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REGULATION AND EFFICIENCY: A REAPPRAISAL OF RESEARCH AND POLICIES

by

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EXECUTIVE SUMMARY

The main question in this study is whether traditional regulation has deeply harmed efficiency. If the harms have been great, and deregulation could easily create competition and efficient results, then the general case for removing regulation is strong.

Economists have indeed shown that there were inefficiencies in various transport industries under regulation, and the resulting deregulation has generally promoted efficiency. But after 1975 these points were expanded into a denunciation of all regulation, supposedly because it always harms efficiency deeply. What was true of transportation regulation was said to hold for all sectors, including electric and telephone service.

Such assertions are ripe for a skeptical review, following the deregulation events of the 1980s. This study re-examines the concepts of the issue and then reappraises the most frequently cited empirical studies. It finds that the efficiency losses (outside transportation) have not been shown to be substantial after all.

The study next turns to the alternatives to traditional regulation. One alternative method is to rely upon competition, after removing regulation. But when is competition really effective? The study considers the conditions that do provide effective competition, using ideas from the complex field known as antitrust economics. It turns out that the conditions of effective competition are strict, and that they are hard to reach when you start from a regulated monopoly. Therefore the deregulation of a regulated monopoly will often fail to achieve effective competition, and the desired benefits will often not occur.

Finally, this study considers ideas of "incentive regulation," particularly "price caps." Such incentive-sensitive methods might treat dominant firms more effectively than does traditional regulation. If so, they might justify partial deregulation. But this study notes that they have important limitations. When it is applied to complex real situations, "incentive regulation" is often about as complicated as is conventional regulation, and the resulting efficiency gains may often be small or nil.

The upshot is that regulation should be removed only when the industry's technology has already shifted fully to a state of natural competition, with room for many strong competitors. Then the dominance by the original monopolist can be quickly swept away, to be replaced by competition among at least five or six strong, comparable competitors. There also needs to be a lack of entry barriers. If all these conditions are met, then competition can be fully effective.

But if the natural-monopoly conditions haven't faded entirely away and entry is not reasonably free, then deregulation is highly risky; it may merely permit a continuation of market dominance by the original monopolist. And now there will be no regulatory protections. That situation of unregulated dominance is likely to harm efficiency and innovation as much as regulated monopoly does.

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FOREWORD

Professor Shepherd's reappraisal of the economic research that has been widely used to provide an intellectual underpinning to a number of important policy initiatives in public utility regulation is both timely and insightful. As we know, both the regulation and structure of the utility and transportation industries have changed dramatically in the last several years. Dr. Shepherd's analysis should be very helpful to policymakers and others as the debate continues regarding the most appropriate regulatory regime for the telecommunications and electric industries.

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INTRODUCTION

Deregulation became a national crusade after 1975, with results that are still unfolding and are highly controversial. The crusade was stoked partly by economists' critiques of regulation for possibly harming efficiency. Actually, many of those criticisms were not new; they mainly just restated concerns that had been familiar as long ago as 1930. Moreover, they were relevant mainly in the transportation industries (railroads, trucking, and airlines), rather than in the electric-power and telephone-service industries.

But after 1975 the temperature rose: the economists' sober concerns were superseded by extravagant claims that regulation is always very harmful. At the same time, there was growing optimism about competition; it was claimed that deregulation would lead easily to full competition and ideal results. At the least, it was said, the old discredited regulation should be recast so as to inject proper incentives for efficiency. "Price caps" became the glamorous new method for replacing harmful regulation.

Thus the topics of inefficiency, deregulation, competition, and incentives came to be fused together in the passions of the deregulation crusade. The rhetoric about them went to extremes that were well beyond the findings scientific research findings, as we will see, and there has been growing suspicion that some of the deregulation has gone too far. There certainly has been a need to re-examine the issues objectively, and that is what this study attempts to do.

We will consider both the concepts and the factual tests in the literature, with special attention to the so-called "gold-plating" effect on investment. We will also look carefully at effective competition, noting that it is usually not consistent with market domination by a single firm. At the end, we will turn to "price caps" to consider whether this favorite new form of "incentive regulation" offers important gains.

The main lessons are:

1. The research literature did not actually show that regulation actually harms efficiency very much (outside several transportation industries, where it had long been known to be inappropriate).
2. The main practical alternatives to regulation (imperfect competition under deregulation, and "incentive regulation") often offer smaller improvements than has commonly been claimed -- or even an actual worsening of the problems.

The Issues

There are three main treatments for firms that have been natural monopolies: traditional regulation, quasi-regulation (or "incentive" regulation), and no regulation (relying on competition). Each method has its hybrid forms, and each has dedicated advocates. The right choice for each industry depends on (1) the relative merits of each general approach, and (2) the specific facts of the industry.

This paper addresses the first of those two questions: it compares the three general approaches. The decision to deregulate a monopoly involves that same basic comparison: how badly would conventional regulation do, compared to "incentive regulation" or actual competition? This issue now dominates the regulatory scene, and it poses difficult problems of theory and practice. The relative merits are still unclear. The confusion reflects partly the lack of experience; no utility monopoly in the United States has yet been deregulated and moved all the way down to a state of effective competition.[1]

The confusion is all the greater because the choices involve two contrasting kinds of economic analysis, both of them long established:

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[1] The airlines were not monopolies before deregulation, nor were the railroads, trucking or buses. AT&T, though it is now extensively deregulated in long-distance service, has evolved only part of the way toward effective competition (see Shepherd and Graniere, 1990). The same is true of various baby Bells. Some deregulation has occurred in electricity, but evolution toward competition is still in the early stages (see Joskow and Schmalensee, 1985).

1. One is regulatory economics, which focuses on natural monopoly. The aim is to make the firm reach good economic results when it faces no competition. The topics include regulatory controls, optimal price structures, rate-base effects, the design of incentives, and the like.
2. The other approach is antitrust economics. Its aim is to make competition work, while eliminating monopoly. Its focus is entirely different, dealing with competitive processes, degrees of monopoly, pricing strategies, freedom of entry, and the like.

One must know both approaches in order to judge between regulation and competition. Only by combining these two approaches can one choose wisely and guide the transition of a regulated pure monopoly to a state of effective competition. But the joinder is difficult. Regulatory experts often think that any moderate dose of competition -- say two or three small rivals, as in long-distance telephone service -- is sufficient. Once there is some rivalry, competition is effective.

Antitrust experts have long said, instead, that dominance and tight oligopoly usually involve ineffective competition. For competition to be genuinely effective, numerous strong competitors are needed, and the original monopoly firm's market share must recede well below 50 percent if competition is to become effective.

Moreover, it is not enough that the underlying "natural monopoly" conditions begin to fade: scale economies will have to keep shrinking all the way across a wide range until they reach "natural competition." Then there will be room in the market for at least 5 strong competitors.[2] During that transition the original firm will need to pass down through the conditions of both market dominance and tight oligopoly, until it reaches effective competition. After that, the competitive conditions will need to be maintained, against the pressures for mergers and other ways to restore dominance.

In fact no simple, ideal result may be possible for some markets. Instead, within the industry there may be a patchwork; some parts with monopoly, others with

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[2] When the firm produce multiple products, not just one, the question of scale economies gets more complicated. In that case, "sub-ray additivity" will have to decline until there is room for sufficient competitors to support fully effective competition. See Baumol, Panzar and Willig, 1982.

competition, and still others in between. Such patchwork cases are turning out to be common, as in long-distance telephone service, electric power, and oil-products pipelines.

Where competition does appear to be possible, the U.S. since 1975 has been adopting deregulation. Some successes have occurred in transportation industries such as railroads, airlines, and trucking, where (1) oligopoly (not natural monopoly) had been regulated, and where (2) underlying "natural competitive" conditions already existed and were bursting to run loose.

In contrast, the deregulation of straight monopolies has turned out to be quite a different matter, and no regulated monopoly firm has yet been converted to effective competition in the U.S. Moreover, the deregulation of AT&T in particular has brought forth a fog of confused ideas and exaggerations about the meaning of effective competition. We need to reconsider the choices involved not only in (1) whether to deregulate, but also (2) when and (3) how to deregulate.

This paper reassesses the research knowledge on all three questions, with an interest in telephones and electricity as (formerly) classic natural monopolies. The analysis will suggest that:

(1) Regulation's actual harms to efficiency have been overstated since the middle 1970s, and its benefits have been understated. The bias arose from comparing regulation with ideal theories of competition and incentive schemes, rather than with the imperfect real alternatives.

(2) The market form that actually replaces regulated monopoly often contains a substantial degree of monopoly. When the old monopoly remains as a dominant firm or as the leader of a "Big Three" tight oligopoly, competition will not be fully effective.

(3) "Incentive regulation" promises much in theory, but so far it has provided meager provable net benefits.

The apt comparison seems to be among reasonably effective regulation of various kinds, limited forms of "incentive regulation," and partly ineffective competition. In that light, a rapid deregulation of former natural monopolies is risky, when market dominance remains.

Premature deregulation -- before fully effective competition is in place -- is the cardinal danger in principle (Shepherd, 1987), and it is a real danger in several actual cases. The risk is higher because deregulation usually cannot be reversed or corrected if matters go wrong. Yet premature deregulation is precisely what the formerly regulated monopoly firm seeks, often with aggressive tactics. If it succeeds, the firm may be able to retain and strengthen its dominance.

