

CONTRIBUTIONS OF NEOCLASSICAL ECONOMICS TO PUBLIC UTILITY ANALYSIS

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ABSTRACT

Neoclassical economics, the dominant economics paradigm, has influenced and been influenced by developments in regulated industries. We identify major theoretical and empirical accomplishments, discuss the impact of these accomplishments on policy development, and list the channels through which the impacts are made possible. We then discuss regulatory politics, lack of research perspective, an overly narrow focus on economic efficiency, and the academic profession as factors limiting the impact of neoclassical economics on public policy.

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1. INTRODUCTION

Any review of the impacts of public utility regulation and opportunities for potential reform should include the contributions of neoclassical economics. Neoclassical economics is the dominant paradigm at present, and it shows few signs of decline. Over the past three decades, its conceptual framework and analytical tools have served as the basis for a critique of regulation, for designing optimum pricing and investment policies, and for implementing regulatory reforms. However, the usefulness of neoclassical economics for future policy development will depend on the ability of economists to make its message relevant for a rapidly changing world and to communicate its basic principles to decision-makers.

1.1 The Institutional Critique

Within the broader field of economics, neoclassical economics has its detractors. Trebing (1987) characterizes the neoclassical model as being "...premised on the belief that market-oriented rational behavior by free agents can serve as the normative guideline for defining the role of government" (p. 1708). Thus, institutionalists assert that neoclassical treatment of regulation and deregulation contains an ideological bias against intervention. Trebing and others argue that deregulation based on neoclassical analyses has not adequately addressed residual market power, social costs, and economic dislocations. Since the negative impacts are often borne by the poor and the powerless, (on the face of it) some neoclassical analyses appear not to be value-neutral, but to actually perpetuate current structures of political and economic power.

Nevertheless, the bias against intervention has some empirical and theoretical basis. For example, we would argue that the "public interest theory" explaining how regulation actually operates has succumbed to economic theories.¹ The former focused on government intervention designed

to ameliorate market imperfections (market power and lack of information), market failures (externalities, public goods, and nonconvex technologies) and income distribution concerns. Public perceptions regarding such issues can lead to new regulatory agencies. However, elements of the economic theory and the capture theory of regulation have been combined with coalition politics (emphasizing organizational costs, rent seeking activity and wealth transfers) to give a more comprehensive explanation of regulatory activity (Peltzman, 1989). The critique emerging from this framework provides a challenge for policy-makers.²

1.2 Searching for a New Synthesis

The usefulness of economic principles for improving regulatory and managerial decision-making is well established. In particular, the field of regulatory economics has a long and distinguished history of contributing to policy developments. The field has been of special interest to institutional economists due to three factors: perceived political power disparities among stakeholders, distributional impacts when citizens are priced out of the market for "essential" services, and technological and organizational changes which influence optimal industry structure. During the last three decades, neoclassical theoretical economists have also "discovered" the wide range of issues raised by infrastructure industries. Generally, these new contributions are more technical in nature, like those relating to rate design under various cost conditions. However, neoclassical economists have also identified opportunities for fundamental changes in the regulatory arrangements, including the replacement of cost-based regulation with price-based regulation, the introduction of various types of incentive regulation, and even total deregulation. Economists of all persuasions have begun to recognize the importance of transaction costs, information asymmetries, and political power--causing neoclassical and new institutional economics to come together.³

The purpose of this article is to survey the contributions of neoclassical economics to public utility analysis. In Section 2, major theoretical and empirical accomplishments are identified.

Although regulatory environments are very complex, key features can be captured by models that help us understand main issues. Naturally, important aspects of regulatory situations get lost in such models, so care must be taken when interpreting results. In Section 3, the impact of the economic literature on policy development is discussed. The influence of academic research manifests itself through several channels: individual economists, influential textbooks, outreach programs of major institutes, and applications by economists at companies and regulatory commissions. In Section 4, we ask why neoclassical economics has not been more influential. Three answers are suggested: (1) Politics constrains the introduction of efficiency-enhancing programs; (2) The literature often explores elegant, but irrelevant characterizations of the regulatory setting (and when relevant principles can be derived, measurement problems can limit their application); and (3) Economists have difficulty keeping pace with technological and institutional changes going on within infrastructure industries; keeping up to date requires a significant investment--compared to the incremental costs associated with tweaking existing models to achieve a quick publication. When the latter occurs too regularly, the literature begins to feed on itself, without being confronted by external reality checks. In Section 5, we conclude with an attempt to weigh the successes and failures of neoclassical economics.

2. ACCOMPLISHMENTS: INSIGHTS AND APPLICATIONS

The number of recent books on regulatory economics testifies to the vitality of the field: from the update of Bonbright's classic and re-publication of Kahn's analytical overview to Spulber's theoretical synthesis, analysts continue to address issues raised at the turn of the century.⁴ These volumes tend to utilize neoclassical economics. However, the original Bonbright had a strong institutionalist orientation--reflected in concerns over fairness and attention to concrete regulatory issues. Danielsen and Kamerschen incorporated recent neoclassical conceptual developments into the revision, while retaining much of the thrust of the 1961 volume. Kahn's classic was rigorous, without being mathematical: it bridged principles and practice. Spulber's (1989) volume is a review

of the theoretical literature which draws upon his own contributions. He defines regulation as "...general rules or specific actions imposed by administrative agencies that interfere directly with the market allocation mechanism or indirectly by altering consumer and firm demand and supply decisions" (p. 37). Spulber identifies three general sources of inefficient market outcomes: barriers to entry, externalities, and "internalities." The latter "...refers to costs and benefits of a transaction experienced by the parties to the transaction that are not accounted for in the terms of exchange" (p. 54). The latter are characterized by transaction costs, costly contingencies, moral hazard, and asymmetric information. While the volume is axiomatic and mathematical, it tries to address institutional features of regulatory issues in a systematic way.

These volumes and others tend to focus on four major areas in regulatory economics. First, they move beyond single to multiproduct firms. Second, efficient pricing and investment rules are given substantial attention. Third, they recognize the unintended consequences of different types of regulation. Fourth, they consider alternatives to command and control mechanisms. To these points we now turn.

2.1 The Multiproduct Firm Over Time

The shift in attention from single product to multiproduct firms represents a significant step towards greater realism. However, the advance is a mixed blessing: analyses of natural monopolies and the role of regulation are much more complex in a multiproduct setting. Research has formalized a number of important concepts including economies of scale, of scope and of sequence, sustainability and contestability, all of which are now part of the conceptual tool kit neoclassical economists bring to policy issues.⁵

In the United States, privately owned utilities dominate; Hotelling's (1938) route of setting price equal to marginal cost accompanied by a subsidy to cover the resulting deficit has not been pursued. With private ownership, regulation was initially viewed as protecting consumers from the

monopoly power that was believed to be the inevitable outcome in a natural monopoly market as one firm takes over the entire market. This belief was challenged by Desetz (1968) who argued that there could be competition for the market via franchising, and the competition would eliminate monopolistic behavior. This theme was a forerunner to the influential contestability theory developed by Baumol, Panzar and Willig (1982) and others.

