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## Introduction to regulatory economics

The regulation of natural monopolies is a fertile field of study for economists. Theoretical developments over two decades call for a consolidation of past research, even as regulators and managers continue to make decisions regarding prices, investments, new products, and possible deregulation. This book attempts to step back from today's headlines to systematically derive principles for efficient public policy toward those firms and industries with natural monopoly characteristics. The first half of the book analyzes why and how we *should* regulate natural monopolies, with some emphasis on actual pricing structures and entry regulations. The second half of the book examines why and how we *do* regulate natural monopolies, as well as the inherent problems that can arise. Throughout, we use current policy issues to illustrate the relevance of the principles for decision-makers.

### 1.1. Historical background

Sometimes causation runs from research results to policy implementation, but economic analysis generally has not had significant impact on regulatory developments. Research has tended to follow rather than to lead policy implementation (Acton, 1982). The institutions of regulation respond primarily to changes in technology, demands, industrial structure, and dominant political ideologies. Nevertheless, the analyses of econo-

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mists have affected the framing of questions as well as the evolution of regulation in practice (McCraw, 1984; R. H. Nelson, 1987). Theory has contributed to our ability to explain, predict, and evaluate regulatory developments.

A brief overview of natural monopoly or public utility regulation will illustrate how concrete historical developments have influenced economic analysis.<sup>1</sup> Regulatory experience in the United States can be divided into five phases, according to Trebing (1984): (I) Populist/Progressive reform (1877–1920), (II) political inaction (1921–32), (III) New Deal reforms (1933–44), (IV) postwar stability (1945–68), and (V) destabilizing changes in costs and technologies (1969–present). Table 1.1 lists some of the important historical developments associated with each period. Detailed descriptions of current patterns of government intervention and the procedures utilized by regulators must wait until Chapter 8. For now, it suffices to note that issues accompanying the rise of industries have stimulated major analytical developments in the theory of natural monopoly.

In the late nineteenth century, concern over the growing economic power of the railroads placed that industry on the political agenda and spurred economists to examine the implications of this capital-intensive technology. Suspect behavior fell into four groups: (1) prices that were “too high” (reflecting monopoly power), (2) prices that were “too low” (implying predatory pricing, which discouraged economic entry), (3) prices that were “too high” for some, but “too low” for others (involving “undue” discrimination and/or subsidies for some markets), and (4) prices that were “unstable” (making it difficult for producers and consumers to plan ahead). One could argue that today there are few

1 “Natural monopoly” and “public utility” are often used interchangeably. We provide a definition of natural monopoly in Chapter 2. If a firm, such as an electricity, gas, or telephone company (which often are referred to as public utilities), satisfies the definition, it is a natural monopoly. Often a firm not satisfying this definition is labeled a public utility. For the most part, we use the term “natural monopoly” and avoid the term “public utility” because it is less precise.

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issues that are fundamentally different from those at the turn of the century. Economic analysis has become more rigorous and elegant, but the underlying problems have continued to be addressed and readdressed over the decades. For example, Farrer (1902) catalogued five characteristics of a natural monopolist's product or production process:<sup>2</sup> Products tended

1. to be capital-intensive (having significant fixed costs or scale economies)
2. to be viewed as necessities (or essential to the community)
3. to be nonstorable (yet subject to fluctuating demands)
4. to be produced in particularly favored locations (yielding rents)
5. to involve direct connections with customers

Although that listing illustrates how economists perceived the situation at the time, these characteristics have served as the focus for subsequent analyses. A narrower and more rigorous definition is accepted today (see Chapter 2).

Others also contributed to the early systematic investigation of natural monopolies. J. M. Clark (1923, 1939) and Glaeser (1927) brought together principles of public utility pricing and addressed problems in rate-base regulation. Ely (1937), among others, emphasized the potential for competition to become self-destructive or unstable. Thus, the stability associated with monopoly could be viewed as a positive feature of economic performance. This aspect of the problem anticipated current analyses of the sustainability of natural monopoly in the presence of potential entry (see Chapter 7).

Price-structure issues that emerged in the context of monopoly suppliers attracted the attention of many economists. For example, the Taussig–Pigou (1913) debate on the relationship between railroad costs and the prices of services addressed issues that regulators are still grappling with today. If transportation services

2 Lowry (1973) and Sharkey (1982b) have both summarized early attempts to establish the features unique to a natural monopoly.