The dominant-firms' rationale, developed in the 1980s, asserts that regulation is always costly, obstructive, and a cause of large inefficiencies. Competition is said to be guaranteed to become effective, either because the dominant firm will keep losing its market share or because "contestability" will nullify all monopoly power.

I will review the research knowledge on regulation's costs and on ineffective competition. The issues are complex, and pure doctrines jostle with complicated practical issues. Experts in regulation may have little experience with competitive issues, and vice versa. Both may have illusions about the effectiveness of the policy tools.

Chapter I sets the stage historically, by reviewing how the issues have developed and how the extent of natural monopolies has receded.

Chapter II analyzes regulation's actual effects. In theory, regulation can cause the waste of inputs, particularly of investment. I analyze a number of research studies, to find how much inefficiency may actually have been caused. In practice, standard regulation has been quite different from the models, and the measured effects have been moderate at most. It is only in oligopoly markets (such as in transport markets like railroads, trucking and airlines) that regulation caused the main inefficiencies of regulation.

Chapter III analyzes competition, in light of mainstream and revisionist ideas. It shows how market dominance and tight oligopoly fail to provide effective competition. It assesses entry and pin-point pricing strategies. It also appraises the chances that mixed competitive situations will evolve toward full competition or instead remain ineffectively competitive.

Chapter IV considers some features of "incentive regulation." And Chapter V draws lessons for research and policies.

Chapter I

BACKGROUND: EVOLVING SECTORS AND ISSUES, AND THE EXTENT OF NATURAL MONOPOLIES

Regulatory policies and research have both gone through distinct historical phases. Standard utility regulation began after 1905, flowered in the 1930s, and had a (moderately) golden era from the 1930s to the 1960s.[1] Then after the watershed year of 1968 came new pressures, economic criticisms and rapid changes. After 1975 there developed an ideological crusade for deregulation, involving electricity, gas, telephones, cable TV, railroads, trucking, airlines, buses, and other sectors. After all these upheavals, the 1990s are a period of reassessment and, so far, even more deregulation.

Research about regulation has paralleled -- and sometimes led -- the policy choices. The 1900-1930 period explored most of the concepts of regulation. The 1930-1950 interval was mainly fallow, except for largely sterile discussions of rate-base valuation. Economic criticisms arose from 1955 on.[2]

Far from being "new," much of the post-1960 analysis of regulation's costs merely revived and refined (and sometimes distorted) ideas that had originated before 1930.

After 1975, the "new" literature developed on two levels. One part was led by theorists, who extended the pure theory of regulation.[3] The other writers sought frankly to eliminate traditional regulation, replacing it with "incentive regulation" and

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[1] Though the Interstate Commerce Commission was first authorized in 1888, it did not acquire genuine powers until 1906 under the Hepburn Act. Wisconsin created the first state regulatory commission in 1907. See Martin C. Glaeser, 1827, Irston R. Barnes, 1940, James C. Bonbright, 1962, and Alfred E. Kahn, 1971.

[2] See Horace Gray, 1940, and Walter Adams and Horace Gray, 1955.

[3] Among others, see Sharkey, 1982, Baumol, Panzar and Willig, 1982, and Spulber, 1989.

free entry. Both groups have had limited success in clarifying the actual policy choices.

1. The Early and Mature Eras of Regulation

Conventional regulation developed during 1885 to 1915, starting with the Interstate Commerce Commission in 1888. By 1915, many states had established regulatory commissions or were in the process. By the 1930s most states had commissions and the Federal Power Commission, Federal Communications Commission, and the Civil Aeronautics Board were created at the federal level. The high decades of regulation -- when it became standardized -- were from the 1930s through the 1960s.

Regulatory activities had their direct costs, but they were moderate compared to the scale of utility-firm resources which they were meant to control. The commissions' costs, plus the companies' regulatory spending, have probably been below 0.2 percent of company revenues in nearly all cases and time periods. Therefore the indirect costs of regulation -- the possible inefficiency costs -- are the only really significant targets of economic criticism.

Early experience with the Interstate Commerce Commission after 1888 suggested that regulators might have little impact in any event. Only after 1906 did the ICC gain substantial powers, and by the 1920s trucking and buses had already begun to erode railroads' power and profitability.

The possibility of inefficiency under regulation was well recognized from the start, and many of the new commissions sought to prevent excess costs. Numerous early discussants dealt with the possibility that sheltered, regulated monopolists would incur excess costs and investment.[4] The need to enforce "prudent investment" standards was known and acted on, as in the Bluefield Waterworks case (1923). And J.M. Clark in 1923 defined efficient pricing for utilities, anticipating the marginal-cost pricing of the 1960s and the "Ramsey" pricing of the 1980s (see also Nowotney, Smith and Trebing, 1989).

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[4] See *inter alia* Charles Morgan, 1923, L.R. Nash, 1925, John Bauer, 1925, Martin Glaeser, 1927, J.M. Clark, 1928, and Horace Gray, 1940.

During the 1940s and 1950s, regulation was favored by the downtrends in costs in electricity and telephones, as growth made it possible to achieve scale economies and cost-saving new technologies. Commissions needed to do little but accept a series of company-initiated rate cuts.

The FCC described its passive "regulation" as "continuous surveillance." There was in fact no formal FCC regulatory hearing on AT&T's prices from the 1930s to 1964 and virtually no formal regulation by state commissions. State commissions and the Federal Power Commission were largely passive to electric firms, and rate cases lagged behind the falling costs. The companies, on their part, could pocket much of the cost savings, because of the regulatory lag (influenced by the firms themselves) in cutting the prices.

States displayed marked variations in the quality and tightness of regulation. Wisconsin, New York, and California were known as leaders, followed by a number of northern and northeastern states. Regulation in the southeast was generally regarded as moderate or passive at best.

In short, only moderate, slow, and liberal economic regulation occurred, even during the golden era. There was extensive regulatory lag, which was well known and understood to help encourage efficiency.

But the regulation of transportation cartels was different. Adams and Gray (1955) attacked the competition-blocking effects of transportation regulation, as did Nelson (1958). Meyer, Peck, Stenason, and Zwick (1959) presented forcefully the case for deregulating railroads and trucking. Virtually all observers noted that the regulation of most railroads and all trucking was unsuitable and probably highly inefficient.

There was little empirical study of natural-monopoly regulation's effects, in telephones, electricity, and the like. The regulatory process appeared in the 1950s to be slow and highly formalized, even ritualistic, and possibly empty of economic impact.

Yet instead, regulation may have simply been well-adjusted to the favorable cost trends in telephones and electricity. If so, regulation occupied a relatively efficient equilibrium between industrial conditions and policy needs.

The outcomes were mainly benign, because costs were declining, and regulatory lag permitted the firms to keep much of the cost savings. Firms had strong incentives to cut costs and install new equipment. Therefore an important degree of "incentive regulation" existed in those sectors. Regulation could be regarded as successful, both despite the fact that it was moderate and because it was moderate. As the 1950s continued, the regulators and the regulatory literature muted its earlier concern about efficiency in standard utilities. Efficiency was assumed (perhaps rightly) to be reasonably well achieved.

2. Economic Criticisms

Transport regulation attracted harsh criticism, and the harms were obvious.[5] As for natural monopoly regulation (e.g., telephones, electricity), some economists revived the old question whether regulation had had any effects at all. Stigler and Friedland (1963) concluded that it did not, and Stigler went on to foster a series of studies in the Journal of Law & Economics, all of which showed that regulation was either irrelevant or costly to economic welfare.

Discontent with AT&T's monopoly power was also rising, driven by antitrust concerns about excessive monopoly unconstrained by regulation. The 1949 federal antitrust suit against AT&T's vertical monopoly was withdrawn in 1955, under a shadow of political intrigue. Sheahan (1956) noted AT&T's tendency toward slow innovation, because of its excess monopoly power as both supplier and buyer of telephone equipment.

Then came the Averch-Johnson (1962) critique of utility's tendency to overinvest and to capture adjacent markets via cross-subsidizing. The argument was directed partly at AT&T, because of its history of extending its activities beyond the

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[5] Other observers reinforced Meyer, Peck, Stenason and Zwick's argument (e.g., Wilson, 1964), and MacAvoy and Sloss (1967) argued persuasively that ICC policies had blocked major innovations in the railroad sector.

Also, critical attention began to be directed at the CAB's passive regulation of airlines, combined with its rigid blockage of entry and competition in airline markets (Caves, 1962). By 1965, there were strong calls for abolition of the ICC (Peck, 1965) and a competitive unleashing of the railroad, trucking and airlines industries.

natural-monopoly borders. But the A-J study rested on a formal analysis of supposedly tight, effective regulation (the analysis is explained below in Chapter II). The A-J model of regulation diverged from reality; as I have noted, most federal and state commissions applied soft and lagged regulation to electricity and telephone service.

The 1960-1975 analysis was primarily scientific in spirit, seeking to clarify possible distortions. Moreover, the worst cases (railroads, trucking, airlines, and AT&T's unnecessary elements of vertical monopoly) were distinguished from lesser problems. The moderate and pointed criticisms soon had effects by encouraging the deregulation of railroads, trucking, and airlines and the break-up of the Bell System (by a case filed in 1974).

