that there are serious limitations upon public utility price regulation in the United States. Some of these relate to the difficulties of regulating one or one set of prices in a sea of more or less flexible market-determined prices, and difficulties that have arisen in other areas of public utility regulation, such as rate base valuation, rate of return, and the fair return on fair value formula itself. Also, some of these limitations relate to the political structure of regulated public utilities. For example, as cited earlier, Nelson has argued that, for whatever reasons, investor-owned utilities in the United States probably have more incentive to avoid formal public discussion over cost pricing than American commissions have the incentive to force or even to encourage it. The American discussion tends to stop short of exactly what the particular price should be, and exactly why. Instead, it is more concerned with the tie between prices in general and profits in general.33

This raises the question of earnings-limitation as the central logic of regulation of public utilities in the United States, which is taken as given for this discussion except with respect to the inclusion of externality considerations in the theory of regulation. But Nelson's discussion supports the thrust of the other evidence adduced, namely, that the regulation of price does not appear to be a reliable and credible device to attain social goals.

Pricing takes place not only within a regulatory context but also within a context of managerial behavior. The use of public utility prices for externality-solving purposes would have to presume some propitious logic of managerial behavior. But not only is the meaning of propitious unclear, it is uncertain as to just what is the logic of public utility managerial behavior in the absence of externality-solving strategies and structures. Aside from uncertainty per se, if managerial behavior is a blend of rationales, then the task of institutionalizing externality-solving strategies and structures will be enormous. What the literature suggests is that public utility pricing policies are undertaken under the aegis of ambiguous but probably highly complex and diverse managerial behavioral rationales and therefore are more complex because of that. There are a variety of hypotheses, with conflicting conclusions and evidence, that support the plausibility of each. The writings of Baumol, Williamson, Averch and Johnson, and others develop rival models, including such different behavioral rationales as sales maximization, rate of return, expense preference, and so on, either emphasizing or at least underscoring the scope of managerial discretion. As Kafoglis has pointed out, even with rate of return at a "socially responsible" level, there is still a wide range of distributive and efficiency implications possible while fulfilling the general restraint laid down by the regulatory authority.34

It must be concluded that existing rate making is beset with vast complexities and tremendous difficulties, operating under the burden of substantial logical and practical conundrums, and charac-
terized by the existence of a considerable range of choices with re-
spect to the specific welfare implications which the rate structure is capable of embodying and furthering. One may question whether the marginal cost of undertaking pricing policies necessary for ex-
ternalization solutions on a substantial scale, with respect to the social problems identified earlier, is greater than the marginal gains from such pricing. Though it is difficult to form firm conclusions on this point, one may question the magnitude of benefits realized through such pricing programs. Granted that rates are made and that the existence of the aforementioned choices does involve externalities and thus does provide opportunities, one may nevertheless be wary of further burdening the public utility pricing process.

Difficulties Imposed by Externality Considerations. Without overestimating the argument in this respect, a brief review of the complexities and difficulties of measuring costs and benefits with re-
spect to externalities does not engender optimism toward the ease of including externality-solutions in public utility pricing policies. The conclusion seems warranted that given the existing difficulties and complexities of public utility pricing, and also given that some of those difficulties and complexities already involve or are the re-
sult of relatively limited and/or simple externality relationships, it may be too much to ask of public utility pricing that it assume the additional complexities and cost and benefit determination and measurement in order to give weight to the major social externalities herein considered, at least as a main component of externality-solving strategies and structures. Granted that cost-benefit calculations may enlighten public utility pricing decisions, the necessity to make rate structure decisions with such externality goals in mind seems likely to further burden the pricing process. Furthermore, whatever contribution the public utility institution is otherwise able to make to externality solutions will be substantially impeded if the pricing process is used to capture gains or avoid costs while basking in self-serving rationalizations.

One factor which does not require extensive discussion is the conflict between value-of-service (as the main practiced price-differentiating criterion) and the inclusion of externality considera-
tions. Those latter considerations almost always tend to involve redistributive elements, e.g., subsidies and cross-subsidies, and come directly into conflict with value-of-service as a decision rule.

It is, however, the difficulties of cost and benefit determination and measurement which present the greatest burden-compounding problem. The use of cost-benefit techniques, however, has numerous determination and measurement problems which are of such magni-
tude as to dwarf the matter of public utility pricing even if revision of price structures could be assumed to be highly potent as levers for the solutions of externality problems.

It is not too far afield to refer to a recent paper by Anthony Downs on uncompensated non-construction costs which urban highways and urban renewal impose upon residential households. While the particular problem which Downs treated would not neces-
sarily be confronted by utility pricing committees and staffs, it would indirectly enter, and more importantly concern, analogous difficulties for utility price makers. First, Downs identified the kinds of losses imposed upon residential households by urban high-
way and urban renewal projects (other than paying for construction costs) and summarized them as follows:

A. Losses imposed upon residential households by displacement itself.
   1. Disruption of established personal and other relationships.
   2. Losses due to the taking of real property.
   3. Losses due to house financing arrangements, mainly contract buying.
   5. Costs of paying for alternative housing elsewhere.
   6. Additional operating costs.
   7. Higher operating costs of residing elsewhere.

B. Losses imposed upon residential households by uncertainties and delays.
   9. Inability of property owners to sell property at reasonable prices during waiting periods.
   10. Declines in the value of properties during waiting periods because of neighborhood and individual property deterioration.
   11. Losses of income suffered by owners of rental property because of the departure of tenants before actual taking occurs.
   12. Costs of maintaining property after its fair market value has been established for purposes of litigation.

C. Losses imposed upon residential households not directly displaced but located in surrounding areas.
   13. Higher taxes paid because of increased city costs to counteract vandalism and other deterioration in the area.
   14. Disruption of local communications through the blocking of streets.
15. Reduction in the quantity and quality of commercial and other services available in the area because they have left or been displaced.

16. Reduction in employment opportunities and increases costs of traveling to work because firms have been compelled to move elsewhere or have gone out of business.

17. Spillover effects of deterioration in the clearance areas during the waiting periods.

18. Higher rents or housing prices because of increased competition for housing among low-income households resulting from displacement.

19. Reduction in the efficiency of community facilities through:
   a. Loss of patronage if displacement has removed customers.
   b. Overcrowding if displacement has removed alternative sources of supply (such as a local school).

20. Losses in property values due to changes in the accessibility of various parts of the metropolitan area.

21. Losses resulting from congestion, vibration, noise, street blockage, dust, and other negative factors involved in the process of constructing the new highway or urban renewal project.

22. Losses in property values due to increased ugliness, noise, air pollution, or other adverse effects of the completed highway or urban renewal project.  

Downs also suggests that "some of the losses which have been described earlier cannot be accurately measured in such a way as to make compensation of the individual households concerned truly practical." He delineates three major specific difficulties: non-measurability, non-separability, and non-accountability and wide individual variation. These difficulties are fundamentally akin to the types of difficulties already encountered in public utility pricing; the likelihood of further compounding is apparent. It is also apparent that given the complex nature of real-world situations and the conflicting interests of the parties at interest, externalities will be identified, measured, and generally interpreted differently as each party at interest has what McKean has called "different standpoints." Downs argues that although compensation is the basic principle, compensation should not be paid for all losses because, first, there is a possibility that some losses will be offset by benefits from the public improvement; second, some losses must be considered inescapable risks of property ownership; and, third, there are the already identified difficulties of measurement. Obviously, the questions of specific content are: when are losses offset by benefits, and when not; which losses are to be considered the inescapable risks of property ownership, and which not; and, inter alia, who determines? Downs identifies the tests which losses should pass to qualify for direct compensation: attributability, significance, non-inherent riskiness, identifiability, measurability, deliverability, and net negative impact. Certainly, for example, the concept of non-inherent riskiness is as ambiguous and diffuse and thereby amenable to variable specification and application as any criterion already found in public utility pricing.

Downs' articulation of the problems illustrates the burden-compounding difficulties. If one can imagine the wide variety of situations in which externality-involvement requires the utility pricing policy and particular price makers to consider these or similar difficulties of cost- and benefit-determination and measurement in making price policy, the added burdens assumed are obvious.

The general conclusion is underscored by further considering the problems encountered by Riddker in his seminal study on the economic costs of air pollution; 37 the problems of cost-benefit comparisons in even a centrally planned, socialist economy; 36 and particularly the many studies of projects where factors of redistribution or differential sharing of the benefits of economic development are involved.

Conclusions. The foregoing and other considerations—most notably the limited potency of public utility prices per se to serve as instruments of externality-solutions—suggest the following conclusions:


1. There should be a minimization of the imposition of additional complexities and burdens on public utility pricing, public utility management, and the regulatory commissions.

2. Public utilities should consider the consequences (the social effects or externalities) of their pricing policies and the ensuing rate structures.

3. Public utilities should include in their pricing calculations and decisions the costs incurred and attributable to improving what the utility would be doing anyway, but which is currently being done in slightly different ways in order to reinforce or support certain externality-solution strategies and structures.

4. Public utilities should include in their pricing calculations and decisions the costs of non-redistributive activities where, for example, the value of service is clear and unambiguous, however general, in cases where externality-type goals are sought.

5. Public utilities should exclude from their pricing calculations and decisions the costs of redistributive activities, such as they may embark upon, in consideration of the following:
   • Value-of-service pricing, as presently constituted, is inappropriate to redistributive cases, in part, because of the tendency to shift costs and losses to consumers with inelastic demands, and, in part, because price differentiation is a tax-and-subsidy arrangement which is, under the value-of-service concept, a function of demand elasticity and not income or redistribution goals.
   • Unless there is a deliberate decision to tax some so as to subsidize others:
     1) public utility prices, even when regulated, are a poor instrument to realize redistributive goals because they have limited potency, partially due to the magnitude of dollar-imbalance; resource-allocation criteria will have to be traded off for income-distribution criteria; the power to make rates is the power to discriminate and should be in government and not private (albeit regulated) hands wherever possible; and subsidy by rich of poor is not likely to be a workable utility policy, vis-à-vis other institutions, including government;
     2) amounts involved would be but a small part of the cost and/or benefit elements of larger programs transcending the utility itself;

3) the main function of the public utility must remain the provision of its basic service.
   • There will have to be greater suitability of direct government subsidy rather than cross-subsidies between utility consumers.

6. Severe limitations should be imposed on the ability of public utilities to capture through their rate structures the external benefits which their activities create.
   • Utilities already use the value-of-service principle as the major criterion of rate making.
   • These would interfere with redistribution goals.
   • Rate-level or earnings limitations really are the more important constraint.

7. Avoid burdening the price system with a problem which is really one of institutional adjustment and organization.
   • Even when the problem is one of institutional adjustment and organization, it may involve reconstruction or extension of market institutions (whether regulated intensively as public utilities or not).
   • Avoid private financing of public goods where unable to internalize externalities; otherwise this makes the public utility an equivalent to a special assessment district.

8. Recognize that business costs are partially a function of law, and that law could be used to change the pattern of costs, including the structure of utility rates which are costs to others; however, caution must be used against over-reliance on such reasoning on grounds that it opens too many doors for error, injustice, and abuse (e.g., aggrandizing benefits, shifting costs).

9. More important is the relation of public utilities to social problems wherein the public utility is a vehicle of realization of externality solutions independent of a rate structure, i.e., the relation of externalities to the theory of public utility regulation.

IV

In the preceding section the argument was essentially negative with respect to the use of public utility prices as instruments or
levers of externality-solution strategies. Nevertheless, this does not mean that public utilities should not be or cannot be made part of efforts to solve social problems such as urban redevelopment. Rather, the public utility institution is capable of such participation with an equal emphasis placed on an affirmative and limited role.

What is involved is the theory of public utility regulation. This theory concerns the place of privately owned but governmentally regulated utilities in the total economic decision-making structure. Ultimately it has to do with the decision making or power position of utilities. More immediately, however, it concerns the social functions entrusted to and expected of utilities, i.e., with the tasks which utility management undertakes to perform; and most controversially, with the opportunities for action, growth, status, and profit accorded the utility and its management, and conversely the combination of restrictions and exposures to the opportunities of other decision-making centers imposed upon the utility and its management. Historically, the thrust of the general, although ambiguous, theory of regulation has been—in theory, if not fact, it should be underscored—the substitution of regulation for competition and the imposition of restrictions upon the utility’s capacity to charge unreasonable, exorbitant, or discriminatory prices.

With respect to the general power position of utilities—i.e., the combination of opportunities and restrictions and functions. Adams and Dirlam identified four possibilities: first, the general competitive model reinforced by suitable antitrust laws to promote both competitive market structure and competitive behavior; second, the existing system of static regulation, assuming the foreclosure of competition and the relative staticity of technological change; third, static regulation-cum-competition, with the thrust of regulation being to promote a competitive market structure insofar as is possible, treating market structure not as a given but as a dependent variable with the regulatory authority possibly exercising supervisory duties with respect to competitive behavior; and fourth, a model of dynamic regulation, “where the variables of market structure and rates of innovation, and their interaction are part of the subject matter of regulation,” in which the regulatory authority would promote both competitive market structure and technological innovation, in part using the latter to promote the former and vice versa. Adams and Dirlam support their fourth alternative and juxtapose to it some of the criticisms levied against the perceived results of the existing system of commission regulation:

... the inherent bias of commissions in favor of the status quo—and the consequent hostility to changes in the environment which threaten their static form of regulation ... . The obsession of the commissions with preserving a regulated’s fair share of a particular market or maintaining a proper balance between different modes of transportation or communication has lent credence to the charge that regulatory commissions are more concerned with protecting the vested interests of their regulated than promoting the public interest in innovation and progress. More than a germ of truth lurks in the claim that regulation breeds more regulation and that regulation is but a disguise for privilege creation and protectionism.”

Not only does the Adams and Dirlam analysis articulate the existence of several rival alternative theories of public utility regulation, but their criticism of existing regulatory practices presents grounds for caution. The use of public utilities in externality-solving strategies and structures presents the possibility for disguised self-serving for the sophisticated and subtle avoidance of costs and arrogation of benefits under the rationalization of promoting the public interest or particular externality solutions. Reward for services rendered is one thing; abuse based on privilege and/or inadherence to another, however difficult they often are to distinguish.