4 Table 1.1. *Historical phases of U.S. regulation*

Milestone	Description
I. Populist/Progressive reform (1877–1920)	
1877 <i>Munn v. Illinois</i>	Tight boundaries drawn about those industries affected with the public interest
1887 Interstate Commerce Commission (ICC)	Regulation of railroad rates and routes
1907–13	Twenty-nine states create commissions
1920 Federal Power Commission (FPC)	Water projects only
II. Political inaction (1921–32)	
1927 Federal Radio Commission (FRC)	
III. New Deal reforms (1933–44)	
1934 <i>Nebbia v. New York</i>	Property dedicated to “public use” subject to potential regulation
1934 Federal Communications Act	Expands the FRC to include telephones
1935 Federal Power Act	Gives FPC jurisdiction over securities, accounts, combinations, interstate rates and services
1935 Public Utility Holding Company Act	Expands ICC regulation to modes competing with railroads
1935 Motor Act	Expands FPC coverage to interstate transportation and wholesale distribution of natural gas
1938 Interstate Gas Act	
IV. Postwar stability (1945–68)	
1946 Atomic Energy Commission	
1947 <i>Hope Natural Gas</i>	
1966 FCC computer I inquiry initiated	

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V.	Rising costs and destabilizing technological change (1969–present)	
1969	FCC MCI decision	
1970	Environmental Protection Agency	
1973	First OPEC price rise (\$4 → \$12/barrel)	
1974	Nuclear Regulatory Commission	
1974	<i>Madison Gas and Electric</i>	Marginal-cost pricing supported by Wisconsin PSC
1976	Railroad Revitalization and Regulatory Reform Act	
1977	Department of Energy	
1978	Public Utility Regulatory Policies Act	
1978	Natural Gas Policy Act	
1978	Airline Deregulation Act	
1979	Second OPEC price rise	
1979	Three Mile Island accident	
1980	Motor Carrier Act	
1980	Stagers Rail Act	
1980	FCC Computer II inquiry decision	Basic vs. enhanced services: competition for equipment and enhanced services
1982	IBM antitrust case dropped	
1982	AT&T settlement: modified final judgment	
1984	AT&T divestiture completed	
1985	FERC Order 436	Pipelines as potential open-access transporters of natural gas
1986	FCC Computer III inquiry decision	Separate subsidiaries for enhanced services waived if comparably efficient connection and open network design

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for different consumers (say coal and copper) involved the same costs, then different prices would be discriminatory (Pigou). However, if the services were distinct and required a joint input, charging different prices need not be discriminatory (Taussig). Although they did not explicitly examine the cost-allocation procedures implicit in their respective formulations, these economists set the stage for later analyses (see Locklin, 1933, for an extensive overview of this debate). Similarly, Sichler (1928) viewed the telephone network as being characterized by joint costs. He was concerned with the residential and business consumers' use of the local telephone network; the same joint-cost problem he explored arises for local and long-distance access to the local network.

J. M. Clark (1911) was perhaps the first to formally address another pricing issue: time-of-use or peak-load pricing. He noted the attention economists had given to railroad rates, and the lack of analysis of the growing electricity industry. His advocacy of marginal-cost pricing emphasized prices as signals for future cost and usage, in contrast to the rate designers of the day, who focused on cost recovery. Electricity suppliers did not emphasize the efficiency implications of rate structures. However, as Hausman and Neufeld (1984) point out, a number of engineers, utility executives, and economists were sophisticated supporters of time-of-day rates around the turn of the century. For example, long before modern interest in the problem, Bye (1926, 1929) formally derived the analytics of pricing for a shifting peak load.

### 1.2. **Regulatory goals**

Economists tend to evaluate rate designs in terms of whether or not they provide appropriate price signals leading to efficient allocation of resources. At the same time, regulators tend to emphasize certain attributes that they would like prices or rates to reflect. Bonbright (1961) provides a list of eight traditional rate-making or pricing attributes (Table 1.2) that includes a broad range of criteria, including fairness. At first glance, the list appears to contain many attributes that are in conflict with

Table 1.2. *Eight traditional rate-making attributes*

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1. Simplicity and public acceptability
  2. Freedom from controversy
  3. Revenue sufficiency
  4. Revenue stability
  5. Stability of rates
  6. Fairness in apportionment of total costs
  7. Avoidance of undue rate discrimination
  8. Encouragement of efficiency
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economic rate-making objectives. However, many of the attributes have efficiency components. For example, consumers' information processing costs should be included in the derivation of efficient prices. To economize on these costs, regulators will emphasize simplicity of rates, the first attribute in Table 1.2. Also, the costs associated with regulatory hearings on rate structures will be reduced if policies can be easily understood by the affected parties. Public acceptability contributes to the perceived legitimacy of the regulatory process, which is essential for keeping down the administrative costs associated with regulation.

As will be seen, a shift away from simple rate structures may be desirable in some situations. For example, less weight will be given to simplicity as a rate-making attribute when metering technologies make feasible the introduction of peak-load electricity prices and usage-sensitive local telephone rates. Of course, the acceptability of major changes in rate design depends on the mix of winning and losing customers (see Chapter 3). If there are net benefits from rate redesign, then, conceptually, winners could compensate the losers – facilitating public acceptability.

Freedom from controversy, the second attribute, is closely linked to public acceptability. If there is widespread disagreement regarding the factual basis for prices, then the natural response is to conduct appropriate studies. For example, calculation of opportunity costs and estimation of demand elasticities (and growth) are essential for implementation of the principles devel-

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oped in this book. A gradual phase-in of new rate structures will also limit controversy. Of course, if some group is being subsidized with current prices, it will fight for the status quo. Most would agree that there is little economic merit in such a position unless there is a consensus that the favored group “deserves” income transfers.