Today, many economists view the *contestability* of a market as determining the need for regulation: potential entrants are viewed as disciplining dominant suppliers in industries subject to traditional regulation. Whether deregulation and the threat of competitive entry serves as an adequate substitute for regulation depends on whether there remains adequate pressure for suppliers to keep prices and costs down. However, when moving from the conceptual to the empirical, applying the concepts of least-cost suppliers, contestability, and sustainability to formulate public policy for multiproduct firms is problematic. The concepts represent idealized cases, involve difficult empirical examinations of industry cost and demand functions, and require accurate forecasts of technological developments. Nevertheless, the ultimate goal of economists working in this arena is to translate these conditions into recommendations concerning which industries should be regulated, and which industries should be deregulated (when contestable markets and sustainability ensure relatively efficient outcomes).⁶

In response to Demsetz, Williamson (1976, 1986) has noted that franchising public utilities has severe limitations related to transactions costs. The paradigm associated with his contributions focuses on the costs of formulating, negotiating and enforcing complete contracts. Information asymmetries and opportunistic behavior can explain the development of institutional mechanisms associated with regulation. This "new" institutional economics blends neoclassical and traditional institutional economics (Crew and Kleindorfer, 1986, pp. 147-151).

Multiproduct economic concepts have been made more rigorous at the same time as technological developments have made it more difficult to determine the least cost supplier for

components of traditional utility services (energy and telecommunications, in particular). Several issues are at the forefront of current policy debates: how to determine which industry structures (and government policies) best promote new services and production processes; how to determine when a natural monopoly actually exists given changing demands and technologies; how to select price configurations that will both recover costs and encourage efficient consumption choices; and how to ensure that those prices are *sustainable*--that is, not susceptible to the threat of entry or self-production by current customers. For weak natural monopolies, there are no sustainable prices in the face of entry--justifying limitations on the provision of utility services by unregulated firms. Alternatively, a non-natural multiproduct monopolist might be protected from socially desirable entry if regulators maintain inappropriate entry restrictions (for a single product firm--intertemporally, or for a multiproduct firm at a given point of time).

2.2 Efficient Pricing and Investment Policies

If neoclassical economists agree on one point, it is the following: rate design matters. In recognition of the important role of price signals, a wide range of rate designs has been analyzed. The following represents a partial listing of the topics addressed in the literature on optimum pricing and capacity:

- Marginal cost pricing. The allocative efficiency consequences of such pricing are well known. For example, the financial viability of the firm may require a subsidy, or more complicated rate designs (such as multipart pricing). Furthermore, short run and long run marginal costs will differ--so while the former serve as the standard for pricing decisions, the latter are relevant for comparing alternative investment patterns--as when alternative providers have different production technologies.

- Cross subsidization and regulation as taxation. *Cross subsidization* can be a deliberate regulatory objective as some customers cover the incremental costs of serving favored customers. Alternatively, it can stem from inappropriate allocations of fixed or variable costs. A related concern

is *transfer pricing* which increases the reported costs of the regulated firm. This device might be used to shift profits from the regulated firm to an unregulated subsidiary. Such shifting raises a dilemma, because when regulators mandate complete separation among business units in response, the firms lose economies of scope. The result is higher costs.

- Discriminatory pricing and demand separation. The ability to separate markets and prevent resale is facilitated by customers being hooked up to utility distribution systems. Since consumers with inelastic demands are often the ones regulators are trying to protect from monopoly power, commissions often will overlay *cost allocation regulation* upon rate level regulation--preventing "undue" discrimination.

- Ramsey pricing. If the firm can identify different customer groups and charge different prices to the various customer classes, *Ramsey pricing* can be utilized to minimize economic misallocations. However, such a pricing policy (charging more to those with relatively inelastic demands) might still be viewed as unduly discriminatory, even though the firm does not realize excess profit. Citizens might prefer other price configurations for the multiproduct natural monopolist.⁷

- Predatory pricing and market dominance. If high cost suppliers are driven from the market due to entry by a multiproduct natural monopoly, resource allocation is improved. However, these suppliers may claim *predatory pricing* if the output is produced by an unregulated subsidiary or by the regulated firm. Producers of substitute products could argue that revenues from the utility's captive consumer groups (or regulated products) cover costs associated with products subject to competition. However, one ought not accept fully-distributed costs as indicators of subsidization.⁸

- Cost allocation regulation. A multiproduct firm is charged with allocating its total costs, including common costs, over its various products in an effort to ensure that revenue from the sale of each product covers its allocated cost (Braeutigam, 1980). This area may be one of the more under-analyzed in the field of regulatory economics. Regulators have often viewed fully-distributed cost allocations as techniques for ensuring that customer groups are not unfairly burdened with shared

costs. Besides leading to potentially undesirable prices and cross subsidies, there is the danger that separations procedures and cost allocation manuals may foster an unwarranted feeling of accomplishment among regulators. Sweeney (1982) finds that output-based allocation schemes can yield perverse results: we end up with prices such that one or more of them can be lowered--improving welfare without decreasing the monopolist's profit. In addition, we can have relatively high prices in unregulated markets.⁹ Finally, Cabe (1988) illustrates that any output vector can be achieved by some fully-distributed cost method.

- Peak load pricing and intertemporal patterns of demand. This literature has a rich history. The early contributions by Boiteux (1960) and Steiner (1957) stimulated analyses of intertemporal demand patterns. The production technology (involving fixed or variable coefficients and with and without scale economies) drew upon actual engineering studies of cost structures. Diverse technologies, interdependent demands, selection of rating periods and other issues were addressed, as economists began to characterize realistic demand and cost conditions.¹⁰ Rate design in such situations must take these factors into account.

- Pricing with random demand and supply. The intertemporal issues noted above have also been addressed in the context of uncertainty. Consumers value reliability of service which will be affected by the interaction of price (announced in advance) and uncertain demands (driven by weather, seasonal conditions, and hourly factors) and production capabilities (related to unplanned outages).¹¹

- Nonlinear pricing and interpersonal patterns of demand. Whether one is considering pricing entry and rides in an amusement park or access to and usage of a telephone system, multipart pricing offers a viable option for enhancing revenues. Much of the literature on multipart pricing and nonlinear outlay schedules is surveyed by Brown and Sibley (1986). The pattern of individual demands proves to be important for the development of first and second-best rate designs involving fees and usage charges.