In addition to the A-J "rate-base" or "goldplating" effect, economists noted that regulation contained a general "cost-plus" tendency toward an over-use of all inputs (e.g., toward "X-inefficiency" and excess cost).[6]

The Averch-Johnson paper stirred excitement among economists and consternation among utility firms. It stimulated a growing debate.[7] At first, utilities vigorously denied that they were causing wastes. Then, after 1975, they reversed their claims diametrically. Now they claimed that regulation was particularly reprehensible: it was making them waste large volumes of resources. The issue is still important; some observers and firms claim that there are large impacts, while others see little real effects.

The possibility of "X-inefficiency" in the regulated firm because of regulation's cost-plus nature had also been long recognized. But it too rested on extreme

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[6] "X-inefficiency" is a term coined by Leibenstein (see his 1976 book) to denote all inefficiency other than allocational inefficiency. It corresponds to familiar notions of "business inefficiency" or slackness in controlling costs.

[7] See, among others, William G. Shepherd, 1966, Milton Kafoglis, 1969, William J. Baumol and Alan K. Klevorick, 1970, Elizabeth E. Bailey and J.C. Malone, 1970, Alfred E. Kahn, 1971, George R. Cory, 1971, Noel M. Edelson, 1971, Elizabeth E. Bailey, 1973, Dayan, 1975, Roger Sherman, 1976 and 1985.

Indeed, the *Bell Journal of Economics* (now the *Rand Journal of Economics*) was founded and financed by AT&T partly in order to provide a forum for articles dealing with this issue.

assumptions about regulatory strictness. Only if regulation were perfect would it remove any excess profits immediately. The firm would then be unable to gain any benefits from keeping its costs low or cutting them. But if regulation were not perfect, then the firm could keep some cost savings and it would be motivated to achieve them.

In any event, the 1960s saw a rebirth of economists' doubts about regulation as a cause of inefficiency. The resulting new literature about the possible anti-efficiency effects of regulation soon broadened in the 1970s into a general exploration of the costs of regulation. Younger scholars provided by 1974 several empirical tests of the rate-base effect (see Section II). Some research focused on electricity, while others dealt with railroads and airlines.

Other researchers offered a range of more general evaluations, varying widely among utility sectors.[8] Recently, Richard Schmalensee (1989) has provided an important general analysis of the conditions under which traditional regulation may be superior or inferior to specified alternative methods.

Generally, the regulation of transportation industries was found to be harmful. Electric regulation appeared to be relatively beneficial, on balance, and the efficiency losses were marginal, not large. Telephone regulation's impacts have not been directly quantified.[9]

The research results encouraged action toward reforming regulation, especially in transportation markets, so as to reduce the efficiency losses. The deregulations of airlines, trucking, and railroads were inspired in no small part by these studies.

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[8] See Stephen Breyer and Paul W. MacAvoy, 1974, Breyer, 1982, Almarin Phillips, 1975, Roger G. Noll, 1976, Jeffrey Callen, Frank G. Mathewson, and Herbert Mohring, 1976, Michael W. Pustav, 1978, Richard Schmalensee, 1979, Robert Litan and William Nordhaus, 1983, Theodore E. Keeler, 1984, Paul L. Joskow and Nancy L. Rose, 1989, Robert W. Hahn and John A. Hird, 1990.

[9] Wenders offered an appraisal, but it was based mainly on the lack of marginal-cost pricing, rather than the rate-base and X-inefficiency effects.

3. From Analysis to Ideology

But the criticisms of regulation, once set in motion, were altered after 1975 from the sensible warnings about possible distortions under regulation. Now there were sweeping declarations that all regulation causes large harms to efficiency.[10] Particularly in the Federal Communications Commission, a fervor developed for removing all regulation, even from genuine natural monopolies.

Regulation's declared harms, plus a new confidence that ultra-free entry (or "contestability") guarantees efficiency, were the rationale for the campaign. Much of the rhetoric and pressure for the campaign came from the regulated companies themselves and their expert witnesses, particularly those who were retained by AT&T and its affiliates (including notably William J. Baumol and Robert D. Willig). The AT&T impact upon its own regulation, as well upon regulation generally, have been large.

As the campaign progressed, by 1980 a tone of hysteria crept in: regulation was seen as an evil that must be eliminated at any cost. That apocalyptic rhetoric has continued to the present.

Meanwhile, in Britain the Conservative government's privatization program was influenced by the extreme criticisms of U.S. regulation.[11] Indeed, the anti-regulation crusade carried into many other countries, urging that regulation be abandoned and that entry alone would guarantee efficient results.

By the 1990s, this line of reasoning had become influential in many state commissions and the remaining federal commissions. Even in virtual-monopoly

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[10] Good examples can be found in the various issues of Regulation, as well as in the public press.

[11] In order to avoid the supposedly monstrous U.S.-style regulation, the newly-privatized telephone, bus, gas and electricity monopolies were subjected only to formal rules permitting new entry and to newly designed "price caps." The policies also relied on the new theories of "contestability," whereby the possibility of new competition would nullify the private monopolies' market power (see especially Beesley and Littlechild, 1983, and opposing views of J.A. Kay, C. Mayer and D. Thompson, 1986.

markets such as local electricity distribution and telephone service, some commissions were courting premature deregulation.

4. The Shrinkage of Natural Monopoly

While these ideas have been debated, the scope of actual natural monopolies has receded. But it is a long way from natural monopoly to natural competition. When technology moves away from pure natural monopoly, it may remain in the intermediate range -- favoring market dominance and tight oligopoly -- rather than snap over to the natural- competition extreme. Stuck in the middle, the market's conditions may not move beyond dominance, and effective competition may fail to develop.[12]

During the high regulatory period of 1900 to 1960, natural-monopoly thinking was expansive, to include large blocks of the economy, particularly in three sectors: energy (electricity and natural gas), communications (telephones, postal services, and cable TV), and transportation (railroads, airlines, intercity buses). Also, a range of urban services (such as water and transit services) were regarded as natural monopolies requiring regulation and/or public ownership.[13]

Natural monopoly was thought to justify regulating whole sectors. For example, it was thought to justify regulation throughout most or all of the telephone and electricity sectors, even though the core natural monopolies were only a limited part within the sectors.

By 1960, there was growing recognition that in some regulated industries the pure natural-monopoly conditions were receding, while other regulated industries (airlines, trucking, many railroads, natural gas production) had never had them. By the 1970s, the new realism about natural monopoly had spread (Capron, 1970),

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[12] For discussions of the concepts of natural monopolies and the proper scope of regulation, see Glaeser, 1927, Bonbright, 1962, Kahn, 1971, Schmalensee, 1979, Baumol, Panzar and Willig, 1982, Sharkey, 1982, Spulber, 1989.

[13] See Barnes, 1940, Bonbright, 1962, Kahn, 1971, Schmalensee, 1979, and McCraw, 1984.

Phillips, 1975). The 1980s brought further technology shifts away from natural monopoly.

By 1992, the situations of complete natural monopoly may have dwindled down to include mainly just certain urban services (especially electricity, telephone, water, gas, cable TV, transit, etc.; see Table 1).[14] Even some of these pure natural monopolies have been claimed to be suitable for deregulation. Cable TV was deregulated in the 1980s, and other cases -- especially local telephones -- are being urged for deregulation now.

The Ultra-Free Entry Rationale

The rationale for doing so is to turn away from monopoly in the market and, instead, focus exclusively on an extreme form of free entry. If potential competition can destroy monopoly completely and instantly, then monopoly is theoretically irrelevant. That is the lesson of "contestability" (or ultra-free entry) theory. If entry is "perfectly contestable," then free entry converts even natural monopolies into effectively competitive situations (see especially Baumol, Panzar and Willig, 1982). Even if scale economies permit "room" for only one firm in the market, Baumol et al. assert that free entry will assure an efficient result. Whether there is competition or monopoly inside the market becomes irrelevant, in this theory.

An equally optimistic "new" view applies to mixed monopoly competitive situations. Consider the firm that faces varying degrees of monopoly power in selling a range of services. That is the classic situation where the firm will set discriminatory prices, charging what the market will bear for each.[15] The firm exploits monopoly power where it can, and the result is a series of unfair variations in the pricing treatment of its customers. Such discrimination has long been a traditional target of regulation.

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[14] See the discussions in Shepherd, 1991, Breyer, 1982, Posner, 1969, and Noll, 1983.

[15] It is also called demand-based pricing, usage-based pricing, inverse-elasticity pricing, charging what the market will bear, and the like.

But ultra-free entry is said to banish that harm. If the whole market is "perfectly contestable," then price discrimination is said to be a necessary basis for an efficient ("Ramsey") price structure.[16] Cross-subsidizing and strategic pricing are to be welcomed rather than prevented. The real questions are then whether contestability theory is valid and whether its assumptions hold in these real markets.

But after ten years, the literature has shown "contestability" to be a theoretical curiosum, not a robust condition in significant markets. Therefore, natural monopoly remains an important problem.