It may be further pointed out that John R. Feiton suggested a fifth alternative model, namely, “dynamic regulation with technological change but without effective competition.” He emphasized the constraints on the promotion of effective competition, and that the model appropriate for one industry (e.g., transportation) may not be appropriate for another (e.g., electricity).

An alternative approach to the theory of public utility regulation is a social goals approach, whose thrust goes beyond what normally would be the aims of the competitive market and much of status quo regulation, and superimposes additional objectives and policy


41. Ibid., p. 146.
goals, but within the context of private enterprise and market conditions. According to this approach, considerations of social purpose would be added to the relatively narrower or less ambitious principles of conventional regulation, though such would presumably be less ambitious than under government ownership. Although the regulated utility would remain a private regulated enterprise, it would be used as a mechanism through which to secure additional social purposes beyond those for which regulated utilities have generally been used, or at least more ambitiously so than in the past in this country.\footnote{42}

The social goals approach thus directly adds to the variables of (a) general existence and relation of regulatory commissions to public utilities; (b) market structure in regulated industry, including combination of elements of competition and monopoly; and, inter alia, (c) posture toward technological change and vested interests generally, and (d) the relation of the public utility to externally-solving strategies and solutions.

Perhaps the classic examination of the social goals approach is that made by Bonbright in his analysis of social principles of rate making. According to Bonbright, social principles of rate making...

... refers to any policy of rate control designed to make the supply of utility services responsive to social needs and social costs, and rejecting as even tolerable measures of these needs and these costs the prices that consumers are able and willing to pay for the services and the money costs that the enterprise must incur in their production.

As Bonbright points out, the social principles approach to rate making is typically justified or rationalized on two grounds—the ability to pay and diffusion of benefits principles. In connection with the latter principle, consideration of externalities enters the picture. He states...

... according to this principle, the benefits derived by the community from public utility service are by no means limited to those persons who pay for the service either directly as consumers or indirectly as the purchasers of products made by the aid of their services.

His examples are particularly germane to urban redevelopment: traffic congestion, industry decentralization, and population decentralization, though addition of such further examples as minority group job mobility and employment opportunities underscores the fact that Bonbright's discussion could not have reflected the great urgent quality of the social problems considered herein, though his analysis is no less instructive on that account.

Bonbright is generally negative with regard to the inclusion of social principles of rate making with respect to both pricing per se and the utility as an institution. He points out that American rate making has adhered in the main to the standard of service at cost, and that even most of the departures therefrom have been due to administrative, historical, and business reasons rather than to 'social' reasons. If the social considerations were to become dominant, the enterprises to which they apply would cease to be public utilities in the accepted sense of the term. They would then become socialized... in public schools, the tax-financed or endowed universities, and (to a greater degree) the police, the courts, the navy, and the city-street departments.

He then surveys particular arguments against the ability-to-pay and diffusion-of-benefits principles. In the case of the former, Bonbright emphasizes the relative impotency of public utility prices to serve in a role corrective of maldistribution: "... the more promising attack on the maldistribution of cash incomes lies in a more direct attack on the maldistribution or on its causes, not in the administration of antitoxes." He maintains, with respect to the latter, that a "far more persuasive case can be made for departures from cost pricing with respect to services, the performance of which serves important community needs in addition to those needs for which it is feasible to exact a price." He points out that externality considerations in the form of benefit-diffusion might be used to justify higher rather than (as is usually the case) lower public utility rates. He also points out that "there is the extreme difficulty of prophesying and measuring indirect social benefits and social costs," while at the same time "there is the certainty that exaggerated claims of community benefits will be put forward by pressure groups." He also anticipates the Coase\footnote{44} argument that "there is the question whether the indirect benefits from the production of any given public utility service will be greater than those that would result from the alternative production of other com-
modities and services offered for sale at market prices that do not take social benefits into account.145

Bonbright’s conclusion is directed to both public utility pricing and to the role of utilities in externality solutions, though particularly the former. And his conclusion is essentially limited and negative but not unqualifiedly so:

If the tone of this chapter is somewhat less than enthusiastic for those views of rate making policy said to be based on social principles, the coolness is not due to a belief that these views have no place in the theory or practice of public utility rate making. It is due, rather, to a conviction that those services now called public utility services belong in that great class of economic products, including both commodities and services, that can best be offered for sale instead of being supplied without charge, and that can typically best be sold on the general principle of service at cost rather than at prices designed by a legislature or public service commission to accomplish some specific objective deemed by it to be in the public welfare. This conviction is supported by a recognition of the greater importance of socialized services in other sectors of a modern economy. Even aside from the burdens of national defense, the Federal, state, and local governments will be called upon to devote increasing shares of the total national income to the production of services, such as those in the fields of health, education, and recreation, that cannot feasibly be distributed by the mechanism of the price system. In order to finance these needs for truly collective services, the tax system will be put under heavy strain, as indeed it is put today. Only for compelling reasons should the strain be enhanced by the inclusion in governmental budgets of vast appropriations for subsidized utility and transportation services.

But the viewpoint just set forth merely expresses a general attitude, which is that of a rebuttable presumption in favor of so-called ‘business principles’ of rate making.146 Even if modern rate making policy continues to accept this presumption in the future, as it has in the past, it still faces the task of setting up conditions for successful rebuttal. This constitutes one of the most formidable assignments of modern welfare economics—that of developing principles of social valuation and of social-cost determination.147

The present discussion does not significantly depart from the reasoning employed by Bonbright, however different the conclusion.

Section 3 of this paper has further underscored his reluctance to allow externality or social-goal considerations to fundamentally alter either the public utility pricing process or the resulting structure of rates. And one must concur with his reasoning concerning simplistic and exaggerated specifications of the ability-to-pay and diffusion-of-benefits principles, particularly the former when it comes to rate making per se. But consideration of externalities, including redistributive aspects, in the light of the utter urgency of contemporary social problems seems to have gone far in overcoming in a general but nevertheless affirmative way Bonbright’s rebuttable presumption in favor of business as opposed to social principles of public utility operation.

The crux of this paper lies in the necessity for social organization for the production of externality solutions: solutions for air and water (including thermal) pollution, for minority employment, for recreational facilities, and, more encompassing, for urban redevelopment. The existence of externalities is largely a function of the organizational structure, i.e., of an organizational structure neither encompassing nor rationalizing the consideration of either total costs and total benefits sufficient to preclude the emergence of critical social problems of over- and/or under-production; that the realization of Leibenstein’s ‘X-efficiency’ extended to explicitly include the effectiveness of organization for production (here, of externality solutions) requires attention and cultivation; and that utilities are in generally important positions to participate in externality-solving strategies and structures. It would appear that the presently meaningful presumption is in favor of public utility involvement in such externality-solving strategies and structures—social principles of utility operation.

The foregoing considerations—notably but not exclusively (a) the fact of utilities as creators of cost and benefit externalities and (b) the urgency of the relevant social problems—suggest the following conclusions:

1. Affirmative but limited use should be made of the public utility institution (and particular public utilities) as instruments, levers, and vehicles for the creation and realization of externality solutions. They can be an active part of the organization for the production of externality solutions, but limited in that they largely remain private enterprise under commission (and perhaps other)
control, with the primary (but not sole) task of producing their goods and/or services as utilities.

2. Public utility management should direct its attention to optimizing what the utility can accomplish in doing what it normally does or should be doing in ways to promote the realization of externality solutions. Management should attempt to minimize— even with the incurrence of additional costs to be ultimately paid by the rate payer—the creation of externally imposed social costs, both directly and through cooperative participation in joint private and/or private-public ventures working toward the solution of such problems. It should also attempt to maximize the contribution which it can make to the creation of social benefits even with the incurrence of additional costs to be ultimately borne by the rate payer—within the constraint of not disrupting the primary service obligations and functions of the particular utility.

3. Public utilities should become included in private and private-public schemes for the realization of externality solutions, including those of a redistributive nature. For example, new structures could be created capable of internalizing the consideration and creation of costs and benefits, and precluding the development of (and effectuating the resolution of existing) social problems, and active participation therein by utilities. Also, there could be a limited but affirmative use of traditional devices and strategies, with active participation therein by utilities such as the creation of new market and non-market forms of organization, and the use of government subsidies.

4. Consideration should be given to the role of public utilities in the changing pattern of government-business, or at- tempted and characterized, for example, in John K. Galbraith's, New Industrial State.48

These conclusions should be sufficient to point the way or at least to identify the thrust suggested by this paper. Quite obviously, they do not (a) present solutions for the social problems considered, which a thorough statement of the role of utilities with respect thereto would have to include; (b) present a calculus whereby con-

operations and bear costs to minimize social problems, and opportunities for subtle if not outright abuse and chicanery.

The main point of the argument is not the adoption of a panacea, but rather the more vital involvement of public utilities in the social problems of our times. I do not contemplate—as the context of relevance—the remodeling of the public utility in the image of the Office of Economic Opportunity or any other similar operation; nor do I contemplate a vast proliferation of governmen: subsidies to private enterprise—indeed, in this latter regard I concur with A. R. Prest that "it is very possible that an increasingly complex pattern of subsidies, tax reliefs and so on is self-defeating, whether in defending one industry, one region or one person against another," 49 or, for that matter, in creating externality solutions. What I do contemplate is literally a change in posture on the part of utility management and greater managerial and corporate participation in the creation and implementation of new strategies and structures. I expect public utility management to remain as such, but to enlarge their horizons. This will at least signify their constructive participation in new programs to cope with the social problems discussed here. And I also contemplate that this participation will be truly constructive and with a minimum of utility-oriented self-serving declamations, rationalizations, reservations, and dissimulations. Utility executives should be less sensitive about the public image of utilities and more energetic about getting the job of attending to these social problems done.

Regulatory commissions should exercise their responsibility by educating utility management along these lines, by abetting the participation of utilities in externality-solving arrangements, and by serving as a countervailing force to the discretion of utility management. Here is, indeed, an area for commission leadership and for new approaches to regulation.

In particular, public utilities must be willing to compromise cost and perhaps some growth in the interest of combating air and water (including thermal) pollution through research and development to be sure, but also through pollution-abating techniques. Compromise in the short run coupled with successful resolution of

Electric Institute in his presidential address strongly urged that,

Our industry will remain free enterprise in the sense that decision-making will remain outside of government. But it will continue to incur more and more public and social responsibility than free enterprise is commonly thought to have.

Such a view undoubtedly appears radical to some or many in the utility industries. But is it truly conservative—quite aside from the virtues of being institutionally progressive—not to face up to critical problems?

This paper has suggested that without abusing either public utility prices or the institution of the public utility itself, the marginal social utility of the public utility institution, and of the firms which comprise, manifest, and embody it, can be vastly enhanced by their greater social involvement. The real significance of externalities is not to public utility rate structures but to the theory of public utility regulation and the place of public utilities in the developing American capitalism. Utilities should not get bogged down in rate structure changes which waste precious managerial talent. The importance of the social problems treated here as externalities, and the possibility of internalizing them through utility participation in large-scale organizations, warrants the trade-off of rate-structure improvements for utility activities promoting externality solutions. We must transcend the existing model of regulated utilities and also traditional approaches to managerial incentives—in public utilities and unregulated industries—and create new organizations with new incentives. The day must not be allowed to arrive when we realize first that the quality of American civilization has already been irreversibly compromised and second, and only then, that we should have developed our incentives earlier. The burden, of course, is not on the utilities alone; but their special public service character does mitigate in favor of a special leadership position for utility management. Public utility executives and the members of the regulatory commissions have the responsibility for carefully enlisting the public utility institution in the service of this country's efforts to produce externality solutions.

comment

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Professor Samuels has shouldered the burden of integrating welfare economics, utility pricing, and the role of the public utility enterprise in a society suddenly become sensitive to environmental degradation and social discrimination. He has juggled these diverse themes in an imaginative and yet analytically rigorous fashion, tantalizing us from time to time with glimpses of still further reaches for inquiry, beyond the bounds of even this far-ranging paper. From what is essentially an ethical commitment which infuses his argument and, which at its conclusion, focuses his paper on a program for a kind of moral rearmament for utility executives, I cannot dissent. There are no domestic social problems with a higher priority than urban decay, pollution of the natural environment, and the persistence of a caste system, each exacerbated and reinforced by a rapidly increasing population. If we applied PPB techniques to our research activities, we would probably be concerned with little else.

However, although heartily supporting the call to action, I must conclude that Professor Samuels' approach is in some respects un-
duly cautious, and in others insufficiently sensitive to financial and legislative constraints. On the one hand, he would have utility companies play a leading role in institutional innovation, yet from time to time he backtracks to emphasize the "severe restrictions on the capacity of utilities to serve in the social organization to produce solutions to ... social problems." Insisting that little can be done to change the structure of utility prices, he proposes at the same time broad and novel goals for the industry, with little indication of how to reach them. His ground rules assume the present system of commission regulation, including assurance of a fair rate of return. His discussion abstracts from the question of whether the public utility as an institution should be extended to areas not hitherto regarded as its responsibility, such as urban redevelop-

Nevertheless, in his conclusions, Samuels exhorts utility management to engage in constructive participation in new programs to cope with social problems. The self-imposed limitations on the scope of the paper prevent him from indicating just how the theory of utility regulation and the practice of management and regulatory commissions should be altered to achieve this result, so desperately needed. I will try to indicate in commenting on the three substantive decisions of his paper my major reservations about the analytical underpinning for Samuels's conclusions.

First of all, I would underscore the doubts that Samuels himself seems to have about the usefulness of classifying all social problems under the rubric of externalities. As he points out, in our society of ubiquitous interdependence, every decision we make as consumers, investors, or social beings can contribute to the persistence of social evils unless the decisions are made pursuant to a plan to combat these evils. When the concept of externality is broadened to this extent, far beyond such familiar phenomena as pollution or flood control, there would seem to be serious obstacles to assigning specific social cost or benefits to the behavior of any given producer or industry. Should Samuels not have examined one or more of the issues to show specifically how he could justify internalizing its associated costs—assuming they could be measured?