• Sustainable pricing. Faulhaber (1975) showed that a natural monopolist was not necessarily immune to entry under certain cost structures. This insight raises a dilemma for regulators and implies significant information requirements for optimal pricing decisions. A related issue is the role of the incumbent firm as the supplier of last resort (Weisman, 1988).

• Quality of service. Service quality also raises a number of important issues for analysts. The quality level provided under competition, monopoly, or regulation has received substantial attention.¹² In practice, regulators tend to utilize pass/fail standards. While such standards are clear and precise, problems arise in using them to monitor and reward quality.¹³

2.3 Understanding the Consequences of Regulation

Besides the conceptual contributions of neoclassical economists noted above, many studies have emphasized the following conclusion: regulation can have unintended consequences in the form of inefficient outcomes. This appears true despite the fact that traditional regulation has a number of institutional features which discourage inefficient behavior (Doug Jones, 1992, p. 127):

- (1) "disallowance of imprudently incurred expenses,
- (2) prudence reviews and application of the used-and-useful test,
- (3) yardstick performance comparisons, not only with public power but among similarly situated investor-owned utilities,
- (4) commission-ordered management audits of both the reconnaissance and focused type,
- (5) judicious employment of regulatory lag,
- (6) altering the allowed rate of return to induce appropriate utility behavior, [and]
- (7) occasional and selective jawboning by regulators."

The seven features suggest that cost of service incentive (COSI) regulation is not a "cost-plus" approach; instead, it could be described as a system of command and control. Although the seven features of this system raise a number of incentive issues, they are utilized in most state jurisdictions.

Despite the fact that COSI regulation has been able to adapt to dramatic economic changes (including input price instabilities, environmental regulations, new technologies, and competitive pressures), the ad hoc adaptations have produced a complex layering of rules and cost allocations for utilities. The achievement of regulatory objectives may be thwarted by rules which are potentially inconsistent with one another. In particular, the incentives for cost reduction are attenuated by relatively short regulatory lag under COSI. Managerial efforts which have long-run payoffs in terms of production efficiency gains are particularly problematic.

That being the case, how does one constrain the firm to earn normal returns and produce efficiently? Numerous regulatory instruments are available: rate of return limitations, entry and exit limitations, pricing restrictions, quality of service requirements, and cost allocation rules--to list a few. Of course, intervention at one level often requires further regulations at another level (the tar-baby effect). The consequences can be damaging to efficiency.

Neoclassical economists have developed numerous models depicting a firm which attempts to maximize profit when confronted by some regulatory imposed constraint. Easily the most famous is the AJW model in which a rate-of-return constraint is imposed (Averch-Johnson, 1962; Welliz, 1963). In fact, for years an outside observer might have equated regulatory economics with the AJW model. The analysis suggested that regulation reduces incentives for efficient production--both in terms of input use and the composition of output (Zajac, 1972; Needy, 1975). The evidence on this matter is mixed. Econometricians have not definitely established the existence of an AJW effect: overcapitalization when the allowed rate of return is greater than the cost of capital (Boyes, 1976 and Zimmer, 1978). Furthermore, theory suggests that detecting an AJW effect is complicated by mitigating circumstances (Berg and Tschirhart, 1988). Uncertainty (in terms of demands, input prices, and allowed returns) can induce undercapitalization; regulatory lag offsets incentives to overcapitalize; non profit-maximizing behavior can lend to a variety of results; and incentives not to take full advantage of power pooling may induce overcapitalization at a regional level instead of the firm level.

Thus, alleged inefficiencies related to the so-called "cost-plus" nature of regulation are fully supported by neither theory nor empirical observation. Despite these developments, the AJW model has been useful for its insight and for stimulating empirical tests. The analytics are a testimony to the possibility that a regulatory constraint can affect production efficiency, and while it is probably true that economists have spent excessive attention on the highly stylized AJW model, their refinements have drawn attention to the complex interactions arising when constraints are introduced.

Other models of the regulatory process have also appeared, including models of fuel adjustment clauses and work inspired by Joskow (1974).¹⁴ The latter are attempts to better characterize the regulatory process. Joskow argued that the essence of price regulation was not the rate-of-return constraint. He explored external developments that triggered price changes and changes in the regulatory process.

2.4 Issues in Incentive Regulation

Because of perceived limitations of COSI, it is quite appropriate to consider alternative incentive mechanisms which take advantage of regulatory experience and theoretical developments over the past two decades.¹⁵ The principal-agent literature directs attention to the design of incentive mechanisms. These can be defined as the implementation of rules that grant some discretion to the firm: Regulators can use incentive regulation to better employ the firm's superior information. However, the firm is still constrained in such a way as to encourage it to pursue regulatory goals. The existence of multiple regulatory goals greatly complicates the design of incentive mechanisms.

A body of work on asymmetric information and regulation has been generated during the past 15 years (surveys by See Sappington, 1991, Baron, 1989, and Laffont and Tirole, 1993). Under the umbrella of principal/agent paradigm, regulation has been viewed as a situation in which the agent (firm) has more information than the principal (regulator). A fundamental result is that the optimum

pricing results obtained under symmetric information are not always possible. The firm will gain rents owing to its superior information. When unobservable managerial effort is incorporated into models, the need for incentive mechanisms is underscored.

Some proposed mechanisms are comprehensive while others are targeted in nature. Among the former are price-cap and price adjustment mechanisms based on performance indices. These provide firms with broad-based incentives to control costs, but such schemes have their own limitations. One issue is the establishment of reasonable performance standards when the regulator has imperfect knowledge of the firm's opportunities. For example, what price level should serve as the starting point for a new regime? For a price cap, what productivity index is appropriate for sharing the cost savings with consumers? For any scheme, to what time frame can both parties commit and what procedures are appropriate for modifying the incentive mechanism to adapt to unforeseen circumstances? Another issue is whether broad-based or targeted incentives yield the greatest net benefits. For example, targeted incentive payment programs condition financial rewards or penalties upon a specific measure of a utility's performance, such as changes in a component of costs. Narrow approaches can induce inefficiencies (Berg and Jeong, 1991).

A related area is incentives for innovation under regulation.¹⁶ Dynamic considerations may be the most important (but least tractable) from the standpoint of policy development. Command and control mechanisms are particularly ill-suited to promote technological advance. Productivity growth is the outcome of a "discovery process." Under traditional COSI regulation, lawyers (not scientists and engineers) are the ones who focus on discovery! Victories are achieved in the hearing room, not the marketplace.