In terms of the revenue-sufficiency attribute, efficient prices equal to marginal costs may not yield total revenues sufficient to cover the costs of production; with inadequate returns, investors will be unwilling to maintain and expand the firm’s capital equipment. The issue leading to controversy is how a revenue shortfall is to be made up if marginal-cost prices are used. Economists have suggested increases in flat monthly charges or price increases to consumers with inelastic demands (thus minimizing the distortions resulting from pricing above marginal cost). This revenue-reconciliation problem is nontrivial in practice.

Revenue stability is another of Bonbright’s suggested attributes, but, presumably, net revenue (after costs) is the important variable for a firm, because a revenue reduction accompanied by the same cost reduction does not strain the entity’s financial resources. Thus, when prices track costs, a reduction in consumption will have less of an impact on utility finances than when they do not. To compare alternative rate structures, regulators must examine how rates, customer responses, and production costs interact to yield revenue stability. Certainly, the cost of capital to a utility increases if it adopts rates that yield highly uncertain net income streams.

Rate stability is one attribute that can conflict with the others. Stability allows consumers to plan ahead; however, if costs are not stable, then unchanging prices provide inefficient signals. For example, when capacity costs are rising over time, average-cost pricing based on historical costs can lead to overinvestment in capacity and overconsumption of output. Rate stability that masks change can be quite inefficient. In the case of electricity, relatively low prices in the 1960s and early 1970s resulted in minimal consumer investments in energy-saving appliances, insula-



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tion, and timers for hot-water heaters. Partly to maintain price stability in the 1970s, regulators did not let prices track marginal costs. That policy served as a disincentive for energy conservation. The long-run impacts of such stable, but inefficient, price signals were serious in terms of forgone opportunities.

To avoid imposing hardships on particular consumer classes or on consumers within a class, regulators will tend to prefer a gradual transition to new rates. For example, jumping to peak-load prices that reflect opportunity costs may be very disruptive to those who have made investments based on past pricing policies. Highly disruptive changes are bound to be politically unacceptable and may well be uneconomic.

Fairness in the apportionment of total costs, the sixth rate-making attribute, arises when different consumers benefit differentially from a new rate structure. The economist's observation that the winning group *could* compensate the losing group and leave both better off is not much comfort to the losers when such transfers do not in fact occur. Nevertheless, the efficiency costs of "socially condoned" income transfers should be identified prior to making equity the primary goal of regulation. Also, as is indicated in Chapter 3, the winners and losers may be the same group, and fairness is not an issue.

The seventh attribute, avoidance of undue rate discrimination, also must be balanced against the others. Although charges of discriminatory pricing are often made, the test for whether or not discrimination exists requires information about the cost of service – the standard cost-allocation techniques discussed in Chapter 3 are woefully inadequate for this purpose. Moreover, price discrimination can be beneficial. For example, it may allow a service to be provided that otherwise would not be. As we shall see, relatively higher prices for consumers with low demand elasticities can have positive welfare properties.

Bonbright's final attribute can be broken down into four components. *Technical efficiency* requires that the least-resource-consuming production processes be used to produce a given level of output. Such technical efficiency can be contrasted with *allocative*

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*efficiency*, which requires that the economically correct level (and mix) of output be chosen from among the technically efficient outputs. Consumer valuations of various time patterns of consumption also come into consideration for allocative efficiency. Organizational slack or managerial pursuit of goals that are contrary to the owner's interests can lead to what has been labeled *X-inefficiency* (Cross, 1970; Leibenstein, 1966). *Innovative efficiency*, another aspect of this broad attribute, depends on how well firms perform the intertemporal tasks of cost reduction and new product development. Because this book focuses on efficiency considerations, we present detailed discussions of these topics later.

In general, economists have built a strong case for emphasizing efficiency in the rate-making process, although one could argue that the determination of the weight to be given to each criterion when choosing from among alternative rate designs is essentially a political issue. Schmalensee (1979) argues that although the members of society are interested in values other than economic efficiency, the task of balancing efficiency against other goals (such as income distributional concerns) is far too difficult for natural monopoly control mechanisms:

In short, the political view of appropriate regulatory performance is an inherently unattainable ideal; effective interest group competition on all decisions and effective decision making are incompatible. In order to permit regulators to consider the whole spectrum of collective goals and to respond directly or indirectly to all interest group pressures, they must be given considerable freedom of action. But the relative lack of control that must accompany the delegation of broad authority increases the difficulty of ensuring that desirable trade-offs are made and makes special interest dominance and arbitrary action or inaction more likely. It is simply not possible, desirable though it seems in principle, to use the control of natural monopoly effectively to pursue a number of potentially conflicting social goals. (Schmalensee, 1979, p. 17)