In short, to expand the term externalities to include consequences of such social behavior as the exodus from the central city or decisions to have more than two children weakens the concept's effectiveness. Perhaps we could measure the social cost per unit of ex-

panding population beyond the optimum. Yet, how could this cost be fairly imposed on families without making interpersonal utility comparisons? There are even graver difficulties involved in regarding race discrimination as involving externalities. True, some eco-

nomic disabilities are imposed on persons foreclosed from job opportu-

nities. One could perhaps measure the social cost of preventing disadvantaged persons from reaching their potential productivity levels. But this cost is already imposed, to some extent at least, on firms unwilling to make full use of the available human resource. A tax could, of course, be imposed on white industry that would through transfer at least compensate for the direct economic loss suffered by blacks. Apart from the question whether this loss is actually a cost avoided by industry, we cannot be sure that mone-

tary compensation would be sufficient to alleviate the psychological pain of being excluded from top decision-making groups. Perhaps all groups in a discriminatory society suffer psychological damage, apart from losses (say through riots) that the depressed groups manage to impose on the dominant caste. Hence it is possible to argue that to some extent these social problems have been inter-

nalized all along.1 The solutions to which we are moving cannot easily be justified by comparing marginal social cost and marginal social benefit; for instance, counting as cost the decline in land values that might result if blacks moved into an affluent white community, and as benefit the associated stimulus to the productivity of black managers.

More pertinent to the immediate topic, however, is the relation, if any, between the activities of public utilities and the undesirable effects of urbanization, rapid technological change, and expanding population, not to mention the caste system.

Public utility management by failing to hire black workers, and with some notable exceptions, failing to drive for a solution to urban problems, have undoubtedly contributed to the wasting of human resources. But they are not alone. The behavior of all institutions, including educational ones, having been negligent.2 A special connection with these


other externalities seems remote. My second reservation, therefore, is that Samuels fails to show that the public utility industry is significantly different from any other industry with respect to the generation of conditions resulting in substantial social costs. Nor does he show how, with one exception, public utilities might more effectively be able to offset or reduce these social costs. In Watts, he feels that availability of public transport could have raised incomes; but local transport in most areas is no longer a field for regulated enterprise. One would have liked to see a more detailed consideration of alternative solutions. Industry could be encouraged to move to Watts by a subsidy financed by taxes on land values in all-white suburbs. General Motors and Standard of New Jersey is order to raise the real incomes of disadvantaged groups could be asked to devise inexpensive, repair-free vehicles on the grounds that their upper income stockholders have benefited from and imposed the cost of a highway-oriented society.

Unless we begin with an analysis along these lines—first defining a social problem, and then examining alternative solutions to determine those which might best involve public utilities—it is left unclear how utilities as an industry could or should provide unique solutions for social problems. Samuels nevertheless holds that “public utilities are in a significant position in the economic structure to serve as vehicles, levers, instruments for the effectuation of externality-solving policies and programs.” The point may be that, being regulated, they are in a relatively weak position politically to resist pressures designed to force them to hire minority group members or to invest so as to maximize collective benefits from their installations. Samuels alludes to their vulnerability as regulated monopolies only in passing and without inquiring into the welfare consequences of imposing higher costs on stockholders, or rate payers, if utilities should be charged with new and extraordinary responsibilities.

In the second substantive part of his paper, Samuels begins his analysis of utility rates with an expression of helplessness and concludes that public utility pricing can by no means be used to achieve redistribution, or subsidization, or to finance public goods. The public utility is to be a vehicle of realization of externality solutions but not through its rate structure. Coming after his insistence that utilities should be in the vanguard in providing solutions for social problems, it is disappointing that Samuels finds nothing worth changing in the conventionally accepted principles of public utility rate making. He dismisses, without examining in any particularity, possible (though not necessarily consistent) roles for public utility pricing along the following lines:

(1) Large families impose heavy costs on society. Utilities might impose higher rates on families with more than two children, the base rising progressively with the size of the family; or they might delay or give lower priority to servicing such families.

(2) Ghetto residents might be given lower rates to compensate for damage imposed by society.

(3) The suburban-central city division contributes heavily to social problems. Electric and gas rates might be doubled or tripled in suburban areas. The result might be to lower suburban land values, but if accompanied by lower rates in cities, such a pricing structure could discourage the flight to the suburbs, particularly if the surplus were used to finance recreational areas in the cities.

(4) Central cities lack recreational facilities. Utilities could give lands or adapt hydro-electric facilities to recreation, raising rates to cover the cost.

In rejecting the possibility of using rate structure changes for welfare purposes (other than to achieve optimum allocation) Samuels relies on several lists of criteria for rate structures, beginning with Professor Bonbright’s, which are couched in old-fashioned utility textbook terminology. They are scarcely designed to cope with an era when disgruntled members of disadvantaged groups may toss a Molotov cocktail into a substation. Bonbright views regulation as a method of resolving conflicts of interest, although these conflicts simply mean that we are trying to maximize economic welfare while permitting monopoly of supply. The conflict between supply and demand is found everywhere. Rate stability and rate simplicity are not criteria that have to be reconciled with other goals, such as efficiency. Some characterizations of rate structure reduce cost of capital or shift demand by reducing costs imposed on customers. But such benefits should be measurable. With all due respect to Bonbright, his list of criteria should be superseded by a systems approach which would derive an optimum rate structure by simultaneously allowing for all costs and benefits.

Nor does value of service conflict with cost of service, in any fundamental sense. Value of service, if it has any technical economic
meaning at all, is discrimination practiced to assign common costs on the basis of inelasticity of demand. Professor Baumol recognizes this, and instead of speaking of conflicts of interest, refers to "unanticipated side effects." Similarly, I don’t see why we need an elaborate demonstration that simplicity should not take precedence over more sophisticated economic criteria. Are public utility pricing problems more complex than those of other industries, such as oil, steel, or aerospace? Samuelson appears to feel that an attempt to take into account externalities of the kind I mentioned earlier would unduly burden the public utility pricing process. But we might ask, what is the social cost of adding one more variable to those now taken.

It is disappointing that Samuelson did not devote more time to an examination of the regressive character of many utility rate structures. The essence of the value of service principle is that it lowers prices to customers with elastic demands at the expense of the customers with inelastic demands. The electric and gas consumer who bears the disproportionate share of the burden of overhead cost is, as everyone knows, the residential customer. The residential electric customer may very well be a ghetto resident, subsidizing an industrial customer, owned in turn by well-to-do stockholders. The economic justification for applying the value of service principle is that without discrimination there may be less than full utilization of the plant, or an inefficiently small plant, in which case the customers with the inelastic demand may have to pay even more than they pay under conditions of discrimination. William Vickrey has suggested, however, that unassignable common costs, or the gap that results from charging peak customers long-run marginal costs under conditions of long-run decreasing costs might be financed through assessments or in some fashion other than the application of conventional value of service principles.

Such proposals do not, of course, involve tampering with the price mechanism to achieve social goals. Most of the changes advocated by utility economists would actually provide for more precise allocation of capacity costs to the customers responsible for peaks than now prevails. Thus, Vickrey would raise subway fares in rush hours and lower them at other times in order to dampen peaks. Farrell would also make sure that no customer pays less than marginal cost, although he is convinced that long-run average costs for most utilities are rising, and that marginal cost is almost always in excess of average cost. Moving closer to marginal cost pricing could intensify the regressive features of the rate structure, because the lower income groups might predominate in riding subways at peak hours or in causing the daily peak in electric power. Only if regulation were artificated so as to reduce demand elasticity of industrial customer classes—which would mean control of prices of all substitutes—would it be practical to use rates to achieve a substantial income shift. Moreover, it is difficult to determine the ultimate effects on welfare of higher rates to industrial customers.

Nevertheless, there is an opportunity for modifications in utility pricing that are not de minimis, in order to achieve redistribution goals, as shown by Boston Consolidated Gas Company’s “Public Supported Housing Rate” which provides for a lower minimum

7. “In Defense of Public Utility Price Theory,” in Public Enterprise, ed. R. Turvey (Baltimore: Penguin Books, 1968), p. 44. It is interesting that Kahn, who sees long-run costs as decreasing, would not impose rigorous pricing conformity with marginal peak costs because he believes that utilities have, on balance, failed to give sufficient weight to demand elasticity.
bill and a lower rate for additional use than the rate for multiple apartment buildings not receiving federal or state aid. Therefore, I am not sure what purpose is served by Samuel's demonstration that marginal cost pricing of the pristine variety is probably impossible to administer. Rather, the issue is whether, in a specific situation, one should devise a new rate that will contribute something toward solving one portion of a social problem.

Samuel's conclusions on pricing seem to be unduly conservative. This is not because he would rely on marginal cost pricing, but because, recognizing it as a will-o'-the-wisp, he falls back on value of service. Surely, this stereotype should be re-examined by more precise quantitative inquiry into the characteristics, in terms of demand elasticities, social and economic characteristics, and customer classes and sub-classes, given the urgency of social issues.

In his final section, Samuel refuses to go along with Bonbright's rejection of the social approach to public utilities as institutions, although he accepts it as far as pricing is concerned. If utilities are to be active in solving the major social problems, as he proposes, without altering their pricing patterns—which must also mean not changing their quality or pattern of their service—then they must engage in types of activities not normal for public utilities. From Samuel's discussion, I am not sure whether this is what he wants. Would he regard favorably the activity of Eastern Gas and Fuel Associates, the parent of Boston Consolidated Gas, which became involved in two rehabilitation programs because "together the opportunity to use real-estate depreciation as a tax deduction . . . (and) the revenue to the Gas Company . . . created the economic carrot that made our entry into the critically necessary low-income housing field reasonably justified on a financial basis"?

Although Samuel states that public utilities should attempt to minimize the creation of externally imposed social costs and maximize their contribution to social benefits, he does not tell us what the limits are to these maxima and minima, nor does he tell us what

Comment

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Professor Samuels’s paper carefully points out the many ramifications and their implications of any attempt by public utilities to deal with externalities; that is, the social, economic, and political environment within which they operate. Quite reasonably he expressly avoids consideration of particularities—each of which could be the subject of a paper in itself. For my comments, however, I would like to turn to some specific instances because it will help to illustrate that we are further down the road in our thinking and execution of externality solutions than Samuels’s paper would imply.

First there are what I call environmental problems. Most prominent of these are air pollution, water quality, and aesthetics. The avoidance of material impairment of air and water quality seems to be rapidly losing its status as an externality. The cost of measures to reduce contamination of the atmosphere and to dissipate the waste heat from thermal plants is becoming an ordinary cost of doing business with the advent of more pervasive and more specific regulation. Nevertheless, this still leaves borderline questions as to what air contaminations are material and what extent of heat dissi-
tion is adequate. However, public utilities will be doing more than their share in coping with these problems, which have reached their present magnitude as a result of contributions from every part of our social and industrial complex. Still, as Samuels suggests, coping with these specific problems brings further externalities into play. For example, evaporation in a tower to cool condenser discharges from a thermal plant will consume large quantities of fresh water and in many parts of this country fresh water is an increasingly scarce resource. Viable mechanisms for balancing such unde- sirable consequences against the immediate evils of thermal pollution are unfortunately lacking in our present regulatory framework. Aesthetics is another environmental problem and in some ways a comparatively new one. In the past, the presence of poles and wires was regarded as a negligible visible penalty for the advantages of electric energy. Today, many electric companies have adopted policies which keep to a minimum the construction of new overhead distribution lines. Instead, a substantial program is pursued to place existing overhead distribution lines underground in a response to what society wants and should have. This is admittedly a value judgment which many will believe has been slow in coming, although even now it is questionable whether in a popular vote a majority would think it worth the costs entailed. Samuels cautions utilities not to be too concerned about their public image, but I cannot agree. The undergrounding of distribution lines has been advocated because electric companies can make more money as a result. Samuels points out a number of times, their primary business is that of providing utility service. It must be kept in mind too that they are under strong and constant pressure to hold their rates down. I do not believe that they pay undue attention to their corporate image when they pay heed to this pressure.

Recreation is another area where externalities are directly related to utilities' activities. Primarily, utilities are involved in recreation in connection with hydroelectric projects. Storage reservoirs create entire new recreational centers. Utilities are constrained to keep interference with downstream fish life to a minimum to provide passage around dams for anadromous fish and to maintain reservoir levels with some regard for public recreational needs. In addition, however, utilities participate in the development and maintenance of such recreational facilities as campgrounds, boating facilities, roads, trails, and even elaborate resort complexes. These recreational facilities are generally open to the public without charge or for nominal fees and are not productive of net revenue to the utilities. Although a good case can be made for having the recreational supplements to hydroelectric projects financed and maintained entirely by governmental agencies, utilities have interpreted their external responsibilities to require them to share a substantial part of the cost. One of the newer forms of utility expenditure on externalities has been in the field of minority employment. Here, of course, I am referring not to mere avoidance of discrimination against minorities, but to the conscious endeavor to provide special opportunity and training for particular individuals who do not come prepared and adapted to our needs for workers. The particular activities of my own company in this field are too numerous to describe here, but I think they demonstrate a keen awareness of the society in which we live and to which we endeavor to contribute. Indeed, our efforts make us one of the leaders in this field. But, whether public utilities should undertake special activities far beyond and above that of other businesses is a major question raised by Samuels for which I do not have an answer. With a rather substantial inelasticity in much of the demand for their services, they may have opportunities to obtain and consequently spend revenues which are not available to other enterprises, but this opportunity should not be exploited just because it is available. As Samuels points out a number of times, their primary business is that of providing utility service. It must be kept in mind too that they are under strong and constant pressure to hold their rates down. I do not believe that they pay undue attention to their corporate image when they pay heed to this pressure. There is no validity to the assumption expressed by many economists that utilities are motivated to expend capital unnecessarily simply to expand their rate base. Their restraint in the installation of underground electric facilities is ample evidence of the desire not to expand their rate base unnecessarily. Anyone who has had to obtain approval of expenditures through the various levels of management and finally by an executive committee would never accept such an assumption. There are several reasons why the free spending assumption is not true. A basic reason is that, even if motivated only by economic incentive, utilities would be inspired to operate in
as efficient a manner as possible in order to maximize earnings between rate cases.