Another recent body of work addresses partial regulation (Braeutigam and Panzar, 1989, Lewis and Sappington, 1989, Laffont and Tirole, 1990, Tschirhart, 1989). This line of research explores the implications of regulated utilities moving into unregulated markets. New rules have been devised, and cost allocation and cross subsidies have moved into the fore. Again, socially optimum

solutions are not feasible given asymmetric information. Multiproduct economies are generally the basis for entering new (unregulated) markets. These analyses suggest that economic gains can arise from underlying technological factors or from demand interdependencies. Determining how to share the benefits of jointly used facilities requires that regulators have full information on demand and cost interdependencies. Often, the feasible sets of alternative price combinations (and "implied" cost allocations) will be quite large, so a wide range of alternative divisions of benefits is possible. This division between the firm and consumers and among consumer groups raises troublesome questions for regulators.

3. THE INFLUENCE OF NEOCLASSICAL ECONOMICS

The previous section indicates that a large body of neoclassical literature has been generated dealing with public utility economics. Moreover, this literature has been a major part of the industrial organization literature and microeconomics in general. Indeed, neoclassical public utility economics has often been at the cutting edge of microtheory, with sophisticated tools being applied to pricing, investment and technology problems in regulated industries. But how influential has this literature been? Do current regulatory public policies reflect the literature, and if so, does the research lead or lag the policies? Definitive answers to these questions are elusive, and likely to be biased by one's stake in the literature. As authors who have a stake, we begin with a series of observations, suggesting that the literature has had a positive influence.

3.1 Evidence Regarding the Influence of Economic Writings

Quantitative evidence regarding the impact of neoclassical economics could be manifest through several sources: casual empiricism, case studies, or citation analysis. None of the approaches is ideal. Personal interviews may shed light on why economists wrote their results in certain ways for particular audiences, but anecdotal evidence is generally not convincing. Similarly, case studies are

idiosyncratic in nature--dependent on the selection process. When considering research links, citation analysis sheds light on the roles of various authors. However, it is somewhat problematic as evidence of links to policy implementation, since an *American Economic Review* article is not likely to be referred to in, say, a regulatory pronouncement or an Electric Power Research Institute publication. Nevertheless, the appearance of economic terms in policy publications related to energy, telecommunications, water, and other utility areas testifies to the influence of neoclassical economics.

For example, in 1990 the United States Telephone Association (USTA)--not noted as a premier economic research group--published a collection of articles that provide a framework for examining rate design issues. Authors included Baumol ("Minimum and Maximum Pricing Principles for Residual Regulation" and "The Deserved Demise of Full Cost Allocation"), Bonbright, Danielsén and Kamerschen ("Assessment of Competition and Regulation"), Zajac (on "Cross-Subsidization"), Kahn and Shew ("Current Issues in Telecommunications Regulation: Pricing"), and Larson ("Cost Allocations, Predation and Cross-Subsidies in Telecommunications"). The listing of titles indicates how economic analysis is permeating the regulatory process. Although these particular articles lack elegant mathematics and complex diagrams, the fundamental principles are the same as those analyzed more rigorously by these and other economists in the most prestigious journals.¹⁷

A decade earlier, the Electric Utility Rate Design Study (1977-80) commissioned over one hundred studies: academics, consulting firms, and utilities participated in a large scale analysis of rate design. The sponsors were the Electric Power Research Institute (EPRI), the Edison Electric Institute, the American Public Power Association, and the National Rural Electric Cooperative Association. The effort was to assist the National Association of Regulatory Utility Commissioners in addressing pricing issues which had arisen during the 1970's. The studies ranged from empirical analyses of peak load pricing, to comparisons of alternative marginal costing methodologies, to mathematical analyses of second-best issues (Lancaster, 1979).

It is difficult to gauge the full impact of these studies. To the extent that regulators and managers focused on the resolution of methodological issues, they were probably able to narrow the range of disagreement over some policy alternatives. Furthermore, the principles were not only documented but widely disseminated within the regulatory community.¹⁸

3.2 Pricing and the Promotion of Efficiency

Trebing (1984) suggested that neoclassical economics has made its greatest contribution in the area of rate design. Probably the preeminent topic in rate design has been peak-load or time-of-use (TOU) pricing. Joskow and Noll (1981, p.17) point to TOU pricing as "...the one great practical triumph of [monopoly pricing] theory." And although TOU pricing has a long history (See Hausman and Neufeld, 1984), Acton (1982, p.114) referred to the 1970s "...as the decade when American electric utilities discovered time-of-use pricing." He credits this to the strong theoretical foundation established in the literature, and dramatic changes in the industry's costs that created pressure for more efficient pricing structures. Studies funded by EPRI and other organizations measured the benefits and costs of moving to TOU pricing by relying on neoclassical models and consumer surplus tools.

More fundamental than TOU pricing is the long-held tenet that prices should equal or at least be based on marginal cost. Historically, pricing in regulated industries has been dominated by average costs and mechanistic cost allocation rules, but Jones (1988) points out that average costs have steadily lost ground to marginal costs in ratemaking. Marginal cost pricing can be found incognito in the 1978 Public Utility Regulatory Policy Act (PURPA). PURPA promoted six pricing standards in the name of efficiency and conservation, including the following cost-of-service standard:

Rates to each class of customers shall be designed to the maximum extent practical to reflect the cost of providing service to those customers. Methods should take into account the extent to which total costs are likely to change if additional kWhs or electric energy are delivered to electric customers.

In spite of the absence of the word "marginal", Joskow (1979) noted that the standard was meant to encourage marginal-cost pricing; Nowell and Tschirhart (1990) found that over half the state regulatory commissions adopted the standard at least in part to promote efficiency. In the telecommunications industry, marginal-cost pricing has taken the form of measured service whereby customers are charged for each call based on their duration and distance.

Ramsey pricing is related to marginal-cost pricing in that prices are a percentage deviation from marginal costs, where the percentage is inversely proportional to demand elasticities. Faulhaber and Baumol (1988, p. 594) cite Ramsey pricing as "...a clear example of a principle that derives from the literature and has (recently) achieved a good deal of attention among government agencies." They note that it has been discussed in many courts, state commissions, the Federal Communications Commission (FCC), the Federal Energy Regulatory Commission (FERC) and the Interstate Commerce Commission (ICC), as well as in other countries. Faulhaber and Baumol also highlighted the stand-alone cost test as an example of a contribution of economic theory to regulatory pricing practices. The test places a ceiling on rates. No consumer or group of consumers ought pay more for service than the cost of serving them apart from all other consumers. Although this approach can be traced to pricing practices established for the Tennessee Valley Authority under the name "separable costs and remaining benefits" (EPA, 1975, Straffin and Heaney, 1981), only in the last two decades has it become prominent in the literature where it has been related to the core concept in game theory (Faulhaber, 1975; Sorenson, et al., 1976, Sharkey, 1982). The theory also provides regulators with a rigorous definition of cross subsidization that eschews the arbitrary definitions associated with fully distributed cost pricing practices. Faulhaber and Baumol indicate that both the FCC and ICC have considered using stand-alone cost tests in rate making.