The Meaning of Natural Monopoly

The meaning of natural monopoly needs to be defined carefully. In much of the past literature, "natural monopoly" has included markets where technology favors the existence of just one firm. That is because the average cost curve declines steeply up to at least the size of the total market demand (Glaeser, 1927, Bonbright, 1962, Kahn, 1971). In multi-product firms, Baumol et al speak of cost subadditivity as calling for a single firm. In either case, technology compels the existence of monopoly.

If natural monopoly recedes to permit two or three firms, that is still not good enough. As Chapter III explains in more detail, it takes at least five comparable

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[16] The reasoning is as follows. The firm is assumed to be a natural monopoly, so that its marginal costs are below average costs on many or all outputs. The firm will then suffer a financial deficit if all of its prices are set at marginal costs. Some prices must be set above marginal costs, and the inverse-elasticity rule (given by price discrimination) will minimize the resulting inefficiency; see Kahn, 1971, and Baumol, Panzar and Willig, 1982. The firm will automatically set the efficient array of discriminatory prices as a by-product of its efforts to maximize its profits (or at least to survive). If the resulting set of prices just allows the firm to break even financially, then they are so-called "Ramsey" prices.

The theory has several limits and defects. One is that it applies only to firms with natural-monopoly conditions over much or all of their output. Otherwise, Ramsey prices are merely a nice label for monopoly behavior. A second limit is that the theory is strictly static. It provides only static efficiency, not innovation, fairness, and other economic values. Aa third problem is that the firm's total profits must be precisely at zero. If any excess profits occur, then the pricing is not efficient. The theory also suffers other defects; see Shepherd, 1984.

firms -- with none of those firms holding a dominant position -- plus free entry, to provide effective competition. Therefore, only if there is room for at least five or six firms, or more preferably ten firms, does "natural competition" exist.

But that possibility still does not automatically justify deregulation. The technology may permit competition, but it does not assure that effective competition will actually emerge and remain. The incumbent monopolist may become an entrenched dominant firm; or only two small competitors may emerge; or eight competitors may develop but then they may merge to create dominance anew; or the rivals may form collusive cartel behavior.

Control over Specific Bottleneck Facilities

Even under "natural competition," there may be some other specific monopoly-creating condition. Monopoly and/or dominance can also be created or enforced by specific controls, such as ownership of a bottleneck facility which competitors must use in order to compete. One standard example of a bottleneck occurs when local public electric systems get their bulk power through high-voltage lines owned by surrounding investor-owned utilities. The local systems often compete with the surrounding system/supplier, directly and indirectly. Because the investor-owned utility is both a supplier and a competitor, its control of the bulk-power supply can function as a bottleneck. In such cases, even where the underlying technology might permit competition, the control of a bottleneck may make the competition ineffective.

In sum, the conditions which justify some degree of regulation include:
(a) technology-dictated natural monopoly, or
(b) a utility firm that retains dominance or leadership of a tight oligopoly that is likely to continue or deepen under deregulation, or
(3) dominance or tight oligopoly with specific control over access to the market by means of bottleneck facilities.

A list of the probable remaining such cases as of 1992 is suggested in Table 1.

TABLE 1
Likely Cases of Natural Monopoly and/or Monopoly Power

- Local electric service
- Many bulk electric power markets, especially with bottleneck controls
- Local telephone service
- Most cases of intra-state telephone service (there are dominant firms in most markets)
- Inter-state telephone service (dominated by AT&T)
- Water service
- Local gas distribution
- Local cable TV service
- Local transit service (bus, subway)
- Intercity bus service, on many city-pair routes

By 1992, the mixed monopoly-competitive cases had become a leading problem, in which deregulation may invite cross-subsidizing and the blocking of competition. The correct policy choices require a complex balancing among judgments about: (1) the relative importance of each part, within the whole, (2) how monopoly power in one part may affect performance in the whole market, and (3) the prospects for further competition in each part and in the whole market.

Chapter II

EFFICIENCY AND INNOVATION UNDER MAINSTREAM REGULATION

Now I turn to the actual costs of regulation in reducing efficiency, innovation, and equity.

Not Just Static Allocation. The literature has dealt almost exclusively with the static efficiency element, as if static allocation were the only economic goal. That narrowness has reflected the pure theoretical nature of much of the recent analysis, with models focusing on maximizing consumer surplus.

But that is too narrow a basis for sound policy. It leaves out innovation, which is more important in the long run in many markets, probably including many utility markets. Also, equity is an important goal. And competition itself offers important social values. Therefore, pure theories of static efficiency cannot be a sufficient basis for policy choices.

1. Logic

The logic about regulation's inefficiencies is straightforward. The conventional regulatory formula is:

$$\text{Profit rate} = \frac{(\text{Price}_i \times \text{Quantity}_i) - (\text{price}_j \times \text{quantity}_j)}{(\text{price}_k \times \text{quantity}_k)}$$

where i is an output, j is an input, and k is capital.

Cost-plus Effects Toward Bloating

The earliest analyses pointed to the obvious danger of cost inflation; monopoly firms could simply pass on their costs to the ratepayers. That cost inflation could occur in the form of excess amounts of inputs (qj) and/or excess prices paid for inputs (pj). For example, too many workers might be hired, and at too-high wages.

This would cause the firm's profit rate to go below the permitted rate, and so the regulators would permit the prices of output (Pi) to be raised.

The result would be a degree of X-inefficiency, caused by rises in both pj and qj. But note: only the extra quantity of inputs (the rise in qj) would be true inefficiency. The higher payments to the factors (the rise in pj) would be merely a transfer of income from utility customers to utility employees and suppliers. In logic, that transfer does not subtract from efficiency. Though it may affect equity, the "cost" of that effect is (partly) an ethical issue, not strictly an efficiency question.

A further loss of X-efficiency may occur when employees of the utility, knowing that costs will be covered, reduce their work efforts. Such "shirking" is a major topic in recent labor-economics writings, and Leibenstein casts it as possibly the largest component of X-inefficiency.[1]

Extra costs may provide higher quality of service, including higher reliability. Therefore, any waste may have value rather than be a deadweight loss. This issue is simply part of the general utility problem of optimizing service quality and reliability.

Also, any cost bloating may be kept low by good management practices. Managers' training leans against permitting inefficiency, and so any cost-plus tendencies may be constrained by customary standards of good management, rather than running wild.

In any event, regulation may not be the real cause of any rises in cost. Rather, the firm's monopoly position may be the true cause, while regulation is merely present without adding to the effect. Regulation may have the duty of reducing the X-inefficiency -- and it may fail to do so -- but regulation may not be its cause.

The A-J Rate-base Effect Toward Higher Investment

The Averch-Johnson study noted that if the firm is allowed a profit-rate increment above the cost of its capital, then the firm will have an incentive to use more capital. Thus, suppose that the firm's cost of capital were 10 percent, but the

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[1] See Harvey J. Leibenstein, 1976.

permitted rate of return were 12 percent. Then the firm would gain a 2 percent rate of return on all capital in the rate base. Therefore, it would make choices of technology which increased the size of the rate base.

The analysis merely restated and refined the earlier 1920s' concern about prudent investment. But it provided theoretical illustrations which injected very large distortions; in their models, capital was induced to overexpand by 120 percent and costs were increased by 25 percent.

A second effect of rate-base regulation was the incentive for the firm to expand into markets that it would not have entered except for regulation. The firm would have incentives to capture these adjacent markets even when its costs exceeded those of firms already in those markets.

The Averch-Johnson paper stirred sharp responses, including Baumol-Klevorick (1970), Bailey (1973), and Westfield (1965). Edward Zajac (1972), a senior economist at AT&T, noted that the effects on capital might be small.

In fact, several arguments against large A-J effects are immediately apparent, and they were advanced in the literature:

1. Good Engineering Practice. Many observers and participants have noted that engineers and company officials would not overtly choose wastefully large investments. Their training instead instills an avoidance of waste.

2. Actual Regulation Is Not Ideal. Scherer, Baumol, and others argued that if regulation were relatively weak and/or slow in practice, then the rate-base incentives would be attenuated, perhaps to negligible levels. And in fact, regulation has indeed been weak and/or slow in many cases.

A prime cause of weak regulation is overstatement of needs. Firms may overstate their needs, anticipating that regulators will routinely authorize less than is demanded. The result may be that the firm obtains what it really preferred, by inflating its demands. The literature recognizes that this element may often be present in actual regulation.

3. Accounting Adjustments, Not Real Resources. I have also noted that a large share of any rate-base padding might be merely nominal, not real. It would occur through accounting decisions about depreciation, and by other adjustments in

valuations, rather than by incurring actual expenditures on real capital. To that extent, the overinvestment would not involve real resources, because only the numbers of accounting costs are raised.

Yet the core of the rate-base hypothesis has survived intact, and regulation can in principle still be said to encourage overinvestment.[2] The real question then remaining is a factual one: how large are the real rate-base effects?

In judging that, there are several more points to consider:

4. A-J Effects May Simply Offset the Monopoly's Restraints. The monopoly firm will restrain output and investment in order to maximize profits. If it is price-constrained, then it will prefer to underinvest because the marginal returns on investment will be low. The monopoly will also tend to reduce the rate of innovation, and its excess profits will reduce fairness.

The A-J effect would tend to offset the first two distortions, while the regulatory constraint itself would prevent the third effect. The A-J effect would raise investment, and it will tend to increase the adoption of the new technology embodied in investment.