The American spirit of competition is also an important factor for efficient operation. Utility executives wish to stand high in their respective fields. A measure of their success is the efficiency with which they perform their utility obligations and the respect they gain by being concerned with their social responsibilities as good citizens.

Another limitation is imposed by regulatory commissions in reviewing the need for large expenditures for such items as facilities for electric production and bulk transmission. Public utility companies are a prolific source of tax revenue. Something like 23¢ out of every dollar received from a customer goes to one tax collector or other. This is a very substantial contribution toward governmental endeavors to deal with externalities. It is unfortunate that some 20 percent of the electric rate payers in this country, who are served by governmental and cooperative electric systems, make no such contribution, but that is a separate subject. I bring it up only to emphasize that customers are doing a great deal toward meeting the problems of externalities.

A very important item which seems to have been overlooked in Samuel's paper is the people who are involved in supplying the energy needs of our civilization. Competent and highly motivated people must be attracted to the industry. Graduates from colleges and universities with a sense of responsibility who are anxious to meet the challenges of our rapidly growing America, instead of retreating from them are especially needed. It is here that the academic community can be effective.

As for the utilities, by reducing air and water pollution, improving the aesthetics of utility facilities, developing recreational facilities, employing and training disadvantaged people, and shouldering a substantial tax burden, public utility companies are already a long way down the road in coping with externalities.

There is need for further improvement in many areas, of course, and it is stimulating to be made aware of the various points of view of those concerned with the environment and the place of utility operations. Many needs have been expressed but there have been only a few concrete suggestions for solutions. However, no lasting solutions will be found without the cooperation of all concerned. We need the thinking of the academic community, the setting of policy regarding environment and social goals by our governmental and regulatory bodies, and the requirement for those in the business world to point out what certain goals will cost in terms of time, talent, and money. Finally, those in the utility business must try effectively and efficiently to execute policies developed in harmony with objectives of governmental bodies and regulatory commissions. However, the magnitude of the problem requires that other businesses in the private sector of our economy, as well as privately-owned utilities, must recognize the necessity for active participation in dealing with our national problems in order to effectively confront the economic and social concerns of our country.
Administrative Controls
and Regulatory Behavior

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Regulation, as it is usually administered, experiences numerous defects that have been widely noted and documented by others. Richard Posner's recent examination of the regulatory process leads him to conclude that its costs probably exceed its benefits, particularly when viewed in the long run. Although he makes an impressive case for market over administrative controls, he acknowledges that de-regulation is not politically feasible. Thus, despite a preference for de-regulation, he advances the following four recommenda-

1. R. A. Posner, "Natural Monopoly and Its Regulation," Stanford Law Review, February 1969, pp. 548–643. As will be evident, I rely extensively in this paper on Posner's evaluation of the regulatory process. Although parts of my discussion emphasize differences rather than areas of accord, this in no sense implies basic disagreement with the bulk of Posner's analysis—which I find, at once, to be the most current, complete, and provocative treatment of regulation.
tions instead: (1) regulatory controls should be generally relaxed; (2) regulatory agencies should give more emphasis to research and analysis (such as the Federal Power Commission’s National Power Survey, 1964); (3) sounder pricing principles should be designed; and (4) proposals to extend regulation to new industries should be resolutely refused.

The proposals advanced in this paper do not clearly fall in any of Posner’s four categories—although my suggestion that selective regulatory initiatives be exercised has the appearance of violating the first. I merely note that I agree with his second proposal and would judge that marginal cost pricing (appropriately qualified) provides the essential theoretical framework upon which to base further studies of the pricing question. Also, the last proposal faces formidable political obstacles. Moreover, while one might agree that regulation, on the average, has net negative consequences, this still leaves open the possibility that it works (or can be made to work) reasonably well in some circumstances. If, therefore, one were confident that (prospectively) the favorable cases could be distinguished from the unfavorable, a policy of examining individual proposals for extending regulation on the merits might be preferred over Posner’s recommendation that the extension of regulation be arrested completely. A substantive research question is thus posed at the outset: what product, customer, and other circumstances are conducive to the successful application of regulation to an industry?

This paper does not, however, deal directly with this issue. What I propose instead is that regulation should activate the “efficiency audit” and institutionalize regulatory lag while simultaneously free-

2. Ibid., p. 841. I originally misinterpreted Posner and assumed that his view that “the principal danger in administrative relaxation of regulatory controls is that it will be selective rather than across the board,” was intended to apply generally. From correspondence, however, it is evident that his concern is with partial relaxation that is inconsistent, rather than with differential adjustments in the regulatory machinery.


ing up product and capital market controls. So as better to assess this proposal, I attempt in Section I to examine the inherent limitations that regulation is subject to. For regulation to be designed heedless of these may result in an excessively ambitious statement of the regulatory objective and stand as a virtual invitation to failure. But while one might agree that administrative controls have defects and that self-regulation is to be preferred over administrative regulation where it can be secured, the problem of inducing self-regulation still needs to be faced. Section II deals with the regulatory initiatives mentioned above. Essentially the argument reduces to a proposal that regulation should attempt to provide signals and incentives that will mobilize the product and capital markets when self-regulation breaks down.

1. Limits of Regulation

Regulation is not a zero cost remedy. Before invoking it, the limitations of regulation need to be assayed. Moreover, if it is employed at all, regulation should be designed with the limitations which this form of control experiences clearly in mind. Thus, although regulation may be able to correct some of the defects that would otherwise result under an unregulated form of organization (e.g., by eliminating wasteful, if only transitory, duplication of investment and restoring price to cost ratios to acceptable levels), it does this at some expense, invariably weakens the profit and loss incentives that the market provides, and may lead to perverse, protectionist results.

Too little regulation can be a sham and serve to legitimize monopoly gain. But there are also dangers that regulation will overreach and give rise to side effects that could have been avoided with restraint. It is the purpose of the remaining discussion in this section to identify what the principal sources of “regulatory failure” are. These are discussed from the standpoint of constitutional defects in the regulatory process. The emphasis will be exclusively on the inherent organizational shortcomings of the regulatory process. The disincentives and distortions that are attributable to the introduction of constraints into the regulated firm’s maximization calculus are not developed here. I merely note in this connection that profit and entry regulation frequently induce adaptive responses.
Inefficiency (both in the sense of "slack" as well as distorted factor combinations), aggressive pricing (even, possibly, reductions in price below marginal cost) against competition encountered at the boundary, and laggard technological development are among the effects discussed elsewhere by others.4

1. Definition of the Task

Regulatory agencies are typically given broad responsibilities to serve the public interest with respect to the products and/or services under their jurisdiction. The Federal Communications Commission, for example, has as its standard for the issuance of licenses "public interest, convenience, or necessity." It is obvious that specifications of this kind are nonoperational. This would appear harmless, perhaps, but unfortunately imprecise responsibilities often lead to vague and inconsistent regulation. Especially in view of the inherent control weaknesses that regulation experiences, attention is easily shifted away from matters for which regulation potentially could be effective to become absorbed in formalistic detail. The transformation is perfectly natural and once achieved has high survival properties under what has been characterized elsewhere as "Gresham's Law of Planning": programmed activities drive unplanned activities out of existence.5 Lacking operational specifications of regulatory responsibilities, form rather than substance tends to be emphasized, with the result that routine procedural matters tend to become dominant. Such a result is avoided mainly by making substantive activities sufficiently explicit that these become part of the programmed activity of the organization.

It is not surprising that legislatures prefer an assignment of broad rather than specific regulatory responsibilities. They frequently lack the expertise needed to evaluate the regulatory issues and are subjected to conflicting pressures themselves. The safer course for them is to shift the burden of giving content to the regulation to the agency and the courts. But were it made evident that the unidrected implementation of broad mandates predictably leads to ineffective control, this might be corrected. The obvious remedy would be to restrict regulation to an operational subset of problems, deliberately refraining from an ambitious (and ambiguous) assignment of responsibility. Lacking a priori knowledge (or ex post evidence) that unregulated behavior with respect to a particular class of performance is clearly apt to be unacceptable, the rule would be: leave performance on this dimension unregulated.

The above rule introduces an element of uncertainty into the regulatory posture through the ex post qualification. Fortunately, however, regulatory uncertainty of this sort (as distinguished from that which results when regulation is assigned an unspecific public interest responsibility) need not have entirely undesirable consequences. For one thing, if the uncertainty is acknowledged from the outset and if franchises are awarded by bid, prospective franchisees will reflect the uncertainty in a lower bid price. The effect, therefore, is for the franchising authority to absorb the costs of uncertainty, which may frequently be an appropriate way for it to be borne.

Not only might the ex post rule be desirable for this reason, but the existence of regulatory uncertainty may give franchisees the incentive to police their activities in a self-regulatory manner. Especially if the regulatory agency is conscientious in discharging its regulatory responsibilities over the subset of issues for which regulation has been made explicit, and if the effectiveness of regulation is made evident in these restricted respects, franchisees will hope to forestall the extension of regulation by behaving voluntarily in a way calculated to yield socially acceptable, unregulated performance.6 Thus the threat of effective extensions of regulation may be


6. There is at least a hint that firms potentially subject to regulation behave in this way in the study by George Stigler and Claire Friedland, "What Can Regulators Regulate: The Case of Electricity," Journal of Law and Economics, October 1962, pp. 1-16. Their failure to detect evidence in the data that the performance of regulated electric power firms is different from their unregulated counterparts may be due, as they suggest, to genu-
used strategically to induce behavior fully as desirable (and at lower administrative cost) than the fact of regulation would itself produce. Indeed, the resulting unregulated performance will possibly be even better than what regulation would produce. For one thing, apprehensive franchisees may voluntarily take up positions that are well within the limits which regulation would impose. (As is well-known, specification of "acceptable" limits stands often as an invitation to crowd the boundary.) Second, self-regulation experiences fewer disincentives of the sort that Baumol describes than administered regulation. Third, administered regulation when extended too broadly experiences debilitating weaknesses.

2. Control Weaknesses

To better evaluate how effective regulatory controls might be, it will be useful to consider a general control model for the enterprise. I have proposed elsewhere that an augmented version of W. Ross Ashby's model of the ultrastable system permits one to assess the effectiveness of a variety of enterprise control devices. The argument there was mainly concerned with capital market controls, but the same type of analysis is at least as well suited to dealing with regulatory control.

Ashby is concerned with the problem of providing the minimum specifications for a system to adapt appropriately (in the sense of maintaining survival, if nothing else) to environmental change of two types. First, the system experiences frequent, small changes to which the adaption requires only a change in degree. Second, the system experiences infrequent, large changes to which the adaption requires a change in kind. Assuming that the organism is already in a state of equilibrium, changes of the first type require only that the system preserve the state, while changes of the second type require that it be able to shift to a new stable form. He then shows that the appropriate adaptive control system will be one with double feedback. A direct feedback loop will exist between the environment (E) and the "main variables" of the reacting part (R), and this will permit adjustment against small, frequent disturbances. The second feedback loop will pass through the "essential variables" (V) to a step-function generator (S), and this permits adjustment to large, infrequent disturbances that threaten to push the essential variables out of control limits under the existing specifications. In a sense, a two-stage hierarchy is set up. The secondary control loop both monitors and supplies direction to the reacting part. It discharges what is typically regarded as a "management" function. The specification of control limits on essential variables can be viewed as a goal determination process to be implemented under the rules and parameter values supplied at the step mechanisms. Subject to these constraints, the routine operating requirements presented by the environment are discharged by the reacting part.

A detailed discussion of the system as it applies to brains living and mechanical is given by Ashby. Stafford Beer has examined the system in a normative way as it applies to decision and control processes in corporate organizations, while I have been concerned with using it as a means for characterizing the properties of alternative corporate control techniques. Rather than repeat the argument here. Figure 1 reproduces a slightly augmented version of an ultrastable system. The major difference between this and a "pure" version of the ultrastable system is that a direct connection between the reacting part and the essential variables, including a data distortion capability (D), has been introduced. The latter becomes operative when own-goal pursuit by the reacting part occurs. The principal points at which control potentially can be exercised in this system are shown by the heavy arrow constructions.

11. It might be more realistic to trace the data transmission first from R to S and then from S to R. Distortions may develop in both links. Our use of the direct R to V data transmission can be regarded as a simplification representing a composite of these two links.
Consider the possibility of exercising control by specifying minimum performance constraints (C). Control at the essential variables of this sort will be referred to as *ends-specification*. This takes the form of either changing the control limits on existing essential variables or of introducing different performance constraints. But in neither case is any specific direction supplied; the only requirement stated is that certain performance goals be met. The details by which goal satisfaction is secured are therefore left for adjustments at the step mechanisms in conjunction with the reacting part to work out. Thus, however powerful ends-specification is in principle, implementation is not assured; the support of other parts of the organization is required for goals to be translated into action programs.

Note in this connection that effective ends-specification requires that the authority specifying the ends be knowledgeable of the capabilities of the system, including an understanding of how changes in the environment affect the size and shape of the “opportunity set” within which the reacting part operates (where opportunity set is used in the sense employed by Gary Becker). Lacking the necessary competence or information to make these judgments accurately, ends can only be specified in a crude way. Ordinarily this implies a bias downwards, since to specify unattainable ends induces dysfunctional behavior in the system. Moreover, repeated specification error of this sort exposes the ignorance of the ends-specifying authority and tends thereby to erode its standing.

A more active variety of control would involve intervention at the step mechanisms (C). Control of this type is referred to as *means-specification*. Whereas control at the essential variables involves output requirements, control at the step mechanisms entails input specifications. Performance programs supplied to the reacting part may be shifted or elaborated by controls exercised at the step mechanisms. This more active variety of intervention presumes a higher order of expertise on the part of the controlling agency than is required for essential variable controls. More precise knowledge over internal operating conditions and of the interaction between main variables is essential for intervention at the step mechanisms to be effective.