Two-part tariffs have been extensively covered in the literature and are common in the telecommunications, natural gas and electric industries. Their origin dates back at least to the Hopkinson (1892) electricity tariff which distinguished between costs that were dependent and

independent of use. One of the six PURPA standards mentioned above encouraged eliminating declining block tariffs in the name of conservation. Some commissions called for replacing them with two-part tariffs. In addition, the design of telephone access fees and lifeline rates in the major utility industries have benefitted from the theoretical work on two-part tariffs.

Another pricing method that has appeared in the literature and that has been increasing in usage is interruptible rates (Chao and Wilson, 1987). The literature has stressed the welfare gains that are available if consumers are offered a menu of prices and service reliabilities. In PURPA, interruptible service pricing appeared as one of the six standards.

3.3 Alternative Regulatory Constraints

Since Averch and Johnson's seminal paper on rate-of-return regulation, scores of authors have pointed out the negative incentives created by this policy. Nevertheless, until the last decade rate-of-return (cost-of-service) regulation appeared safely entrenched at both the state and federal levels. Today, the picture is very different.

In telecommunications, the FCC has replaced rate-of-return regulation for AT&T with price caps. By removing the cost side of the profit function from scrutiny, and only regulating price, the utility has an incentive to minimize cost. This is a major change in the regulatory process that the FCC is considering extending to local exchange companies (LECs). At the state level, several commissions have begun experimenting with price caps for LECs. More commonly, state commissions have placed caps on rates of return: LECs that earn above their caps must share the excess with ratepayers according to a prearranged formula. Currently, at least twenty states have some type of sharing rule in place.

Price caps were first introduced in the United Kingdom after being recommended by Stephen Littlechild, an academic (now regulator) who has made numerous contributions to the neoclassical

literature. Price caps have two particularly favorable features: a decoupling property and a regulatory property:

(1) Price caps decouple current prices from current observed unit costs. This mechanism addresses the problem of monitoring and rewarding excellent performance by the utility. Under a traditional COSI structure, low managerial effort leads to higher costs, which are translated into higher prices at the next rate case. Prudence reviews can identify the most egregious managerial failures, but level of effort is effectively hidden from the regulator. Price caps can deal with this moral hazard problem by decoupling observed costs from the allowed price (Cabral and Riordan, 1989, Brennan, 1989).

(2) Price caps also have the regulatory property of administrative simplicity: "regulation with a light hand."¹⁹ In the $RPI - X + Y$ form, electricity price is allowed to rise with some external price index (in the UK, the retail price index--RPI), less an expected rate of productivity advance (X), plus cost increases beyond the firm's control (Y). Thus, Y could be an external index of fuel prices weighted by the generation mix of the particular utility.

There has been less activity in the electric and natural gas industries with respect to changes in rate-of-return regulation. The Arizona commission, in consultation with economists, did adopt a five year price-cap plan for Tucson Electric Power which met with mixed success (See Isaac, 1991). Lyon and Toman (1991) have proposed price caps for natural gas, although they modify the system used in telecommunications. Other forms of incentive regulation are being pursued by the public service commissions of New York, California and in many other states.

3.4 Deregulation as a Policy Option

The most fundamental regulatory issue is whether firms should be regulated in the first place. Neoclassical economics has painted a coherent, logical framework for answering this question. The framework is centered on the concept of natural monopoly which has been around for many years

but was refined considerably by Baumol (1977). The framework spells out the conditions under which a firm should be regulated. Important considerations include whether there are barriers to entry or in the more extreme case whether markets are contestable, and whether sustainable prices exist.

Deregulation began in earnest during the 1970s under President Carter. Regulated industries that could not pass the natural monopoly test for justifying regulation were largely deregulated. These included the airlines and trucking. Indeed, many economists believe that airline deregulation was one of the crowning achievements of regulatory economic analysis, particularly because it was orchestrated by Civil Aeronautics Board Chairman Alfred Kahn under the constant scrutiny of the public (McGraw, 1984). Subsequent mergers, unequal access to gates, and airline reservation systems have reduced some of the gains to deregulation--but empirical analyses still indicate improvements in efficiency (Bailey, Graham and Kaplan, 1985, Call and Keeler, 1985 or Morrison and Winston, 1986).

Deregulation has also proceeded to varying degrees in the railroad, telecommunications, electric and natural gas industries. The 1980 Staggers Rail Act eliminated substantial regulatory control over railroads. The breakup of AT&T and the rapid changes in telecommunications technology that have made competition viable, have placed substantial pressure on state commissions and the FCC to deregulate large segments of the industry, and to allow LECs to enter new markets. With respect to the latter, prominent economists (e.g.s, Kenneth Arrow, George Stigler and Roger Noll) have argued in Judge Greene's federal court on the pros and cons of particular policies by appealing to theoretical concepts such as economies of scope and uneconomic bypass (entry induced by higher prices for services providing cross subsidies).

In natural gas and electricity, deregulation has not been as dramatic; however, the familiar vertically integrated structure of these industries is changing. Local gas distribution companies and large users often contract directly with gas suppliers instead of pipelines, while the pipelines are moving toward common carrier status. In electricity, promoters of deregulation have argued that

generation is no longer a natural monopoly, therefore, competition at the generation stage is warranted. PURPA opened the door to competition by requiring utilities to purchase power from non-utility generators who could produce below the utilities' avoided costs. (Avoided cost is another disguised version of marginal cost.) After utilities balked and economists pointed out that this system would not ensure least cost supplies, states began implementing bidding schemes whereby the utility would publish requests for power and interested parties could bid for the right to supply. At least ten states have set up formal bidding rules (Jurewitz, 1991), and California is using a second price auction bidding scheme based on the work of Vickrey (1961).

Winston's (1993) comprehensive survey of economists' predictions and assessments regarding the effects of deregulation addresses the contributions of economic analysis to policy development. He noted that we did not foresee some instances when deregulation would cause major changes in corporate operations and technology (eg. hub and spoke systems for airlines). Similarly, regulatory relief sometimes lead to more extensive price discrimination (eg. railroads). Nevertheless, he concludes "... the evidence clearly shows that microeconomists' predictions that deregulation would produce substantial benefits for Americans have generally been accurate; hence their predictions of additional benefits from continuing the process should be taken seriously" (p. 1286).

3.5 Using Markets to Address Externalities

If the 1970s is the decade that utilities discovered time-of-use pricing, then the 1990s will be the decade that utilities discover externalities. As large, stationery sources of air pollution, electric utilities will be major players in meeting reduced emissions levels mandated by the 1990 Clean Air Act Amendments. The methods used in the Act for achieving reduced emissions represent a move away from command and control strategies of the past, and toward market based permit systems which have long been touted by economists (Crocker, 1966, Hahn and Noll, 1982).