This point deserves particular emphasis, because it injects an automatic offset. When regulation permits a substantial margin of extra profit (which then induces a higher level of investment), the higher prices will automatically reduce the level of required output.[3]

5. Regulatory Lag. If regulatory lag is large, it may provide incentives to restore efficiency and innovation. At the same time, the regulators' actions may achieve some effect toward fairness. Therefore lagged, moderate regulation may give a realistic approximation of an efficient, innovative, and fair optimum.

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[2] A recent theoretical paper has suggested that a rate-base effect can occur even under perfect regulation, which holds permitted profits exactly in line with the cost of capital; Donald S. Elliott and Stanford L. Levin, 1992. That contrasts with the Averch-Johnson model; there, the firm's motivation stems from the sliver of excess profits which regulators permit.

[3] The only exceptions to this would be if demand is totally inelastic or if the firm adopts differential pricing which over-stimulates peak-load usage.

Consider regulatory lag more closely. It can be extremely important. It operates when there are intervals between actual changes in costs and the firms' ability to change revenues so as to cover the costs. The lag can have many alternative causes. Commissions can have slow procedures, or they may cut the requested price rises too deeply. Exogenous cost trends may be too rapid. Companies' rate requests may be patently inflated or not believable for other reasons.

Moreover, regulatory lag may work in opposite ways, depending on whether costs trends are rising or falling. When costs are falling, the firms want lags to be long. Lags give higher profits, which are a desirable but not compelling result.

When costs are rising, the firms suffer from regulatory delay. The lags cut profits, perhaps causing actual losses; that is undesirable and it is compelling.

In both cases, the cost-sharing ratio -- firm's share in keeping profits or enduring losses -- will vary directly with the length of the lag.

Regulatory lag's effects can be presented in a simple equation, which shows the fraction of cost savings which the firm gets to keep.[4]

ACTUAL PROFITS = PROFITSr + S (Expected Costs - Actual Costs)

The firm's total actual profit consists of the formally-permitted profits, PROFITSr, plus a portion of any cost savings or cost over-runs. The coefficient S is a percent between 0 and 100 percent. In perfect regulation, S would be zero: all cost savings would be passed on to customers. If there were no regulation, S would be 100 percent: the monopoly firm would keep all cost savings.

The S coefficient varies directly with regulatory lag, as noted. With longer lags, the firm keeps more of its cost savings or suffers from paying more of the cost over-runs.

Therefore the regulators indirectly apply an incentive factor (S) by the delay from their actions. The degree of incentive may range from zero up to a strong

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[4] The analysis is parallel to the literature on cost incentive in weapons purchases by the military. There, cost-plus contracts can give effects that are similar to regulation's incentives. See Scherer, "The Weapons Industry," a chapter in Walter Adams, 1975, and the voluminous literature of the 1980s on weapons cost over-runs.

maximum. Even when it is less than maximum, it may still be strong enough to offset the other incentives toward inefficiency.

6. Marginal-Cost Pricing. The effects on efficiency are also related to price-structure issues, because peak-load pricing can be a crucial device to offset any tendencies toward overexpanded peak-load production and investment.[5] Where utilities have reasonably efficient marginal-cost pricing in line with peak costs, the A-J effects will tend to be minimized.

So far, the topic has been efficiency: allocation and X-efficiency. Innovation and equity are two other possible effects.

Innovation

Innovation lies largely outside the economic literature on regulation. If regulation discourages cost-saving actions, then it may discourage (1) product innovations, which create new goods and services, and/or (2) process innovations, which reduce costs for existing products.

Regulation may discourage innovation in several ways. It may be slow in approving new products. It may permit too much monopoly (by extending the monopoly franchise too far), and that excess monopoly may retard innovation.[6]

Yet regulation may instead promote innovation. When prices are constrained, the firm may turn to innovation to modify or create products so as to escape the constraints. Also, process innovations will be pursued if regulatory lag permits retaining cost gains. In these ways, actual regulation may be pro innovation even though theoretical regulation is not.

Also, the regulators may act quickly to approve product innovations. And the franchise may be fitted tightly to the natural-monopoly conditions, so that competition

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[5] See Lewis, 1948, Houthakker, 1951, Vickrey, 1955, Nelson, 1964, Shepherd and Geis, 1965, Shepherd, 1966, Schmalensee, 1979.

[6] There is an extensive literature on monopoly retardations of innovation. See Scherer and Ross, 1991, Chapter 17, Shepherd, 1990, Chapter 6, and sources cited there.

has a maximum role for promoting innovation in other parts. Finally, if the A-J effect does occur and real investment is enlarged, that added margin of new investment may increase the rate at which new technology is adopted.[7]

Equity

One of regulation's original goals was to promote fairness, or equity. The equity gains from regulation may range from negative (shifts reducing fairness) to positive (shifts increasing fairness). They are usually expected to be positive, by preventing monopoly exploitation by the franchised utility. But since 1970, Chicago School analysts have urged that equity is merely ethics, where no scientific answers are possible. Transfers are merely transfers, and judgments about them only reflect personal tastes.

Yet if equity is a genuine social goal, then the prevention of monopoly exploitation is unambiguously positive. It may also be a large value.

From the points in this section, there is ample basis for expecting that any the A-J effect on real investment levels may be prevented from causing substantial welfare losses. And if static inefficiencies do occur, they may promote innovation, so that the net results are positive. If equity is also served, then the whole outcome may be unambiguously positive.

2. The Sensitivity of Efficiency Outcomes to Specific Conditions

From this analysis, it is apparent that several types of conditions can affect the firm's efficiency and innovation. I now consider them in more detail.

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[7] This point was first made by Alfred E. Kahn, 1971.

1. The tightness of the general profit constraint.

This will be inversely related to excess costs. Tighter constraints will generally be part of a tighter regulatory approach to utility performance, including cost minimizing.[8]

The A-J over-investment issue is more complex. One intuition suggests that regulatory tightness would be inversely related to the degree of induced overinvestment. Tighter regulation would lead to less overinvestment. That is because tighter regulation tends to squeeze down the excess returns that might be gained by expanding rate base. That would reduce the firm's incentive to enlarge the rate base by padding its investment.

Conversely, if regulation is lax, allowing high degrees of excess profit, then firms would have larger yields from overinvestment. The incentives would therefore be stronger.

Yet an opposite intuition is also reasonable. An unconstrained monopoly would tend to restrain output and, therefore, to underinvest. If regulation has any effect toward overinvestment, it would become stronger as regulation becomes more restrictive.

Scherer (1970) deduced the latter effect, with tighter regulation intensifying the over-investment. He did note that this effect seemed perverse.

The literature has not resolved this difference, and so we are unable -- even 30 years after the A-J article -- to determine unambiguously this important aspect of the A-J effect. Instead, it is likely that a non-linear function exists, as illustrated in Figure 1. At the extremes of extremely tight and loose regulation, the effect is probably weak. In the middle range of regulatory tightness, the effect may be at its strongest, though not necessarily very strong.

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[8] It can be argued that costs are independent of the rate-of-return tightness. In theory, the firm can pass on inflated costs equally well, whether the rate-of-return constraint is loose or tight. But such an assumption -- that regulators do nothing but examine rate-of-return numbers while being oblivious to actual company performance -- is fanciful. Instead, commissions tend to be consistent throughout, with similar stringency on profit rates and cost efficiency.

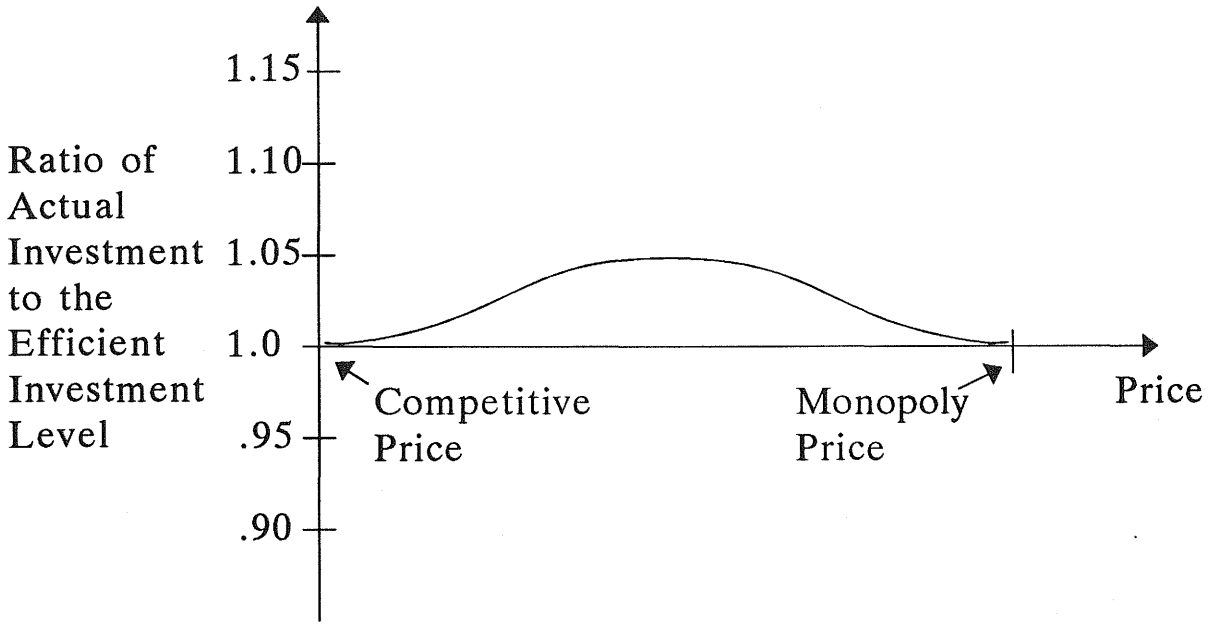

Figure 1. Illustrating the Probable A-J Effect

Degrees of Effects. Even if we know the shape of the function in Figure 1, we lack evidence about the strength of the effects. Especially if other conditions constrain the inefficiency (including the following six items), the effects may be small.