13. The step mechanisms can be viewed as devices by which behavior is shifted from one class of performance program to another, the appropriateness or not of each change being tested by a trial and error process. Clearly, for a control agency to intervene at the step mechanisms and induce better performance (quicker adjustment, higher level attainment) than the unassisted adoptions that the step mechanisms will make by themselves in response to goal failure, the control agency must possess either an overview or expertise superior to that of the unassisted system.
An additional way in which a control agency might intervene is by changing the composition of the reacting part ($C_a$). If the reacting part behaves in a purely functional way, this involves only technical changes. Components that are technically "better" (quicker, more accurate, less costly, and so forth) would be substituted for or used to augment existing components under control of this sort. Consider now, however, the possibility that an identity of goals among the parts of the organization does not prevail. Where goal differences between the control unit and the operating unit exist or can be anticipated, an additional set of control processes may be activated. Selection and training procedures designed to homogenize the reacting part can become important. The use of pecuniary rewards to enhance the effectiveness of promotional policy can also be expected.

The strategic use of information also becomes important under these conditions. Since the control unit is dependent on the data reported by the reacting part to make performance judgments, an operating unit bent on pursuing own-goals can advance its objectives by filtering and distorting the data. A variety of data checks may therefore be employed. 14 One such possibility is to employ the technique proposed by Andrew Stedry of distorting the data supplied to the reacting part in a way designed to induce desirable performance. 15 Thus the control agency might tap into the data line between the environment and the reacting part and selectively adjust the data so as to offset the effect of goal difference ($C_a$). Hence, to the extent that they can be anticipated, such biases can be partially defeated by prior bias adjustment. A second possibility is to use periodic audits to establish the fidelity of reports and the effectiveness of performance ($C_a$).

Manipulating the environment ($C_e$) is not ordinarily regarded as a control option. This appears mainly to be a matter of convention, however. Ability to control the environment is frequently ap: to be among the most powerful of control techniques. Thus one might regard collusion with rivals as a control activity that is designed to provide the firm with a more favorable environment—albeit that this conceives of control in a reverse way from which it is ordinarily expressed. Lobbying to influence the political process might similarly be regarded. The kinds and amount of data supplied to the capital market may likewise affect the degree to which controls from this source are efficacious. Controls exercised by the management of the organization at $C_e$ can thus be regarded as ones that are designed to expand the opportunity set of the firm.

Although the above discussion runs mainly in terms of what an internal control agency (principally the management supported by an elite staff) might perform, Ashby's characterization of the ultra-stable system is sufficiently basic to permit him to establish broad generality: "any system that has essential variables with given limits, and that adapts by the process of testing various behaviors by how each act ultimately the essential variables, must have a second feedback formally identical (isomorphic) with that described here." Assuming that the salient control points have been correctly identified, any proposed control device should, in principle, operate through one or more of the six control categories. 17 Moreover, the efficacy of a proposed control arrangement should be estimable by examining the access which the intended controls have at each of the $C_a$. What should be examined now are the control consequences of superimposing a regulatory authority, which is an external control agency, on the management of the firm. How effectively might a regulatory agency exercise control to produce behavior that conforms with its objectives? What are the limits of its powers with respect to each of the $C_a$? 18 Thus:

14. For a more complete discussion, see Anthony Downs, Inside Bureaucracy, New York, 1967, pp. 118–31. Among the anti-distortion devices that he discusses are redundancy, external data checks, creation of overlapping areas of responsibility, counter biases, and coding. Some of these are mentioned below.

C1: Regulation can influence control at the essential variables by fiat, by executive selection, or by incentive. Since refined control by fiat presumes expertise, and since typically regulatory agencies are lacking in this respect, only essential variable control of a gross variety can realistically be expected. Overall rate of return control, together with limitations on conspicuous expenditure items, may be the extent of it, although the regulatory authority may also supply background pressure to assure the adequacy of capacity to meet prospective peak demands. Executive selection, while potentially a powerful control device, is not directly within the purview of the agency. Only for gross malfeasance would someone be forced out of office; and then the regulatory agency would be unable to name his replacement.

Incentive regulation attempts to induce the management voluntarily to specify values at the essential variables that conform to regulatory intentions. Rarely, however, have truly self-regulatory incentives been devised. Partly for this reason, incentive regulation has not been widely utilized and is commonly held in low esteem.

C2: Control through performance program specification is limited. The management of the firm is responsible for operations, and “second guessing” the management on decision rule questions is not regarded as a legitimate or appropriate function of the regulatory agency. Three types of constraints can, however, be imposed. First, in conjunction with control over rate of return, compensatory and nondiscriminatory pricing rules can be prescribed. Second, the regulatory agency can impose standard accounting practices and reporting requirements. Pricing rules may be difficult to police, although standard accounting practices can sometimes facilitate this. Third, financial “recommendations” may be made with regard to such matters as the appropriate selection of a debt-equity ratio. In no sense can control at the step functions by a regulatory agency be regarded as extensive.

C3: Controls over the reacting part can be divided into two types: technical and personnel. Regulatory agencies typically regard both as management prerogatives. Stipulation by the regulatory agency of appropriate techniques is ordinarily limited to essential variable control—e.g., safety requirements. Subject to such conditions, selection of equipment and operating practices are management’s to make. Stipulation of personnel assignments is likewise inadmissible. Ex post evaluation (in conjunction with C3) may sometimes be attempted, but with uncertain purpose or effect.

C4: No attempts are made to manipulate the data coming to the firm from the environment. The regulatory agency that attempted systematic data distortions would surely find such action to be politically indefensible. Thus no controls are exercised at C4.

C5: The regulatory agency may perform some gross performance checks through auditing and comparative performance analysis, with special attention to conspicuous expenditure items, but genuine internal efficiency checks are rare.

C6: The regulatory agency typically regards itself as a means of insulating the regulated industry from encroachments. It usually attempts to extinguish variety rather than promote it. Product and capital market pressures are deliberately attenuated. By reason of the administrative intervention of the regulatory agency on behalf of the regulated firm and industry, the environment is made more benign (less hostile).

One concludes that, by comparison with the controls which the management of a firm can exercise at these strategic control points, the controls that the regulatory agency typically has access to must be regarded as weak indeed. It is simply unrealistic to expect an external agency itself to make “fine tuning” adjustments by intervening at C4 through C6. Not only is this impractical, but any such attempts are apt to be counter-productive. Extensive intervention here would upset management prerogatives with likely dysfunctional consequences. This same judgement, however, is less clearly indicated at C5 and C6. Conceivably there are strengths to which administrative agencies can play at these control points which, in combination, promise more effective regulatory results. Might the regulatory agency perform genuine internal efficiency checks at C6 and, supported by these evaluations, unleash market forces at C4 which then operate at C5 through C7? Section II is devoted to an examination of this possibility.
3. Political Vulnerability

Lack of sustained political support leaves the regulatory agency vulnerable in several respects. First, it can be forced into line by legislative refusal adequately to fund an “uncooperative” commission. Second, appointments to the agency can be made in a way calculated to achieve a weak and uninspired regulatory result. When this happens among the appointed commissioners, it is rare that a quality staff can be maintained to support the agency’s activity. Third, the regulatory agency can be harassed by investigations and political interference which sap the agency’s energies and put it on the defensive—hardly a condition to encourage the decisive disposition of regulatory issues.

Although political non-support or interference with regulatory affairs is not an inevitable result, it is not uncommon in the life-cycle of a regulatory agency for this to develop. This is especially true if the agency’s responsibilities have been assigned too broadly—expressed in global or unspecific terms. Left to work out its relationship with the industry, the agency finds that the only viewpoint persistently, forcefully, and operationally advanced is that of the industry. As the agency matures, the initial “force that gave it impetus is spent. . . . it loses its taste for conflict. Divorced from other sources of support, it turns for strength to the industry it regulates.”19 Lacking standards of its own it comes to identify with the industry’s standards. Thus, eventually, “the commission loses all contact with the public interest. It envisages its function as that of protecting the health and welfare of the regulated industry and maintaining its own status as the industry’s protector.”20 A competitive threat to the regulated industry is posed by firms beyond the agency’s jurisdiction, an extension of that jurisdiction may be sought: “when the highways came to protect shippers against the railways, the reaction was not to relax the regulation of the rails, but to suppress the competition of the trucks.”21

20. Ibid., p. 473.

Again it should be emphasized that this is not an inevitable outcome, but the tendencies are sufficiently strong to warrant precautionary measures. Relevant in this connection are Roger Cramton’s summary views on the regulatory process:

. . . like other tools of governmental control of society, [regulation] has characteristic virtues and vices. When the objectives to be achieved are clear and precise, techniques for their realization can usually be designed. . . . But when the blunderbus . . . is used and a potpourri of vague or inconsistent objectives is thrown into regulatory safe-keeping, the results are likely to be limited to the protection of established interests or to be wholly unpredictable.22

The argument deserves consideration not merely because of the control limitations which regulation experiences, but because its political vulnerabilities are especially great when impossibly broad and nonoperational assignments are made.

4. Expense

An additional reason for limiting the scope of regulation is that it is not costless to operate. On the contrary, statutes typically require that “regulatory powers be exercised only after full hearings.”23 The time and talent tied up in this way can involve considerable expense. In designing a regulatory structure, therefore, it is essential that the administrative expense of implementing a particular regulatory proposal be included as a social cost in estimating the net benefits that are expected to obtain under the proposal. Also for this reason, it is attractive to design a regulatory structure having self-enforcing properties.

II. Regulatory Initiatives

As indicated earlier, Posner’s review of regulation led him to conclude that regulation suffered from limitations which, both in principle and practice, were so serious as to warrant its abandonment.

23. Ibid., p. 186.
The above discussion does little to restore faith in the efficacy of the regulatory mechanism. Given, however, the secure political base on which regulation rests, abandonment is scarcely a realistic alternative. The relevant question, therefore, is whether some of its more egregious defects might be partially remedied.

Most of the defects of regulation are ultimately attributable to a combination of disincentives and control weaknesses. The former are due to the debilitating effects of profit and entry constraints, while the latter result from the inherent organizational limitations of the regulatory apparatus. Posner’s suggestion that profit controls be relaxed and the condition of entry freed up is directed mainly at overcoming some of the disincentive consequences of constraint. William Baumol’s suggestion that regulatory lag be institutionalized is likewise directed to the incentive issue. Each is considered briefly below. To these I add (an essentially complementary) third proposal that has both organizational and incentive aspects. This involves the exercise of regulatory jurisdiction to perform efficiency audits which, supported by regulatory lag, mobilize the capital market in such a way as to induce more effective self-regulation.

1. Profit and entry controls

As Posner points out, “the rationale of regulating entry is that unlimited entry under conditions of natural monopoly leads to ruinous competition.” He goes on to observe, however, that “the fear of ruinous competition seems largely groundless. If a prospective entrant realizes there is room for only one firm in the market, it will not enter unless confident of being able to supplant the existing monopolist . . . .” The market will shake down to a single firm, at least if there are no undue inhibitions on price competition or merger. There may, of course, be transition costs of moving from the initial position, where slack operations characterize the performance of the monopolist, to the eventual efficiency configuration produced

by the shake-down. These costs may not be great, however; if self-regulatory intentions are realized, they may be non-existent; for the purpose of freeing up entry is less to encourage actual entry than it is to place existing suppliers under pressure to exercise self-restraint. Where absolute, or near absolute, protection against entry exists, this background threat naturally vanishes.

This proposal comes down to introducing a change in the rules at C, by altering the environment within which the regulated firm operates. For entry to be attractive, of course, the successful entrant must have reasonable assurance that realized cost savings will not quickly be eliminated by rate reviews but will be permitted to show up as profits. Thus a simultaneous relaxation of profit and entry controls is indicated. Unless profit controls are eliminated entirely, which is unlikely, or unless admissible upper bound profit limits are specified, which runs at cross-purposes with efficiency incentives, this brings us to the matter of regulatory lag.

2. Regulatory lag

In an attempt to overcome the insufficient incentives that regulation provides for superior performance, Baumol has proposed that the regulatory lag between rate review periods be institutionalized. As Posner has noted, however, regulatory lag is not entirely free from defects. For one thing, the optimal lag period is not given but needs to be derived: very long lag periods may allow “excessive” monopoly gains, while very short periods provide insufficient incentive to realize cost reductions. In addition, the regulated firm may “game” the regulatory agency by strategically accumulating cost reductions for implementation after rate reviews. Also there is the possibility that unanticipated inflation (or other factors outside of management’s control) will raise costs sufficiently to impose losses — although, as Baumol points out, a price-level adjustment mechanism can be built into the basic regulatory scheme, and possibly “interim rate raises [could be allowed] under most unusual circumstances.” But Posner’s basic objection to regulatory lag is that
In view of these limitations, it might easily be concluded that the defects of regulatory lag are too serious to warrant its serious consideration. However, some of these objections can be overcome by augmenting regulatory lag to include an efficiency audit. In particular, potential unresponsiveness and “gaming” aspects of managerial behavior are apt to be made less serious by combining regulatory lag with an efficiency audit. The cost base question might also be handled in this way, but this may require efficiency audits of a more ambitious sort than contemplated here.

3. Efficiency Audits

Previous proposals to employ efficiency audits have conjoined the efficiency audit not with regulatory lag but with target rate of return regulation. The purpose of target rate of return adjustments is to supply incentives for efficiency; almost certainly this requires that an efficiency evaluation be made. Implicit in the argument is that a satisfactory mechanics can be worked out and that manipulating margins will produce intended effects. That the mechanics can be worked out is at least questionable. Even conceding feasibility, however, the efficacy of a margin manipulation program appears doubtful. As Schumpeter has emphasized, the “competition which counts . . . strikes not at the margins of the profits and the output of existing firms but at their very foundations and their very lives.” For both reasons, but especially the latter, target rate of return regulation is not suggested here.

Instead of an elaborate mechanics, the proposal advanced here employs a relatively modest two-stage inference technique. Also, rather than adjust target rates of return, it relies instead on activating the capital market and/or management’s own demands for professional excellence. The capital market part of the argument is tied in an essential way to regulatory lag.