States and cities have also discovered externalities. The California South Coast Air Quality Management District is very active in establishing market systems, and Chicago is investigating marketable permits at the local level. Numerous state commissions currently are grappling with the question of whether they should adopt their own externality programs that would necessarily piggyback on federal programs.

3.6 How Influential?

One might conclude from the preceding paragraphs that neoclassical economics has certainly had a positive influence on policy making. A more critical reader, however, might view this conclusion askance and argue that: (1) the glass is half empty not half full, and (2) all of these changes would have occurred anyway.

Consider a few examples in support of (1). TOU pricing has been around for over a century in nonregulated industries, and in regulated industries it was an invention of engineers, not economists (Faulhaber and Baumol, 1988). Ramsey pricing has been discussed at commissions, but the information required to implement it has thwarted implementation. Stand-alone cost tests are costly and result in such a high ceiling price that the FCC (1987) rejected the approach. Rate-of-return regulation has loosened its grip, but it is still the dominant form of regulation for electricity. Embedded cost is still seen by many commissions as the only practical means to determine prices (Breslaw, 1988). Finally, deregulation does not necessarily lead to a competitive environment. There are fewer major airlines now than before deregulation, AT&T is still the dominant toll provider, and promoting nonutility generation (while still shackling utilities with traditional regulation) creates a unlevel playing field from which we learn little about efficiency (Tschirhart, 1991).

The second reason why neoclassical economics may be less influential than the above observations suggest is that the changes cited might have occurred anyway. As world output grows and foreign economies develop, U.S. productivity levels off; there is increased pressure to maintain

standards of living at home. Policy changes that enhance economic efficiency in all sectors of the economy are an inevitable response to this increasing global competition, rather than a long overdue recognition of the neoclassical economics literature.

If neoclassical economics has been less influential than its practitioners would like, it is not because the lines of communication between the economist and policy maker are few and fragile. Academic economists often serve as commissioners at both the state and federal level. Commissions and utilities frequently sponsor conferences where academics present current theoretical and empirical results. Universities house public utility institutes that provide courses, research, forums and well-trained graduate students to commissions and industries.²⁰ In addition, publications either bridge the gap between academic and practitioner (Public Utilities Fortnightly, The Electricity Journal) or summarize economic journal articles for non academics (PURTI Research Summaries). See, for example, Sappington and Weisman (1994a,b).

4. WHY NOT MORE INFLUENTIAL?

Given these opportunities for cross-fertilization of ideas, why do economists not have more influence on policy making? We offer three possibilities: (1) politics, (2) shortcomings of the literature, and (3) the economics profession itself.

4.1 Politics

Regulation is driven by politics as well as, or perhaps more so, than economics. Political goals and economic efficiency can sometimes be compatible, giving rise to socially efficient outcomes. At other times, interest groups whose goals are not aligned with social efficiency can win the political struggle and efficiency is sacrificed.

Interestingly, neoclassical economics has used this theme to explain why it is not more influential. Stigler (1971) introduced the economic theory of regulation which portrayed regulation

as the outcome of competing interest groups vying for government favors. Numerous authors followed up on this notion offering empirical studies of regulatory decisions. The studies typically show that regulators do account for economic efficiency when making choices, but that they are also heavily influenced by their political environments. Peltzman (1989) has summarized how the economic theory of regulation explains regulation and deregulation in seven major industries. He argues that the economic theory can explain a number of industry-specific developments, but that it still has far to go as a predictive model.

Because regulation is a political game, there are tugs of war and economists can usually be found at both ends of the rope. Issues such as the usefulness of contestability theory or the stand-alone test, the existence of an AJW bias in the electric industry, the efficacy of deregulating gas pipelines, or the advisability of allowing LECs into information services have all had prominent economists arguing on both sides. If economists cannot agree, what is the noneconomist policy maker to do? She does not want to err, and she realizes the following: adopting a policy when she should not is likely to be a more obvious error than not adopting a policy when she should. The fear of Type II error protects the status quo.

4.2 Shortcomings of the Literature

A number of shortcomings limit the applicability of the literature to policy making. First, the theory may be either not testable, or when it is tested, mixed results occur. Principal/agent theory has occupied center stage in the theoretical literature for a decade; until recently, it has not lent itself to empirics. Alternatively, at least a dozen authors have carefully tested the AJW hypothesis, but the results are contradictory.

Second, many important variables are difficult to measure. Ramsey pricing requires knowledge of marginal costs and demand elasticities, but regulators are not willing to accept wide ranging estimates, and short-run versus long-run considerations confuse the issue. Stand-alone cost

analysis requires measuring costs of hypothetical firm structures, which limits the usefulness of this concept.

Third, economic models often rely on tools the regulator does not have. The asymmetric information literature has devised schemes that provide the utility with an incentive to truthfully report its costs to the regulator. But many of the schemes rely on subsidies for truthful revelation, and subsidies have not been seriously considered since the marginal cost controversy that followed Hotelling's (1938) seminal work. In response to this shortcoming, authors are suggesting two-part tariffs as a proxy for subsidies.

Fourth, economic models are necessarily abstractions of reality. As such, they provide insights into the workings of regulation, but they do not provide a set of guidelines to regulators who must make detailed decisions. For an example, regulators currently are grappling with what to do about environments in which utilities operate in both regulated and unregulated markets. The regulators have been exposed to economic models that lay out efficient policies for total regulation; in the case of total deregulation, regulators have heard economists extol the virtues of competition. But efficient policies for partial regulation have not been forthcoming. Static, highly abstract models yield clearcut answers for the polar cases: if the utility is a natural monopoly, it should be the sole supplier; if the utility is not a natural monopoly it should be deregulated. But for the intermediate case, when a utility that is a natural monopoly in some of its markets is partially regulated, efficient results are not achieved (Tschirhart, 1989). Thus, while static models have offered limited guidelines for operating in partially regulated environments (Braeutigam and Panzar, 1989), regulators are in the limelight and must make decisions.

Finally, the fact is that most regulators do not view the world as economists view it. "In reality, regulatory commissions have objectives, motivations, and responsibilities far more complex than 'setting price equal to marginal cost subject to a profit constraint'...many regulatory commissions are complex organizations...as in any complex organization, individuals or groups within the

commission have differing conceptions of what they should be doing..." (Joskow and Noll, 1981, p.50). Neoclassical economics has focused almost exclusively on efficiency, which is but one of many objectives to most regulators. The justification for the narrow focus is that the other concerns, legitimate as they are, are too difficult to balance against efficiency given our regulatory control mechanisms (Schmalensee, 1979). Whether or not this is true, it does not seem to dissuade regulators from a strong focus on equity or fairness (Jones, 1988).