Until this issue is clarified, the policy lessons will be unsure.

2. The length of the actual (and expected) regulatory lag.

As noted above, lags permit excess profits to be reaped, when costs are falling. The incentive can be strong, if the firm effectively keeps most or all of the excess. That ratio of cost-sharing depends in a complex way on:

1. the length of lag in starting proceedings,
2. the duration of the proceedings, and
3. the commission's ability to adjust its profit constraint to anticipate cost reductions.

Figure 2 illustrates these elements. Point A is the end of a rate case, which lowers average prices precisely to the level of average costs. Point B is the time when a new rate case begins. Point C is the end of that rate case, when prices are cut to the new cost level. The triangle P is the amount of profits kept by the utility firm.

The commission can alter the basis, as shown at points D, E and F. In this approach, prices are cut down below costs, to anticipate the trend. As illustrated, the firm's short-run losses and profits balance out, so that no excess profits are made. But this sort of pre-cutting of prices is almost never done. Points A, B and C illustrate the normal method.

Hence the firm has strong incentives to cut costs even faster, if it can. By the same token, as its excess profits rise, the pressure to cut costs -- so as to survive -- will be reduced.

Of course a rising cost trend alters the situation; regulatory lag punishes the firm by reducing its profits. That does apply stronger direct incentives for efficiency, perhaps much stronger than in the opposite case. Here again, the actual result can depend in a complex way on the speed of commission actions and the degree to which it anticipates the ongoing trend and its impact on profits.

Therefore the sign of the relationship between regulatory lag and efficiency will be positive, but it may have a higher value if costs are on a rising trend.

Degrees of Effects. The general form of the relationship is

$$\text{Excess of Price over Cost} = \frac{\text{Length X Rate}}{2}$$

where Length is the length of the rate lag, in years between rate requests and rate decisions, and Rate is the yearly trend rate of decline in costs.

The size of effects can be illustrated by considering actual amounts. Suppose that average costs are declining at 2 percent per year. If the regulatory lag is 1 year, then the firm's prices will on average be 1.0 percent above its average costs. If regulatory lag is 5 years, then prices will on average be 2.5 percent above costs.

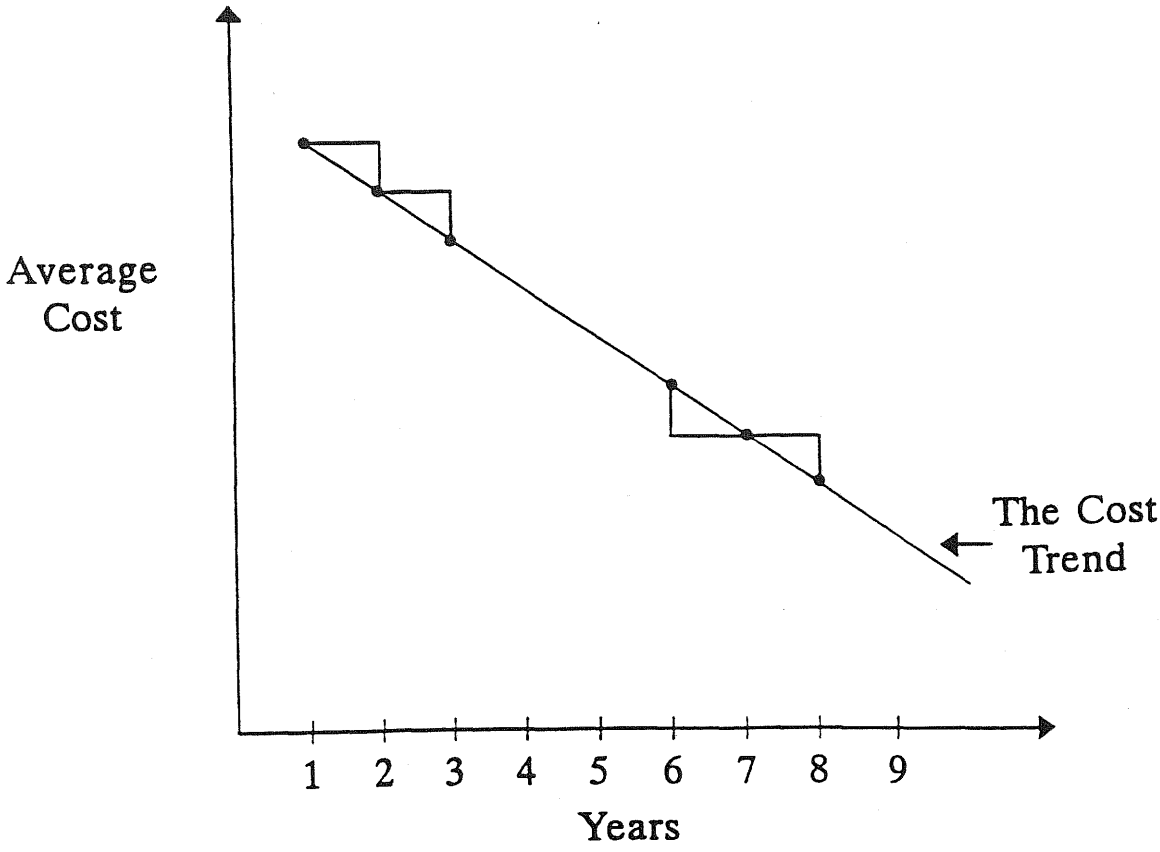

Figure 2. Regulatory Lag and Price Adjustments

There can be sharp impacts from regulatory lag on the rates of return on equity. For example, suppose that the firm's ratio of revenues to investors equity capital is 4 to 1. A five-year regulatory lag in this situation would raise the rate of return on equity by ten points, for example from 10 to 20 percent. This will in turn cause substantial rises in the market price of the firm's stock.

The same relationships hold for rising cost trends, though with a reversed sign. The regulators can, however, nullify the impacts in advance simply by deliberately setting prices above costs at the start of each period.

Longer lags can have strong effects in raising profits, by raising the S (cost-sharing) factor. If the lag is two years long, then the firm's supra-normal profits will be 50 percent of the cost reduction. If the lag increases to five years, the firm's S share will increase to 125 percent.

The resulting effects on profit rates and stock values can be large.

3. The cost-sharing ratio.

The regulators may apply an implicit cost-sharing ratio, as part of their deliberate adoption of regulatory lag. For example, if the firm is regularly keeping half of cost savings because of regulatory lag, the regulators are likely to know that and to use it implicitly as an efficiency device.

Or the regulators may adopt an explicit ratio of cost sharing, as part of a direct "incentive regulation" method. The S coefficient becomes the lever for efficiency. Also, the setting of the target permitted profit rate may be endogenous to the setting of S. For example, if the regulators set a high S in a rising cost period, they may also decide to set a higher permitted profit rate, in order to balance the firm's risks from the S factor.

4. Degrees of actual competition or threats of new competition.

There is often some degree of actual competition, or if not, then the regulators may be able to threaten to let new competition in. That direct or potential competition can apply genuine pressure toward efficiency. Against that, the monopolist will often seek to use pin-point pricing, so as to deter or remove the competition.

Therefore, the actual strength of the competitive pressure on costs can vary over a wide range. If regulators will bar such specific pin-point pricing, while acting to keep the competitive threat open, then the monopolist will be under strong pressure to be efficient and to innovate.

Degrees of Effects. The competitive effects on profits can be sharp. Past research indicates that each drop of ten points in the firm's market share will reduce its profit rate on equity by about two to three points.[9] For example, as market share

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[9] See Shepherd, 1990, chapter 5, and Scherer and Ross, 1991.

drops from 60 to 40 percent, the profit rate might decline from about 20 percent to about 15 percent. Therefore, competition can have strong effects on incentives.

These effects can be ambiguous. A drop in profit rate from 25 to 15 percent, for example, can spur the firm to intensify its efforts to cut costs. But, conversely, the prospect of obtaining a rise from 15 to 25 percent can also stimulate great efforts. Excess profits can deaden incentives, but the hope of gaining excess profits can induce extra efforts.

Normally, the competitive impact is to force greater efficiency; and monopoly's excess profits weaken those incentives. Therefore, any constraints (from regulation or competition) which hold profits down toward minimum levels will tend to spur efficiency and innovation. And regulatory schemes which permit high profit rates will undermine efficiency.

5. The range of choice among technologies.

If the choices among technologies are wide, then regulatory incentives may move the choices a long way toward capital-intensive investments. If, instead, the technology that is available gives give little room for choice, then it may virtually dictate the outcomes. In that case, the regulatory incentives would have little or no effect.