34. R. J. Gordon, “Airl ine Costs and Managerial Efficiency,” in Transportation Economics, New York, 1963, pp. 61–92. Gordon concludes his study of comparative airline efficiency with the observation that “inefficiency seems to be a matter of overstaffing. The data strongly support the claim that a particular management is consistently efficient or inefficient across several cost categories.” Moreover these cost excesses in the inefficient lines were not insubstantial: “Even if the industry had been able to save only a third of the estimated potential cost savings calculated . . . its rate of return would have been almost doubled.”
Environmental Setting

It will be assumed that the capital market will tend to displace managers of firms where it can be shown that (1) there exist cost savings which, if realized, would return a higher yield than obtained under the incumbent management, 38 and (2) the expenses of detecting slack and achieving takeover are not excessive. Regulatory lag is designed to satisfy condition (1), while the efficiency audit is directed at condition (2). The reasons are sketched out below. First, however, consider why, if nontrivial efficiency gains are frequently possible among regulated firms, and if the capital market operates as described, takeover of regulated firms is not more commonly observed.

One answer is that the conditions postulated are not satisfied. This overlooks, however, that (in practice, if not in principle) regulatory lag even now is a fact of life in many regulated industries, 39 and that other utilities with comparable experience may be able to make reasonably accurate inferences. 40 What has prevented takeover here? At least with respect to electric utilities, takeover has occurred: mergers have reduced private systems from about 1,000 to under 500 in the last twenty years. 41 But the reasons for this are varied; technical scale economies, for example, are believed to be an important contributing factor. 42 Thus the question reduces to why management inefficiency, if important, has not presented an invitation to non-utility investment interests to attempt displacement by conducting proxy contests and tender offers.

Three possibilities suggest themselves. First, making accurate inferences regarding the extent of inefficiency may be difficult—which is to say costly. Lacking both own-experience as well as access to internal documents and operating practices, only relatively crude judgments can be made. Second, the takeover agency has no assurance that operating cost savings, once realized, will be permitted to show up as profits: prospective profits may be extinguished by rate adjustments stipulated by a regulatory authority. (Having developed a long and harmonious relationship with the incumbent management, and in consideration of the fact that the realization of large cost savings carries with it an implication of ineffective regulation, the regulatory agency may view the prospect of takeover with disfavor. Prospective takeover candidates may regard the risk that the regulatory agency will exercise its rate review authority in punitive ways as too great to warrant intervention.) Third, regulation may limit the field of prospective takeover agents. Thus capital markets may be partially immobilized if the conditions of takeover are sharply circumscribed by the regulatory authority. 43 Efficiency audits in combination with regulatory lag should help to overcome the first two of these problems with which the capital market, unassisted, must contend. The efficiency audit should both help to reveal inefficiency conditions (reduce inference costs) and make it possible for a takeover candidate to appeal more effectively for stockholder support. For both of these reasons, what could otherwise be major costs of achieving displacement are apt to be reduced. Ceteris paribus, the incentive to attempt displacement increases. Institutionalized regulatory lag provides assurance that profits generated by realized efficiency gains will not be quickly eliminated by rate reviews. It represents a bar to the exercise of regulatory discretion in perverse, protectionist ways. A potentially

38. Higher yields might also be obtained by increasing revenues in relation to costs. Making the prospect of takeover attractive could thus encourage more aggressive pricing. Rate changes, however, would be possible only at the end of a rate review period, and I assume that the regulatory agency would enforce the appropriate relation of prices to costs at that time. See Baumol, "Reasonable Values for Rate Regulation." 39. Ibid., p. 116.
43. Conglomerate takeover of regulated firms was not a threat at the time most regulatory agencies were established and thus often falls outside agency purview. In response, however, to recent takeover moves by conglomerates, the airlines industry and Civil Aeronautics Board have urged Congress to pass a bill that would require CAB approval of an airline takeover by a conglomerate. (See the May 1968 issue of Fortune for a discussion of this and other regulatory moves directed at conglomerates.) The Justice Department has also indicated its support of such legislation (see the Wall Street Journal, 27 March 1969, p. 7). The errant potential of such legislation should be appreciated. If passed and exercised in a protectionist way, it would seriously undercut the proposal for combining efficiency audits with regulatory lag advanced here.
powerful background threat to otherwise lethargicagements is
thus posed by conjoining efficiency audits with regulatory lag.\textsuperscript{45}

Even, however, if the capital market were not activated, publicity
regarding superior and inferior performance may still have some
stimulating effects. The management of these enterprises do not
live in a vacuum but ordinarily occupy positions of prominence in
their respective communities. Claims of inefficiency which could
previously be dismissed as unfounded, carping criticism cannot,
after an audit, so easily be rejected. Allegations of inefficiency that
are supported by statistical comparisons and specific examples take
on legitimacy; the burden of proof shifts. Anxious to forestall such
criticism, the management may be induced to perform internal
corrections.

One might concede that the argument has merit but still resist
such a program on practicality grounds. Among the several diffi-
culties which Posner associates with the efficiency audit concept are
the following: first, even with multi-variate analyses, the results are
"rarely sufficient to warrant confident conclusions."\textsuperscript{46} Also, the
judicial process is ill-suited to making complex economic evalua-
tions; efforts to rank managements by efficiency are apt to produce
"bitter wrangling" and protracted litigation. Finally, management
prerogatives cannot be capriciously upset lest business initiative be
eroded.

These are all telling points, but it is worth noting that this crit-
ciam was directed at the use of efficiency audits for purposes of ad-
justing target rates of return and involves the "due process" ma-
chinery, neither of which is contemplated here.\textsuperscript{47} In any case,
de spite limitations, efficiency audits need not be abandoned. The
critical question would appear to be one of degree: how extensive
should the effort to establish objective efficiency ratings be? Concei-
vably the optimum effort is none at all, but this is not obviously
\textit{a priori}. Consider the following two-stage program: (1) employ
relatively crude statistical inference techniques (of the sorts used by
William Iulo\textsuperscript{48} and R. J. Gordon\textsuperscript{49}) to establish basic efficiency dif-
fferences; (2) authorize more detailed efficiency audits (for example,
by management consulting firms or their equivalents) on those
firms whose actual performance deviates significantly (on either the
high or low side) from predicted performance. Attention is thus
directed only to the exception.\textsuperscript{50} Those firms which, on crude statis-
tical inference grounds, are poorly rated and for which a subsequent
management audit returns a similar verdict will thus be publicized as
inferior performers. Superior performers would likewise be pro-
cessed through this two-stage test and, if they pass both, would be
pronounced exceptional performers. The target rates of return for
high and low performers could be increased or decreased accordingly
so as to give the incentive system further bite, but this encounters
all of the judicial difficulties noted by Posner. We rely instead on
mere publicity. Mobilization of the capital market in response to
manifest failure should make displacement threats credible. Even if
incumbent managements are not turned out, they are not likely to
be wholly unresponsive.

Such experience as we have with the efficiency audit concept is
somewhat mixed. A modest type of publicity control was attempted by
the Massachusetts Board of Railroad Commissioners in the

\textsuperscript{45} Conceivably institutionalized regulatory lag by itself would be suf-
ficient to mobilize the capital market. The advantages of including effi-
ciency audits are three: First, the regulatory agency is more apt to appreci-
ate the "need" for takeover if genuine inefficiency conditions are revealed.
The protectionist inclinations of the agencies referred to in the text and
n. 43 are perhaps less likely to materialize in the face of objective evidence
of inefficiency. Second, the regulatory agency has access to internal operat-
ing reports and can perform inspections that private firms lack authority to
obtain. Thus more precise evaluations can be expected if done under the
segis of the agency. Third, there are apt to be scale economies in perform-
ing efficiency audits, especially since the audits rely extensively on inter-
firm comparisons. A central agency is thus better able to perform such
studies.

\textsuperscript{46} Iulo explicitly recognizes this in his own work on this question. See
William Iulo, \textit{Electric Utilities—Costs and Performance}, Pullman, Washing-
ton, 1961, p. 322.

\textsuperscript{47} Posner's rejection of the efficiency audit was solely in connection
with its use as a rate making device. I do not mean to suggest by this that
he endorses an audit for the purposes suggested here, but neither does he
appear to reject it.

\textsuperscript{48} Iulo, \textit{Electric Utilities}.

\textsuperscript{49} Gordon, "Airline Costs."

\textsuperscript{50} Also, as a matter of equity, one might want to permit firms that fall
within the broad middle band to request efficiency audits if they wish—
provided they are willing to accept the consequences.
Environmental Setting

1880s. Although it was apparently successful, subsequent extension of the board’s authority to include the pricing of securities issues overwhelmed it with a “mass of detailed routine work” and the board lost the confidence of the public. A more ambitious experiment with the efficiency audit was recently performed by New York City with reference to Consolidated Edison. “The management-consultant firm was highly critical of the company, the company replied stormily, and the state public service commission took the company’s side.” The example is interesting but not necessarily decisive. For one thing, ad hoc use of efficiency audits is not the same as what is proposed above. For another, stormy replies do not imply non-responsiveness. What one should like to establish is whether Consolidated Edison was shaken out of its lethargy or, more precisely, would be if repeated ex post evaluations were to be made and publicized should the firm continue to fall well below the mean efficiency performance of other utilities.

It should be emphasized that the purpose of the procedure described above is mainly to induce effective ex ante self-regulation. The objective is both to raise the average and shrink the variance of observed efficiency performance. Over time, as the system reaches a new steady state, instances of exceptional performance on both sides of the mean should decline. By contrast with previous proposals to employ incentive regulation, the program described here (1) focuses only on exceptions, (2) does not require extensive tinkering by the regulatory agency in the pattern of allowable returns, but (3) relies on institutionalized regulatory lag to mobilize the capital market and on management’s belt-needs for self-esteem to produce the necessary corrections.

Expressed in terms of the ultrastable system, the efficiency audit used in conjunction with institutionalized regulatory lag acts at C₂ and C₃ to induce management changes at C₄. The efficiency audit involves exercise of the regulatory agency’s constitutional powers to secure access to internal operating data and make comparative performance evaluations at C₄. Internal efficiency conditions are judged with respect to “standards” supplied by the environment. Institutionalization of regulatory lag alters the regulatory environment by introducing performance incentives at C₃. Where evidence of inefficiency is revealed at both stages of the efficiency review, the potential for a takeover agency to realize larger profits through displacement presents itself. More than potential, however, is required. For takeover to be attractive requires that the original and secondary costs of achieving displacement be relatively low and that the prospective cost savings be capable of translation into profits (over the intermediate run, at least). The audit should facilitate the ease of making a persuasive displacement appeal, while institutionalized regulatory lag provides a guarantee that profits will not be quickly eliminated.

Mobilization of the capital market at C₄ brings about the efficiency correction by re-specifying values at the essential variables at C₃. Replacement of the incumbent management by executives with a stronger profit (and least-cost) preference is involved. Operating as these executives do inside the firm—with relatively easy access to the variety of control techniques (C₃ — C₄) discussed in our

53. The intent would be to shrink the range of efficiency variation among utilities (as a result of self-regulation) over time. Thus if one took a 10 percent deviation of predicted from actual costs as a standard for identifying exceptions and if initially 20 percent of all firms fell outside these limits, one would expect, over time, the 20 percent figure to fall.

54. Posner, “Natural Monopoly,” p. 628. As Posner notes, comparative performance evaluations may not be possible in some industries. He cites the Bell System as an example. This, however, is not the typical situation in regulated industries.

55. I should also indicate, lest the audit proposal be uncritically extended, that I am dubious of its merits as a device to limit the exercise of managerial discretion in unregulated corporations. For one thing, interfirm variety is much greater, and hence the inference problems more difficult, among unregulated rivals. For another, the constitutional objections to a management audit are clearly stronger in the unregulated sectors. Finally, product market competition can be expected to be more intense (although, as argued above, to the extent that regulated industry can be made subject to competition, and assuming that compensatory pricing rules prevail, this is ordinarily to be encouraged).

56. See O. E. Williamson, Corporate Control and Business Behavior (Englewood Cliffs, N.J.: Prentice-Hall, 1970), chap. 6 for a discussion of the requisite control apparatus to assure that a high order of compliance will be realized.
examination of the ultrastable system—a much higher degree of compliance with specified objectives can be expected than if the regulatory agency (with its intrinsic external control limitations) attempted itself to effect the change.

It is not, however, either intended or expected that takeover would be common; self-regulation is the objective. Inasmuch as displacement, probably more than any other device, affects the vital interests of the management in a compelling way, it seems not unrealistic to anticipate that the incumbents will be responsive. Although some of these adaptations may be mainly protectionist (such as raising the percentage of voting stock required to accomplish takeover), and hence should be curbed rather than encouraged, others are likely to involve substantive efficiency corrections.

III. Conclusions

Efforts to overcome the weaknesses that regulatory control is subject to are, to the extent that they regard regulation as a backup or higher level management function, misguided. Regulation experiences intrinsic control weaknesses so great as to appear to be irremediable when conceived of in this way. A regulatory agency simply cannot achieve fine-tuning adjustments (of the sort that are ordinarily associated with comprehensive control) without intervening extensively in the internal affairs of the firm. Inasmuch as this would upset management prerogatives, with attendant dysfunctional consequences, and would be costly in any case, this approach to regulation must be (and is) rejected.

Recognition of this conditions is partly responsible for Clair Wilcox's indictment of regulation with the charge that "it cannot compel or even induce efficiency; it offers no incentive to good administration, imposes no penalty on incompetence." It is the purpose of this paper to suggest that, however descriptive of actual conditions


57. This is the intent of the Baumol proposal. For a similar view, see Harold Wein, "Fair Rate of Return and Incentives—Some General Considerations," in Performance Under Regulation, ed., Harry M. Trebing (East Lansing: Institute of Public Utilities, Graduate School of Business Administration, Michigan State University, 1968), p. 63.

this observation may be, the quest for incentive devices should not be abandoned but should address itself to ways by which to facilitate executive displacement in response to evident incompetence. Thus even though regulation experiences serious control limitations, this does not imply that meaningful control is unattainable. Instead of attempting to overcome its inherent weaknesses, it might instead play to its strengths. Regulatory lag can be construed not as a defect but as an opportunity to supply incentives. The constitutional powers of the agency can be used to authorize efficiency audits which, if the forces of the capital market as a surveillance agency are unleashed and the opportunity for profitable takeover made clear, can induce self-regulation of a potentially superior sort. Competition in the product market should likewise, and for similar reasons, be given freer play.