Regulatory policies have important distributional consequences, and when economists fail to directly address these consequences, they lose credibility among policy makers (Hamilton, 1992). Trebing emphasizes this point: "...the neoclassicists have essentially disregarded equity and distributional effects, and have failed to establish a framework for examining social values" (1984, p.362). This point is driven home by regulatory rejection of Ramsey pricing and stand-alone cost tests. Ramsey pricing implies high prices for inelastic demanders--which means residential users, the very group that regulators wish to insulate from price increases. Stand-alone cost tests were rejected by the FCC in part because they did not provide adequate protection against price increase to some groups.

4.3 The Economics Profession

The last two to three decades have been a boom period for the regulatory literature. Dramatic leaps have occurred in the number of issues and the depth of analysis in academic journals. In spite of these leaps, however, academic economists have been leapfrogged by real-world events. The rapid entry into the telecommunications industry and the dramatic changes in the structure of the electric and natural gas industries are examples of such developments. To some extent, it is a matter of fast moving technology, such as the optical fiber rings being installed around metropolitan areas that engender bypass. But the technologies are prominent in the trade press, so there must be other explanations for why economists fall behind events.

The publish or perish academic environment has been excoriated perhaps even more often than regulation. What it can mean is that academics have an incentive to tweak existing models for a quick publication, rather than to take the time to develop an understanding of important issues. The plethora of articles on the AJW effect or TOU pricing attest to this notion. The literature begins to feed on itself without getting external reality checks. In the case of TOU pricing, it seems to have repeated itself (Ault and Ekelund, 1987). The models become ends in themselves rather than ends to understanding the world. Regulators detect this when some economists cling to the perfectly competitive model of the economy.

Acton (1982) indicated that economists performed well in laying out the benefits and costs of TOU rates to regulators. But when time came for implementation through experimental programs, they dropped the ball. In too many cases, the experiments were not carefully formulated (Aigner, 1985), and their results could support any conclusion. The academic system does not seem to reward studies that search for support of what we think we already know, yet policy makers need this work.

5. CONCLUDING OBSERVATIONS

In his examination of the economics profession's impact on public policy, Nelson (1987) noted that people have criticized economists as tending to be "excessively abstract and institutionally naive" (p. 51). There is no doubt that economists' impact is limited when analyses ignore the historical context in which issues arise. Theory has become more refined and inaccessible, but theoretical applications have certainly influenced public policy and private decision-making in the area of regulated industries, particularly in the areas of rate design and regulatory reform (including incentive regulation and deregulation).

What should economists be doing today? Richard T. Ely, one of the founders of the American Economic Association and a University of Wisconsin Professor of Political Economy,

provided a wonderful statement on the nature and scope of economics in his 1908 revised edition of

Outlines of Economics:

The peculiar and distinctive office of the economic scientist... is to emphasize the less tangible truths, the remoter consequences, the deeper and consequently less obvious forces of economic society. The impulses of the moment, the immediate demands of the hour, the present "fact" that stares us in the face (and sometimes blinds us), are not likely to lack vigorous champions; and to preserve the balance there is need of a craft of thinkers far enough removed from the battle to preserve the wider outlook, mindful of the lessons of the past, jealous for the rights of the future, insistent upon the less obvious truths. This is why economics so frequently appears to the practical man strained and academic. This impression arises from a difference of emphasis which in the main is as salutary as it is inevitable. The academic quality of the economist's work arises sometimes from ignorance, sometimes from pedantry, but more frequently from his courageous insistence upon the importance of the less tangible truths and the distant consequences of present action (Ely, 1908, p. 8).

This paean to the "academic" nature of economics resonates with us today. Ely underscores the importance of the "less obvious truths". No doubt, he would find the mathematics of much of today's literature as formalistic and excessively technical, relative to the genuine insights gleaned from particular models. As an institutionalist, he would, no doubt, want to see models more closely grounded in historical contexts. In addition, as a "progressive" he scorned *laissez faire* as an approach to the economy. He saw government intervention as having an important place in improving the welfare of our citizens. Yet, to the extent that rigorous models have helped shed light on the fundamental sources of governmental and industrial dynamics, he might approve of the substance (if not the precise form) of recent contributions.

For example, one advantage of deregulation is that it tends to stimulate cost reductions and encourages the exploration of demand elasticities. Enhanced economic incentives for innovative efficiency can outweigh short run inefficiencies from temporary market power. With deregulation, identifying which firm (or location) has economic advantages is a task involving trial and error. Unless chronic excess capacity and duplication of facilities is likely to result, a strong case can be made that this task be left to the marketplace, rather than to administrative procedures.

Meyer and Tye (1985) identify two regulatory transitions which raise different fairness and efficiency considerations. In a situation of easy entry and minimal commitments tying particular customers to particular vendors, the contestable markets model is applicable. No residual regulation is needed to protect consumer interests. The bankruptcy of particular vendors may cause dislocations, but at least the elimination of inefficiencies accompanies such adjustments:

Indeed, complaints about deregulation are more likely to originate with the factors of production--labor and capital--for deregulation can often mean erosion of a previously privileged position. ...But from the standpoint of consumer (or shipper) interests above, a prompt, almost immediate, transition would seem advisable (p. 50).

Another situation involves limited entry possibilities, with some consumer groups having sunk costs or commitments tying them to specific vendors for some period to time. Inelastic demands associated with sunk investments at particular locations can be subjected to monopoly exploitation. Ramsey pricing rules based on relative short-run elasticities raise questions of fairness. Claims of injustice arise as price discrimination emerges. As Meyer and Tye state:

It should never be forgotten that in a market economy, whenever prices for any activity rise disproportionately above the underlying cost fundamentals, business ingenuity (in the form of new or altered technologies, product and location substitutions, etc.) is quickly applied to finding ways to do with less (p. 50).

They are concerned with price differentials inducing investments that do not prove to be economically efficient in the long run. Meyer and Tye are skeptical of using Ramsey pricing when our knowledge of short and long-run demand elasticities is so limited, particularly when endogenous R&D investments will alter those elasticities.

Besides recognizing uncertainties related to economic parameters, the neoclassical economist's emphasis on efficiency as the justification for regulation must be tempered by other factors. In particular, political constituencies and powerful special interests can dominate regulatory debates. Such considerations are sometimes clothed in concerns for equity, but neoclassical economists note that inappropriate regulation can induce resource misallocations, reducing the gains to intervention. Adding the issue of how regulators respond to and stimulate technological advance further

complicates on-going debates. Regulators have an obligation to monitor changes in output mix, vertical integration, and diversification by regulated firms. But most neoclassical economists argue that those favoring command and control mechanisms have to be able to step back to see the big picture: price caps and deregulation can make economic sense when the justification for government controls are weakened by economic change.