This can be illustrated nicely with the standard isoquant analysis of production functions. Suppose that output is produced by two inputs: labor and capital. The technology may then look as in Figure 3A. Each curve is an isoquant, showing how a given level of production can be produced with varying alternative mixes of the two inputs. Figure 3A illustrates "open" isoquants, with a smooth and large curvature. There are only gradual changes in the marginal rates of substitution between capital and labor, as one moves along isoquants.

The specific choice of technology depends on relative prices, which govern the slope of the "iso-cost" curves. Line 1 is an iso-cost curve reflecting relatively high prices for capital; line 2 reflects relatively low costs for capital, compared to labor. The outcomes are at points X and Y. At point X, the relatively high cost of capital causes a relatively capital-saving technology to be adopted. At point Y, reflecting a

relatively low cost of capital, the choice is for a technology that uses relatively more capital.

In this case (Figure 3A), the open isoquants yield a big shift in the choice of technology, reflecting differences in the inputs' prices. Now consider Figure 3B. Here, the isoquants are pinched and sharp cornered. When the differences in prices are mapped on (using lines 1 and 2, just as in Figure 3A), there is no effect on the choice of technology. Points X and Y are identical. The sharp-cornered isoquants dictate the choice of technology, regardless of the inputs' prices.

This illustrates how the strength of any A-J effect will depend critically upon the possible openness of the isoquants. If the isoquants are sharp cornered, then no A-J effect will occur.

An example of relatively open isoquants is electricity investments in the 1960s, with choices between conventional coal-fired or oil-fired generating plants and the much more capital-intensive nuclear technology. The rate-base effect could operate over a wide range, in favoring the buying of nuclear plants. Hence the rush into nuclear at that time may have been intensified by the rate-base effect.

But many other cases may involve pinched isoquants, in which the choice of technology is narrowly predetermined. That is the customary view of engineers, who participate closely in the choices. At each period, the scope for leaning toward capital intensity may be slight.

6. Prudence tests to detect and prevent wastes.

When Averch and Johnson's paper on rate-base effects appeared in 1963, commissions had long paid little attention to the risk of overinvestment. But by 1970 the "gold-plating" issue had become extremely sensitive, and commissions had begun applying prudence tests to large elements of utility investments. Although the commissions failed to act promptly on many nuclear plants, by the middle 1970s they were screening most other investments reasonably effectively, judging whether they were "used and useful," etc. Excessive peak-load reserve margins were coming under attack, and denials of inclusion in the rate base had become common. In anticipation, this induced many utility firms to screen their investment plans more closely.

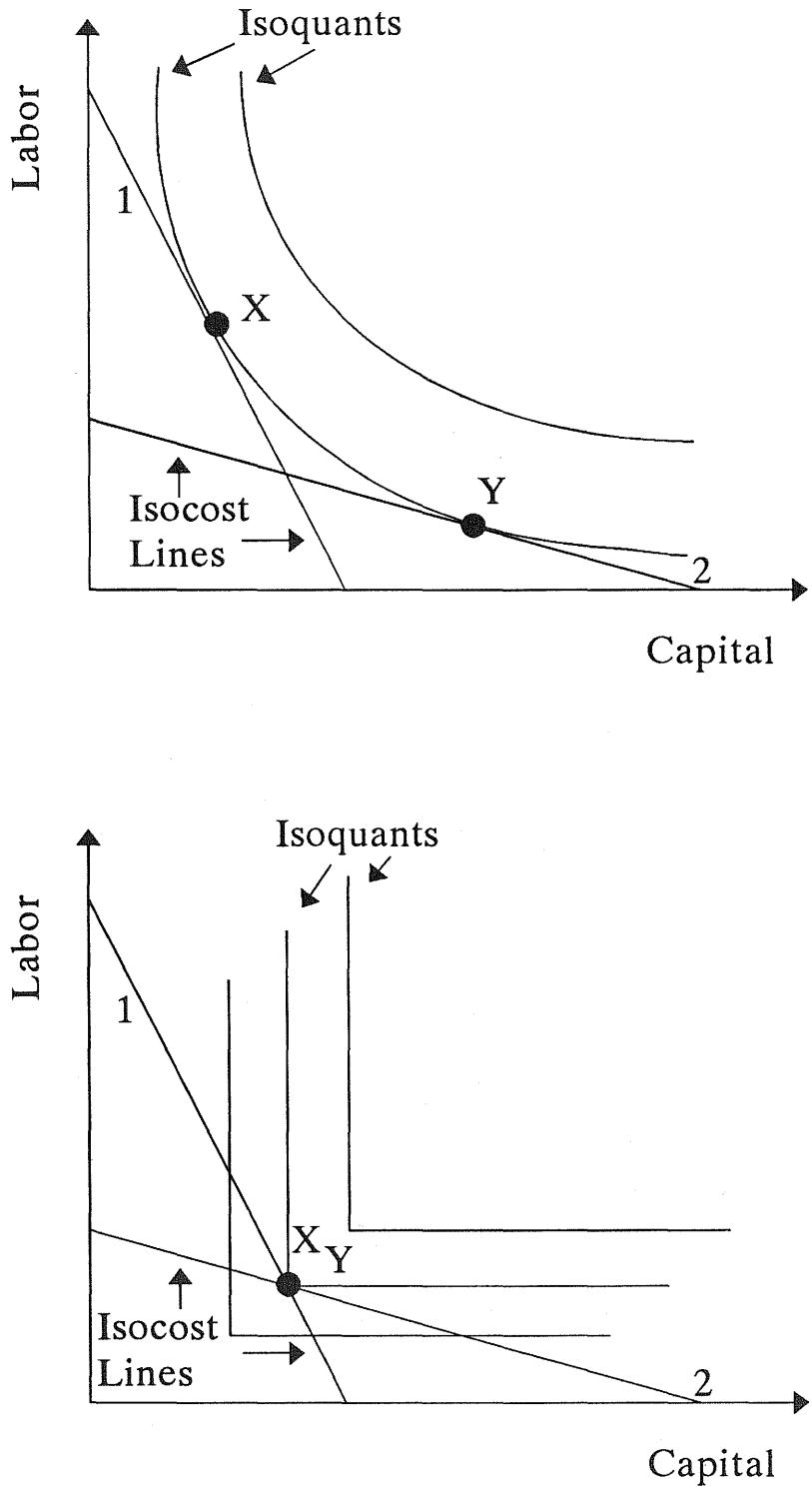

Figure 3. Illustration of Open and Pinched Isoquants

Similarly, on current costs, many commissions by 1975 were applying reasonably tight controls on permissible costs. The days of passive approval were over for most utilities, and a tightening of cost controls became common. Therefore, cost inflation was being alleviated at the same time that the rhetoric about it was being stepped up.

3. Combining the Elements that Affect Efficiency

Taken together, these elements are as follows:

$$\text{Efficiency} = E + a\,T + b\,L + c\,S + d\,C + e\,I + f\,P$$

where:

E is the level of efficiency, if the firm were a pure monopoly under franchise.
T is the strength of the regulatory constraint.
L is the length of the regulatory lag.
S is a cost-sharing ratio that may be implicitly or explicitly adopted by the regulators.
C is the actual degree of competition, as a divergence from the pure-monopoly condition.
I is the degree of openness of the isoquants involving capital investment.
P is the strength of prudency reviews against inefficiency.

The coefficients reflect how strongly these conditions will affect actual efficiency. For example, a large and positive b coefficient for regulatory lag would mean that regulatory lag has a marked effect in raising efficiency.

The expected signs and sizes of the coefficient would reflect the discussions above. Several of them are predictable, but others are ambiguous. The a coefficient on regulatory tightness may go either way but is probably not large on balance. The b coefficient on regulatory lag is likely to be positive and large, because it involves incentives which are probably strong. The c coefficient on the cost-sharing ratio would be positive; its size is not easy to predict. The d coefficient on competition will be positive and may be large; competition generally promote efficiency strongly.

The e coefficient on isoquant sharpness is positive; sharper isoquant mean less possible deviation from efficient choices. The f coefficient on tightness of prudency reviews is also obviously positive.

The equation itself merely codifies the factors involved. Its main value is in displaying how numerous the factors are and how they may tend to reinforce each other in preventing inefficiency. It shows clearly that there are several conditions which may inject efficiency incentives, perhaps strongly. Actual testing may eventually show the signs and sizes of the coefficients for common situations.

4. Reviewing the Possible Inefficiencies of Regulation

All this theory leaves the issues open. Some inefficiencies might occur, but there are counter-forces which would weaken or reverse those effects. I turn now to some of the empirical studies which may show how large the effects really have been.

Robert W. Hahn and John A. Hird (1991) provide a recent comprehensive review of research findings about the cost and benefits of regulation. Published in a leading journal on regulation, it reconsiders the recent view that regulation has caused large economic harms. Their summary covers virtually all possible forms of economic regulation, from utility constraints to agricultural price supports.

Hahn and Hird attempt to present the most reliable evidence, and they appraise the reliability of the various ways to make estimates. They note cautiously "that existing tools for estimating regulatory impacts are extremely imprecise, and that most estimates more properly are viewed as guess-timates" (p. 236). Hahn and Hird note the obvious: that regulatory costs in 1988 were probably much smaller than in the 1970s, because deregulation had progressed far. They also carefully include estimates of the benefits of regulation, to compare with the costs.