What this amounts to, in a sense, is an attempt to implement Charles Hitch's advice (advanced in connection with defense contracting, but surely applicable to regulation as well) that "what is badly needed here is an economics invention or, more probably, several of them . . . that take advantage of the incentives present in the economy." Most treatments of the incentive question take existing practices as given and attempt to manipulate margins. This is incentive regulation in the small. But Hitch is suggesting that potentially more powerful incentives may be discovered if the framework of analysis is extended.

Conceivably, institutionalizing regulatory lag itself will be sufficient; the carrot may not require supplementation by the stick, or unassisted inference and displacement costs may not be as serious as the above discussion suggests. A sequential procedure of first institutionalizing the lag and then, if this proves inadequate, introducing the efficiency audit is thus indicated.

In any case, it should be appreciated that the intent of activating competition in the product and capital markets is not to produce disruptive ownership or investment activities; the main objective is to encourage the regulated firm more diligently to adopt a course

59. Cost excesses that take the form of plant and equipment can often be remedied only in the long run and thus constitute a less attractive basis for takeover than variable cost excesses. On the potential offered by the later, see footnote 34.
of self-regulatory behavior. Whether regulatory agencies have the necessary mettle to execute a course of action of the sort proposed here is a question that the analysis does not reach. In consideration, however, of the evident limits that regulation experiences in other respects, and assuming that the necessary fortitude to implement the program described can be supplied, an experimental test would seem to have merit.

Comment

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I was delighted when I first inspected Professor Williamson’s paper and saw therein what appeared to be a servo-mechanism model being applied to the regulatory process. It has seemed for some years that such a union of control theory and economics might be a way of rescue from the shackles of economic statics and their deleterious effects when applied to economic policy making. I was hopeful that I was looking at a seminal paper, but deeper reflection showed that I was going to be reluctantly forced into an attack mode. However, these comments should be understood as that side of the dialogue intended to produce a creative synthesis, for original approaches to these old problems are needed.

My remarks reflect some early experience at Johns Hopkins where I came into contact with a great many medical students. This is relevant because Williamson is essentially producing a prescription for an institution which he believes to be suffering a serious illness. Now, the first thing that all medical students learn is shown in this sequence:
History + Symptoms → Diagnosis → Treatment

They are taught to take the patient’s history in great detail, determine his symptoms by examination and conversation, and then, by some intuitive or logical process, find the diagnosis either from their own knowledge or from consultants. Only then is it safe to go on to treatment. It is my contention that the diagnosis which Williamson has produced suffers from a lack of appreciation of regulation’s history and overemphasis on current symptoms, and thus results both in a certain amount of overkill on alleged bad performance and in a degree of treatment far beyond what is required. In other words, in the medical profession doctors recognize that you use one approach to therapy if the patient is near death and another if all he requires is a good tonic.

My remarks are based on the premise that regulation, regulated industry, the regulators, the regulatees, academic observers, and other thinkers in this area have something to be proud of in what the underdeveloped economies call their infrastructure. The infrastructure of our nation has been built to a large extent by regulated industry. We do not have anything to be ashamed of but, instead, we do have some areas which require incremental improvement and toning up. Consequently I do not believe that the entire structure should be leveled in order to start out ab ovo. Since we have a living patient, we should use the sequence of history, symptoms, diagnosis, and treatment. It is of interest that there is a term in medicine which comes up in malpractice suits called iatrogenic illness. Translated from the Greek it means that the illness was caused by the doctor himself. I am afraid that if we do not understand the aspects of the control system proposed in Williamson’s paper, then we may produce that particular kind of problem.

I am going to address myself to the idea of the control model as a model, i.e., a generic model irrespective of its use, partly because it is a nostalgic exercise for me. Part of my life was spent in the analysis of feedback systems, applying them to beneficial uses such as bomb sights and devices for handling dangerous materials. The Williamson model is a generic form of that type because it has feedback loops intended to maintain control. The first question asked in considering feedback models or devices is the question of their stability. In the communications business this is a very big factor, for all kinds of amplifiers involving negative and positive feedbacks are used, and some of the most brilliant men in the Bell System have devoted their lifetimes to the study of stability criteria. Nyquist diagrams and Bode charts are fundamental to this work.

Good design requires that a model be so constructed that, when one intervenes in its functioning, the system it represents should adjust to that intervention in a smooth and elegant way. Instability means that the model behaves in ways which aggravate this intervention and cause it to produce perverse effects not intended. A whistling public address amplifier is an example of a control system which has gone unstable. Another example from economic theory is the cobweb model, in which the demand curve is steeper than the supply curve, near the equilibrium point.

With these ideas in mind, we should examine what Williamson calls his “control points.” From the point of view of control theory, these are not control points at all; they are constraints. When one specifies constraints and leaves the control system untouched or unspecified he can unwittingly create instability behavior in the system. For example, at C-1 and throughout most of his discussion Williamson has said that things ought not go outside certain bounds. Yet when one examines these “control” paths (called the main variables in C-4 and the essential variables in C-1), it must be remembered that this is a biological model taken from Ross Ashby’s book Design For a Brain. In Ashby’s description the main variables, which couple the reacting organism to its environment, are based on the sensory processes: eyes, ears, and so forth. The essential variables are those which are vital. In fact, one defines an essential variable as a variable whose limits are such that, if they are exceeded, death occurs. That, of course, is quite basic. In the biological analog, the essential variables are pulse rate, respiration, blood pressure, and so forth. So you do not want to introduce large step functions too violently there.

Williamson takes his model from Ashby, who has named this model “unstable.” But this model is not unstable merely because it has two feedback loops, as seems suggested in the Williamson paper. The source of unstability is the very close calculation and finely-tuned interaction between the lags in the step-function loop and their relationships to the control loop in C-4. (Ashby makes this clear in chapter 8, page 120, and I recommend this to those interested.) Ashby uses the example of a cat which is eating, dozing, and walking about a kitchen. In this state only the main
variables are operable (C-4). Suddenly a hot coal from the fire rolls toward the cat, and now the environment threatens to have a direct effect on the cat’s essential variables. In other words, if the cat’s brain does not go through a step function, it will get burned. The step function escalates amplitudes in the entire control system up to the new demand and keeps the “cat system” stable. Without this alteration, the main variable control loops between the environment and the cat will not function and the cat will then become neurotic or die. In effect the step function pushes the whole system up to another level of operation so that the controls between the environment and the reacting organism can continue to function—that is why this arrangement can be called an ultrastable system. My remarks should not be considered nihilistic, for I am in favor of new approaches to analysis. In fact, we have a research project of our own which attempts to look at regulation as a control system. The mathematician and control engineer working on this problem have found the relationships and variables much more complex than one would infer from Williamson’s paper. They see it as a multi-dimensional problem, and I agree with them.

The difference between a control and a constraint should be examined, for this distinction is fundamental to such models. For example, suppose a regulatory commission issues an order which says that a debt ratio must always be 40 percent. That calls for a far different control system than if they say it should always exceed 40 percent. To specify a limit, or upper or lower bound, is a far simpler concept than designing a mechanism which will constantly equilibrate the entire organism to a single, specific value. This model developed by Williamson is extremely simple, and he states that he has augmented a model developed by Stafford Beer in his book, Decision and Control. However, I submit that a better model for discussion of this problem is found in Beer’s book on page 392, where he charts the relations of a generalized unregulated enterprise.

This model is far closer to reality, yet is still deficient in that the regulatory points are not specified. Notice that the number of places requiring Williamson’s control points are greatly increased. For instance, they must be operative at the world situation environment, production and marketing plans, internal and external forecasts, internal and external states, long-term marketing and production programs, the internal and external environments special to the enterprise, Gestalt formers which structure the entire patterns of in-
formation, variety generators, and a policy formulator. Also, in Beer’s terminology, each of the areas of the diagram, labeled as $H$, are homestats themselves, i.e., they tend to equilibrate around some goal by an unspecified control system internal to themselves, yet are also connected to all the others. This is still, remember, a simplified picture of the reality. Williamson’s image of a control system for even this model will founder on both the complexity of interrelationships and on the indeterminacies which will cause disabling instabilities. Consider just one regulatory problem: the pricing mechanisms needed to couple production and marketing factors to the customer demands. Beer’s model at least suggests the interrelated and complex aspects which must enter the judgment process of price-setting, but Williamson’s model is silent on this vital and vexing task.

The added richness of regulatory interactions force this type of analysis to take far greater account of the “multi-dimensional space” aspects and our own approach attempts to do this—so far, unsuccessfully. To coin a phrase (which might never be placed over the doors to regulatory commissions): the public interest is a vector space.

Williamson proposes that his model be given an empirical test. How would one cope with this assignment? First, one would need to have good, detailed microeconomic models of the firms in the industry, which would be agreed on as reflecting their reality. But the people who felt that they had achieved this essential congruence must be mindful of Clerk Maxwell’s dictum to: “Seek simplicity and distrust it.” If they seek simplicity and embrace it, they will cause the iatrogenic illnesses which arise from the treatment itself. For example, if I produce the model of a Uranium Hexafluoride Molecule, it may be useful for an understanding of how atomic refining takes place, but such a model is not very useful in getting a uranium pile to generate electricity. One needs quite a bit more, or the model itself, producing unfounded confidence, may cause one to place himself in highly dangerous situations. But let us assume we have developed the microeconomic models, and we then go on to further considerations of implementation.

Consider the following situation. You have been asked to organize the commission which is going to use Williamson’s regulatory model. What kind of men do you recruit and what is the first task you assign them? First, they must be men who can state the essential variables, $V$, in the Williamson model. They would have to be men of the highest probity, aristocrats of intellect, democratic populists, statesmen, and so respected that their utterances would be universally accepted as unquestioned criteria of the public interest. Obviously, there would be operational difficulties in securing such people, but let’s assume we overcome these difficulties. The task given these people is to specify the essential variables of the regulatory process, which, according to Ashby, are analogous to pulse, respiration, and blood pressure—the vital functions. Once this group finishes their awesome task, they are not needed any longer, for you must now replace them with a staff whose job it is to carry out the efficiency audits (C-5 in Williamson’s model). These audits are intended to keep the industry’s behavior constrained to the values of the essential variables set down by the previous group of regulatory philosophers. A quick, naive answer is to hire a management consulting firm, but even Williamson admits that the ad hoc, non-continuous nature of their consulting arrangements cannot do the job. However, to avoid the social costs of hearings—one of the prime advantages claimed for this plan—it is essential that every man chosen to fill an expert staff function must be preeminent in his field. For example, the commission’s chief engineer must be so eminent that his counterpart chief engineers in the industries’ firms would never argue with him or dissent from his rulings. However, if the industry’s experts do disagree with the evaluations of the commission’s experts who made the efficiency audit, we will be back in the hearing room again—with possibly even longer transcripts than now. To illustrate the problem, assume we were going to regulate physicists with this model. The efficiency audit group would have to consist of men like Einstein, Oppenheimer, Bohr, Rutherford, Fermi, and Teller, and their job would be to regulate and appraise the ongoing progress in physics. Think what would happen if one of these men were the regulated instead of the regulator and you see the potential for breakdown.

With such a need for eminence and its maintenance, Williamson’s idea suffers an irreparable psychological flaw, for the assignments of the efficiency audit staff are psychologically and operationally non-viable. Williamson’s strategy calls for them to be so eminent, and so able to speak ex cathedra that no one would call for the constitutional guarantee of due process. Thus, their role is completely minatory, and the commission would have to appraise any neces-
sary intervention as a failure of the system, for that would be proof that someone questioned their eminence. I cannot imagine how eminence could possibly be maintained—or deserved—if a professional is not an active participant and contributor to his discipline. Eminence is a transitory state, at best, even with intense effort and work. I do not see how a role such as that of a fire prevention inspector could be made attractive to the leaders in any field whatever, since the assignment would be envenerating.

To show that such a weakness is not dependent on our form of government, the national philosophy, or regulatory procedural safeguards, consider the recent experience of the Soviet System as described by Alec Nove. There the Gosplan set the essential variables of the economy and did the efficiency audits (Williamson's C-5), to ensure conformity and performance. Down in the manufacturing components (the regional centers in Ukraine, Moldavia, and Byelorussia, known as the Sovnarkhozy), these people were trying to cope with their environments and get out the day's work. The bitter disputes between the regional operations and the efficiency auditors and essential variable setters at the Gosplan offices in Moscow resulted in many unfortunate situations, almost always resolved in favor of the working regions and not in favor of the efficiency auditors. Thus even in a completely totalitarian system, where due process is not effective, such conflicts can cause a theoretically appealing control system to go into an unattainable condition.

Allow me to cite a personal experience to amplify the workability criterion. For five years I headed a group at AT&T charged with giving advice and assistance to the hundreds of computer installations throughout the Bell System. We also developed sophisticated plans and procedures for evaluating the relative efficiency of each operation and office. All of the men on my staff had extensive experience in the field offices, were on familiar terms with all of the managers involved, and knew in great detail the jobs being done and the characteristics of every machine used or planned. We also had historical records and trends of every work operation and their evolution, and every field office periodically. This task was not the cosmic one (envisaged by Williamson) of carrying out definitive efficiency audits of the entire range of affairs of an industry, but merely the appraisal and improvement of one, small part of the total task, viz., accounting operations. In effect, our role was that of Williamson's C-5. To carry it out, our documentation was elaborate, and everybody was in agreement with the facts and the reality of this process. We recognized that the efficiency indexes had to be continually adapted to environmental and technological changes, and widely promulgated. Yet each time we made a change, we made eleven “allies” and eleven “antagonists,” for such changes almost always altered relative standings. To complicate matters even more, the composition of the “allies” and “antagonists” was constantly altered as the changes in measurements’ procedures created their asynchronous perturbations. We never achieved unanimity of appraisal, and even in this system we had to resort to a quasi-constitutional solution. We appointed a review board of nine assistant comptrollers from the companies, each one an expert on measurements and operations, with rotating terms of office, whose responsibility was to pass on, discuss, modify, reject, or approve every proposed change in the efficiency indexes. The idea has worked well, but even today, unanimous votes are infrequent, even though we have injected the idea of “consent of the governed” to enhance acceptance. If each dissector were granted formal due process hearings, it is obvious the waste and inefficiency which would flow from a quest for efficiency. All of these ramifications from just a small, well-known sector of the total operating process of the industry leads me to be extremely skeptical of a plan like Williamson’s.