Although no simple road-map exists for partial regulation or moving to full deregulation, the principles developed by neoclassical economists can serve as guideposts along the way. The concepts described here are still in the process of being systematically analyzed. For example, vertical integration and diversification greatly complicate regulatory oversight responsibilities. Given the complexity of the issues raised by multiproduct firms which are partially regulated, we cannot expect to find simple mathematical formulas which yield conclusions of "yes" or "no" to deregulation proposals. Consider Ely's "less obvious truths:" technological opportunities and demands are changing--altering the gains to traditional command and control regulation. Given changing demand patterns and technologies, alterations in product mixes, and new production interdependencies in traditional natural monopoly industries, it is hard to justify a "regulation as usual" approach to our important energy, transportation, and telecommunications sectors.

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Notes

1. Note, however, that the testing of regulatory behavioral theories has often inadequately distinguished between interest group and public interest theories. See Nowell and Tschirhart (1993).

2. Trebing (1987) doubts whether neoclassical models "...produce analytical concepts and public policy recommendations that are workable in modern national and global economic systems." (p. 1722) He finds that models of market failure, regulatory behavior, and interest groups lead to unduly emphasizing the status quo (since the Pareto welfare criterion seems to legitimize ill-gotten gains and existing policies). We argue that the neoclassical system can offer deep insights into the actual regulatory process and thoughtful analyses of alternative pricing and investment behavior. Whether policy conclusions reached by particular individuals tend to be based more on analysis or ideology is another question!

3. It is important to distinguish between mathematical economics and neoclassical economics. The latter emphasizes optimizing behavior by firms and consumers subject to technological and regulatory constraints. Often, only calculus is required to identify equilibrium outcomes and responses to changes in key variables. Fertile areas for formal analysis include making both innovation and regulation endogenous.

4. Bonbright, Danielsen, and Kamerschen (1988), Kahn (1970, 1988) and Spulber (1989). Other important volumes are referred to at other points in the paper.

5. For an interesting historical sketch of the early emphasis on multiproduct firms and the concepts of sustainability, contestability, and economies of scope, see Bailey's Foreword in Baumol, Panzar and Willig (1982). See Spulber (1989) on economies of sequence.

6. Berg and Tschirhart (1994) combine market observations with the concepts of contestability and supportability, a version of sustainability (Sharkey, 1982), to derive implications for the natural monopoly status of local exchange companies in the telecommunications industry.

7. Furthermore, there is no guarantee that Ramsey prices are sustainable in the long run: some coalition of customers could end up paying more than the *stand-alone* costs of serving them--leading to self production and the loss of their business. The technical literature on Ramsey pricing is ably summarized in Sheshinski (1986) and Braeutigam (1989). Mitchell and Vogelsang (1991) apply much of this literature to telecommunications pricing.

8. Furthermore, when a group of firms is under industry-wide regulation and when price is based on industry average costs, the presence of high cost firms could increase the profits of efficient suppliers (Daughety 1984). The removal of such cost-based pricing would reduce prices and lead to bankruptcy or consolidation of inefficient firms. Such a

development would again bring forth charges of predation, but these charges would be groundless.

9.Sweeney explains these results by noting that because regulated products are permitted to return a "fair return" on shared input, output reductions in unregulated markets allow more of the common cost to be shifted to regulated markets. As a result, greater profits are earned in these regulated markets. In one sense, these results may appeal to regulators. The prices are high in the unregulated markets, thereby quelling fears of cross subsidies from the regulated markets. Also, competitors in the unregulated markets would be pleased, since the monopolist is apparently not relying on profits from the regulated markets to predatory price in their markets. In the long run, the monopolist's prices could be undercut in at least some of the unregulated markets, perhaps even driving the monopolist out entirely. The advantages of natural monopoly production for multiple markets are then lost, and the regulator's optimism regarding FDC procedures proves short-lived.

10.Crew and Kleindorfer (1986) have made a number of important contributions to this literature. See also Panzar 1976), Sherman (1984), Berg and Tschirhart (1988), and Burness and Patrick (1991).

11.Berg-Tschirhart (1988) summarize this literature in their survey of regulatory economics.

12.See Spence (1975). The rich literature that has emerged in recent years is summarized by Berg and Lynch (1992).

13.For example, by evaluating performance relative to a pass/fail cut-off, distinctions among various levels of sub-standard and super-standard performance are ignored: utilities have little incentive to exceed targets. In addition, the targets themselves are often somewhat arbitrary, having arisen from a chaotic process reflecting historical engineering capabilities, political pressures, and administrative happenstance. Consumer valuations of different quality dimensions and firm knowledge of emerging technological opportunities are not likely to be reflected in current pass-fail standards.

14.See Berg and Tschirhart (1988) and Sherman (1989) for surveys.

15.The basic reason for regulation is that the firm's goals differ from the regulator's goals (either based on statute or personal preferences). Investor-owned firms seek profits for stockholders, while regulators seek other objectives. If the goals were identical, there would be no need for regulation. Firms would "do the right thing." Some recent studies illustrate the application of neoclassical economics to incentive regulation. Waterson (1988) presents a very accessible overview of regulation and the theory of the firm--including policies such as state ownership, bidding schemes, privatization, and deregulation. Train (1991) surveys the theory of natural monopoly using only diagrams to provide the intuition behind neoclassical analysis. Brown, Einhorn and Vogelsang

(1991) categorize the pros and cons of alternative regulatory schemes. Crew and Kleindorfer (1985) focus on the governance (administrative) costs of regulation.

16. Berg and Tschirhart (1988) survey the theoretical literature and attempt to draw some broad conclusions regarding impacts on industry behavior.

17. In fact, the foreword to the USTA collection notes that given the dramatic telecommunications technology changes working their way through the economy, an understanding of economic principles is crucial to the development of corporate (and regulatory) policies towards new digital services. Designed for practitioners, the volume testifies to the impact economics is having on the regulatory process.

18. For example, Lancaster's conclusions are of some interest for today's policy debates about taking environmental externalities into account for utility planning:

It is true that, in principle, even the smallest regulated sector can bring about some improvement by adopting second best prices, but the informational cost of attempting to determine even the direction of divergence of the appropriate prices from marginal cost or other existing prices would be . . . overwhelming. . . . Unless a simultaneous second best solution is determined for the complete regulated sector, therefore, it would seem that the next best thing (the "third best"?) is to ignore second best elements in pricing policy at the decentralized level. (pp. 92-93)

19. See Weyman and Jones, 1991, p.69.

20. Academic centers play a significant role in supporting and publishing research, making that research available to noneconomists, and offering training courses and conferences. Universities that house centers include: Auburn, Columbia, Connecticut, Florida, Georgia, Illinois State, Indiana, Michigan State, Missouri, New Mexico State, Ohio State, Rutgers, Wisconsin and Wyoming.