A final point relevant to his model is the fact that, should lags from the hearing process develop, this model becomes unstable because of non-synchronized information in all of its control loops. This occurs because such information creates confusion and disorder in the reacting body, the environment, and in the regulatory agency itself. Williamson, of course, knows this, and thus must take steps to eliminate hearings—and their lags—if he is to achieve stability. But we have already discussed the low probability of that outcome with this system.

Allow me to end on a positive note, with a quotation from Alfred North Whitehead’s The Aims of Education: “The tragedy of the world is that those who are imaginative have but slight experience, and those who are experienced have feeble imaginations. Fools act on imagination without knowledge; pedants act on knowledge without imagination.”

I am uncertain as to whether these remarks of mine will be considered foolish or pedantic, and I recognize that a case might be
made for both views. However, I am certain that the future improvements in the regulatory process will come from men who are neither foolish nor pedantic. Such men will couple wisdom and experience to active imaginations in order to produce the authentic and workable solutions required.

Comment

Leland L. Johnson
The RAND Corporation

Professor Williamson has presented an interesting general treatment of some of the possibilities for modifying the machinery of regulation. After dismissing a number of alternatives as showing little promise, he concludes that a process of “efficiency audits” conducted by regulatory agencies combined with “institutionalized regulatory lag” have attractive prospects for improving regulatory performance. However, I come away from his discussion troubled by the efficiency audit-institutionalized lag approach. On balance, I share the pessimism of Posner to whose work Williamson repeatedly refers. In the real world, the kinds of problems that regulatory agencies would encounter in pursuing systematically studies of efficiency are so severe, it seems that this approach offers rather little hope.

In the first place, the concept of efficiency has many dimensions. In evaluating the performance of a particular firm, relative to other firms or to some norm, the regulatory agency would seek some sort of weighted average as an overall measure of the firm’s efficiency.
In the absence of strong market indicators, the agency would be hard pressed to sort through and satisfactorily quantify these weights in the face of the widely varying characteristics and circumstances with which it would have to contend. Several hypothetical examples are enough to highlight the burden of this task:

1. Company A, an electric utility, may suffer relatively high unit costs because it maintains an abundance of equipment and crews to cope with disruptions that arise from severe winter storms in its area. The agency may assert that other utilities operating under similar climatic conditions do not maintain such extensive standby arrangements. The company might reply however that its customers are happy with the more costly but more reliable service as witness the few customer complaints regarding service standards relative to those of other firms included in the agency’s comparison. The agency might counter that while this is true with respect to service standards, many complaints have been filed about A’s high rates, and so it goes on.

2. Firm B, an airline, experiences high unit costs as a consequence, it alleges, of an extensive retrofit program in a fleet of aircraft required to remedy structural defects entirely unforeseen at the time of procurement and not ascribable to any fault of the airline. The agency might observe that under a “correct” method of charging off extraordinary costs, the relatively high unit costs now being experienced can be shown to be due not primarily to the unfortunate procurement, but due rather to the quantity of frills that the airline bestows upon its passengers. We could then imagine the airline replying that in the absence of these frills it would lose business to its competitors.

3. Firm C, a small rural independent telephone company, strikes the agency as being very efficient because its unit costs relative to other such companies are both low and have fallen impressively over the past few years. Using this evidence in its comparative analysis, however, the hedgedagled agency is confronted with arguments by these other less fortunate companies that Firm A has a higher subscriber density per square mile than they do (or that it operates over more favorable terrain), that it initiated operations much later in time than the rest and hence was able to take advan-

tage of the most advanced technology then available, and that the recent reductions in cost resulted from installation of certain equipment which the others had considered, but had rejected for procurement on grounds that its long-term reliability was in doubt.

A basic problem illustrated by these examples is that elements of Williamson’s control model are interrelated. He recognizes that it is unrealistic to expect the regulatory agency to intervene at control points C1 through C4. Yet one may well question whether efficiency audits could be satisfactorily undertaken at C6, unless the agency has a tolerably good understanding of both “ends-specification” (C1) and “means-specification” (C2).

A second difficulty arises from the fact that agencies would be largely at the mercy of the firms they regulate as sources of data for the efficiency audit. While Williamson recognizes that the operating unit can engage in “filtering and distorting the data,” this point deserves greater emphasis than he gives it. Even armed with subpoena powers, an agency could face great frustration in obtaining relevant and timely data (of the necessarily complex sort that would go into an audit) from a firm reluctant to cooperate. While presenting every appearance of wanting to cooperate with government authorities (after all a good public image is at stake), the firm has boundless opportunities for a) asserting that particular data do not exist in the form that the agency has requested, or that an inordinate amount of money and time would be required to obtain them, b) aggregating the data in ways to blunt their usefulness in comparative analysis, c) delaying responses to particular agency requests for both valid and specious reasons, d) compiling data under complex sets of ground rules difficult for an agency staff to comprehend, e) simply snowing the agency with volumes of trivial and
irrelevant material (within which some useful stuff is buried) knowing that a small and overworked agency staff simply will not have the time and resources to sort through and analyze.

Dependence for data on the regulated firm is an especially serious problem because of the severe demands for empirical verification. Williamson notes that "institutionalized regulatory lag provides the assurance that the profits generated by realized efficiency gains will not quickly be eliminated by rate reviews." This sounds fine in principle but application in the real world would, I fear, prove overwhelmingly difficult. Relative to some past period, the regulated firm may show a combination of lower unit costs, lower prices, and greater output. On one hand, the combination could be a reflection of a downward shift in the cost curve as a consequence of greater operating efficiency on the part of the firm. On the other hand, this outcome could be the result of an outward shift of the demand curve combined with a fixed downward sloping cost curve. The requirements for data in order to discriminate between shifts of demand curves and movement along particular demand curves, and to explore the evolving nature of cost conditions faced by particular firms are frightening—all the more so if the firm is reluctant to assist.2

Another reason for doubting the feasibility of efficiency audits and institutionalized regulatory lag is their requirement for a large expansion in agency staffs and budgets. In this regard, it is well to note the recent experience of the Federal Communications Commission, in its current telephone investigation, in attempting to determine the cost of capital for the Bell System—a concept so less straightforward than many of the other facets of an efficiency audit mentioned above. Nevertheless, even the one task of evaluating the cost of capital consumed many months of staff time, with debate and argument accumulated within thousands of pages of testimony and analysis. And all this with the result that disagreement persists to this day about the level of Bell's cost of capital.

This is not to say that, on an occasional ad hoc basis, efficiency audits and some formal recognition of regulatory lag would be out of the question. One can easily enough imagine that on occasion a firm might perform so badly in all or nearly all dimensions that even a crude audit would suffice. And a rise in earnings might be easily identifiable on occasion with greater operating efficiencies to justify a postponement of rate reductions. But Williamson explicitly rejects such an ad hoc approach. Rather, he emphasized the importance of repeated ex post evaluations—a process simply out of the question with the resources currently available to regulatory agencies.

As a practical matter, one cannot reasonably expect a large-scale expansion of agency resources in the face of the multitude of pressures confronting federal and state governments. Among other aspects, regulated firms themselves would very probably be bitterly opposed, fearing (perhaps rightly) that undue probing and interference in their internal affairs would be the inevitable outcome.

Finally, even assuming the feasibility of efficiency audits, their usefulness is not entirely clear. Williamson would rely in part on the workings of the capital market to displace managers of firms that demonstrate opportunities, on the basis of the audits, for greater earnings than now exist. Yet one might question whether successful takeovers by new managers can be depended upon as a major tool of regulatory policy. On this point I can do no better than to quote Williamson from his earlier book:

It is sometimes believed that raiders constitute an important threat to existing managements and thereby place a genuine bound on the discretionary resource allocation processes within the firm. No doubt they have an effect. The real question is how severe is the constraint that they impose? In general, as long as the firm earns modest profits, it seems unlikely that the raiders will be highly successful in generating the interest and support they usually require from other stockholders. For one thing, they have to contend with the proxy machinery that favors the incumbents. For another, the suspicion with which the average stockholder regards the motives of the raider typically prevents attempts at overturning the company executive unless the performance of the organization is clearly unacceptable. Finally, even in those cases where the raiders have been successful in their efforts to gain control, their management of the enterprise has often failed to meet expectations. For each of these reasons, the potential threat

2. This suggests that whatever useful incentives are afforded by regulatory lag arise precisely because the lags are not institutionalized. Once they are formally introduced into the agencies' decision-making procedures, the burden of analysis they would impose on agency staffs, the drawn-out argument and debate they would promote, and the distortions in firms' behavior they would encourage would all combine to erode their effectiveness as a regulatory tool.
of raiders would appear to have only a moderate influence on the operations of the business firm.\(^3\)

The preceding remarks should not be interpreted as a basis for unrelieved pessimism, for there is still hope. And this lies largely in Williamson's \(C_t\) variable—environmental control. That is, latitude does frequently exist for altering the market structure of regulated industries, for opening up certain markets to competition, for permitting new entrants to test their ideas and, more generally, to reduce barriers to entry. Perhaps regulatory agencies will become less timid through time in reviewing new applications and less concerned about protecting entrenched interests. A higher rate of return allowable to regulated firms, reflecting an environment of greater competitive uncertainty, may be a worthwhile trade for the benefits of greater competitive pressure. Not only might this pressure induce firms to operate more efficiently and to seek out and exploit new opportunities, but it would also generate an improved data base upon which efficiency audits and institutionalized lags might eventually become more feasible. Thus, to Williamson's question "might the regulatory agency perform genuine internal efficiency checks at \(C_t\) and, supported by these evaluations, unleash market forces at \(C_t^*\)?" I would answer that perhaps the sequence is the other way around—that an expansion of competitive forces may ultimately provide the most promising basis for subsequently exercising a degree of control at \(C_t\).

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Reply to Comments

Oliver E. Williamson

University of Pennsylvania

This reply is intended not so much as a response to my discussants' comments as it is an effort to restore perspectives. I therefore treat only those remarks that appear misdirected rather than attempt a detailed reply.

1. Although the examples cited by Leland Johnson are all interesting, they miss the point. Note that Johnson has the regulated firm appealing its case to the regulatory agency in every instance; he extends prevailing practices into the future. But under my proposal, the forum in which the regulated firm must appeal for support is the capital market rather than the hearing room. The regulatory agency merely facilitates but does not mediate the exchange. Only at rate review intervals is the old agency-firm dialogue renewed. (One might argue that even this be discontinued; but this

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Oliver E. Williamson was unable to attend the 1969 conference and therefore he did not have an opportunity to respond directly to the comments made by Henry M. Boettigter and Leland L. Johnson. Accordingly, his rejoinder is included as part of this collection.
approaches de-regulation, which moves outside the rules of the game.

2. Johnson is also concerned that performance is multi-dimensional and that the procedures will not be sufficient to make fine judgments. This is typically the case with complex systems. Consider this example: one hundred students have just been given a performance test and ranked accordingly. Even assuming that the exam satisfies elementary tests of relevance, neither Johnson nor I would be willing to assign much significance, ordinarily, to a difference between the fiftieth and fifty-first students in the ranking. The difference between the tenth and the fiftieth, however, is apt to be something else—particularly if, after review, it is evident that there are no mitigating circumstances of consequence. This is all that I propose.

3. H. M. Boettinger informs us that an iatrogenic illness is one caused by the doctor himself. Although he intends for this to apply to me, I would judge that, inasmuch as most of the problems that regulation experiences are of its own making, he has supplied the relevant medical analogy for regulation in this instance. The thrust of my remarks is that regulation be unburdened of some of its responsibilities by harnessing natural forces available elsewhere in the economy.

4. Boettinger has me augmenting Stafford Beer’s model. If the reader will check the language in the paper, however, he will find that the augmentation referred to applies to Ashby’s model. (This is so clear as to be almost unmistakable: “an augmented version of W. Ross Ashby’s model of the ultrastable system” and “a slightly augmented version of an ultrastable system” are, presumably, the referent passages.) Also I would have thought it apparent that I am using the model in the same sense as Ashby; namely, as an organizing device. I would judge that Ashby does not really intend for us to regard his model as an exact analog of the brain living or mechanical. It is a model designed to expose the essential properties of adaptive systems that are subject to disturbances of the types described, no more and no less.

What seems essential in the regulatory area is that a coherent framework be supplied. I suspect that the Ashby model is about as elementary as one can usefully employ and remain within this tradition. Whether the types of questions that are of concern to me in the paper could be more fruitfully examined with a more elaborate version can be asserted but remains to be shown. I would concede, however, that there are important questions that can be posed for which this model is not sufficiently rich. Possibly Boettinger would prefer that we move away from an overview of the regulatory process and tinker with the micro-structure. This difference in emphasis may explain, in part at least, our differences in other respects.

5. Boettinger misunderstands me when he states that I propose that the model be given an empirical test. Ashby has already done this. The test that I propose involves combining the efficiency audit with regulatory lag as an incentive device.

6. Boettinger claims that efficiency audits must be performed by men prominent in their field (men like Einstein, Oppenheimer, Bohr, and so forth); otherwise the industry’s experts will disagree with the commission’s experts and “we will be back in the hearing room again—with possibly even longer transcripts than now.” It would not surprise me if the industry experts did disagree with the audits, and I doubt that Einstein, Oppenheimer, or Bohr, individually or collectively, would make much difference. But the point has already been made in my response to Johnson: the forum is not the hearing room but the capital market. Evidence of gross inefficiency is being reported (recall that we are dealing only with the tails of the distribution). Profit potential is apparently going unrealized.

Management displacement is being threatened.

Possibly Boettinger really believes that the managements of regulated firms are entitled to special guarantees of “due process” against displacement. If so, he should make the case directly and not rely on “recent experience of the Soviet System.”

7. An adaptive response that I failed adequately to treat, but which Boettinger’s remarks reveal a need for, is that incumbent managements may be prepared to go to great expense in providing a defense against displacement. Lest the stockholders’ interests be badly served, a limitation on corporate funds spent for this purpose would seem to be indicated.
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