Hahn and Hird also include an array of other "economic regulation," relating to such miscellany as the Davis-Bacon Act (wages), international trade interferences, milk controls, natural gas production, and agricultural price supports. Interesting and debatable though these cases are, they have nothing to do with monopoly regulation.

Relevant Cases

I have sifted out and assembled their figures for the industries relevant to this study in Table 2. Transportation industries are the most numerous, and they have involved large costs, as is well known. There are no figures in Table 2 for electricity, because Hahn and Hird do not report any research results for that industry.

In Table 3, I present Hahn and Hird's comparable figures for 1988, after extensive deregulation had occurred. The costs of regulation in the transportation industries had largely been eliminated by then, along with the possible income transfers.

To compare with the costs, Hahn and Hird indicate what they regard as the probable transfer benefits of regulation. Some of the transfers come from restraining monopoly overcharges. Others come from creating valuable scarcity rents, such as from restricting truckers' access to trucking routes and airlines' access to airport loading gates and runway time slots. Because they lack precise estimates for these transfers, Hahn and Hird attribute transfer volumes at approximately three times the size of the efficiency costs. That proportion is of course debatable, but it may fit roughly the true magnitudes.

Hahn and Hird report regulatory "costs" for telecommunications at both periods, but the costs are based mainly on John Wenders' (1987) estimates. Those values reflect the apparent lack of marginal-cost pricing in several dimensions of telephone service. Such pricing impacts may be substantial (Wenders rates them at $14.1 billion in 1988 dollars). But they are quite different from the inefficiency "costs" that may be caused by the control of monopoly, as discussed earlier.

Hahn and Hird note Crandall's (1989) important criticism that deregulation would not guarantee the adoption of efficient marginal-cost-based pricing. Indeed, the resulting price discrimination (or Ramsey prices) might be highly distorted from cost patterns. In any event, Crandall reaches much lower estimates of the costs from distorted pricing, at from $1.7 to $4.5 billion.

Airline regulation's costs have been estimated at high levels, especially by Morrison and Winston, as included in Table 1. Deregulation removed a large share of those costs, at least during the 1978-1984 period.

TABLE 2
Annual Cost of Economic Regulation in 1978

Industry	Efficiency Costs ($ billions)	Transfers $ (billions)	Sources
Telecommunications	(6.5) (1.7)	(20.0) (4.5)	Wenders (1987) Crandall (1989)
Airline	8.0 1.4-6.0 2 - 5	 6-15	Morrison & Winston (1986) Litan & Nordhaus Consensus
Rail	2.3 0.1	7.5 0.3	Winston (1985) Boyer (1987)
Trucking	1-2.5	3-7.5	Felton (1978), Moore (1975)

Yet the return of market dominance to airlines and trucking during the 1980s has probably erased substantial amounts of the earlier gains that deregulation had achieved. For example, Morrison and Winston recently estimated the remaining losses caused by control over scarce airport gates and slots at some $3.8 billion in 1988. That would offset a major share of the estimated earlier gains from deregulation after 1977. Therefore, the comparison of airlines (under regulation) with airlines (now under limited competition) is much less favorable to deregulation than the comparison for the 1979-1984 period when competition was effective.

TABLE 3
Annual Cost of Economic Regulation in 1988

Industry	Efficiency Costs ($ billions)	Transfers $ (billions)	Sources
Telecommunications	14.1 1.7	42.3 4.5	Wenders (1987) Crandall (1989)
Airline	3.8	7.7	Morrison & Winston (1986, 1989)
Rail	2.3	6.8	Winston (1985)
Trucking	0	0	

To summarize, Hahn and Hird's review shows:

1. There were substantial costs in transportation and miscellaneous other industries, from a range of dubious interferences which were <u>not</u> standard natural-monopoly regulation, and
2. There is little clear evidence of cost-plus and rate-base inefficiencies under natural-monopoly regulation.

And in any event, Hahn and Hird indicate that regulation probably has provided other benefits that are larger than the costs.

Affirmative Defenses of Regulation

Since 1970, a series of papers has provided analysis that notes the strengths of rate-of-return regulation, rather than its possible inefficiencies. The literature on this side and on the other related issues is so large that a comprehensive review would be too lengthy for this paper. I will focus on several leading papers.

Gordon R. Corey (1971) contradicted the Averch-Johnson conclusions by rejecting the assumptions underlying the Averch-Johnson analysis as being "invalid" (p. 358). He stressed that real regulation does not fit the rigid model used by Averch-Johnson and that the marginal cost of capital is usually above the permitted rate of return. That would directly counteract a tendency to over-invest. Corey contended that regulation would be more likely to reduce investment than to enlarge it too far.

Alfred E. Kahn considered the A-J effect relatively briefly in his major treatise on regulation (1971). He suggested that any investment-stimulating effect would tend to yield positive benefits, rather than economic losses. If the firm did actually enlarge its use of capital, that would create a larger ratio of newer investment in its capital base. The effect of the enlargement would be to explore and adopt new technology more rapidly. Technological progress would be advanced, and those gains might overbalance the current static-efficiency losses.

Bruce C. Greenwald (1984) adopted a dynamic framework to assess regulation as a process of adjustment, rather than a merely static phenomenon. He analyzed the properties of regulation as a process which aligns restraints with changing values and expectations. He found that "rate of return regulation as now practiced is effectively equivalent to an almost ideally flexible system of sequential market value promises" (p. 94). The conclusion holds true even though (or because) the standard regulatory approach permits a wide choice among alternative rate base evaluations.

Jeffrey Callen, G. Frank Mathewson and Herbert Mohring (1976) analyzed the effects of regulation under a range of alternative conditions. They found that under common conditions, regulation would yield substantial net benefits. They also found that regulation provides large benefits even when it is relatively liberal. That reflects in part the general properties of regulatory lag, in supplying continuing incentives for

efficiency. Yet they find that regulation approaches the ideal results most closely when the rate-of-return constraint is tight.

These papers focused on efficiency, showing that regulation's efficiency impacts might be more positive than the 1960s A-J literature had presumed. These conclusions hold even if the equity benefits of regulation are held aside. Those equity benefits may be substantial, as Hahn and Hird noted.

5. Comparisons with Incentive Regulation

During the 1980s, the discussion of regulation's possible inefficiencies merged with the increasing study of "incentive regulation." Actually, incentives had been discussed all along, including in the 1960s (Iulo, 1961; Shepherd, 1966b). By the 1970s, a number of practical efforts were being mounted to reward efficient companies directly. Also, direct audits of efficiency were used by a number of regulatory commissions.

The 1980s discussions extended the formal analysis, and they focused on price caps as the main new alternative. Previously, price ceilings had been widely regarded as inappropriate and impractical, because the array of utility services was so numerous, complex, and subject to arbitrary changes in quality. The utility firm would be able to manipulate price changes and it could degrade service quality, in order to maximize profits by evading the price controls. Moreover, price discrimination among these services was seen as an obvious danger, because the firm could predatory pricing on specific items.

The new literature swept away these concerns, arguing instead that:

1. discrimination was actually favorable, because Ramsey prices were efficient, under the new Baumol et al. analysis;
2. by separating services into "baskets" of related services, price ceilings could be sufficiently detailed;
3. the price caps approach could be fitted precisely and reliably to costs and productivity trends;
4. there were no significant imperfections nor strategic uses of prices in order to suppress competition.

These four points were advanced with great confidence by price-cap advocates. Yet all four are dubious, as we will discuss in detail below.

Joskow and Schmalensee

In the mid-1980s, Paul L. Joskow and Richard Schmalensee (1986) reviewed this growing literature, in order to judge how superior the new approaches were, particularly for the electricity industry. They noted the theoretical reasons why regulation may reduce efficiency, especially because of the "cost-plus" aspect. They noted that regulatory lag has beneficial incentive effects. They also concluded that setting the "sharing fraction" (recall the discussion above) remains a critical unsolved problem for incentive regulation.

They concluded that the theoretical case for price constraints -- in place of rate-of-return regulation -- was attractive, but that there exists no general optimal "incentive" approach. Instead, specific conditions will affect the choice of best regulatory methods. That caution undercuts the view that price caps are an easy, general approach. It also contrasts with the general strength and flexibility of rate-of-return regulation, as discussed above.

Moreover, Joskow and Schmalensee noted that practical problems with incentive regulation were still severe. Some thirty-one "incentive programs" had been applied in twenty states, and the Federal Energy Regulatory Commission had adopted some incentive payments. Yet Joskow and Schmalensee found that the programs relied too heavily on specific productivity measures (e.g., for generating stations and for fuel costs alone) rather than on comprehensive measures of productivity. Joskow and Schmalensee noted that such a "narrow definition of performance" would tend to "distort decisions" in several ways.

Generally, Joskow and Schmalensee found major limits and poor design in these applied "incentive regulation" programs. They also saw limited opportunities for future improvements in them. The standard regulation of electricity emerged as a relatively effective alternative.

Schmalensee

Schmalensee (1989) has later extended these ideas further in a major paper on "good regulatory regimes." He compares "cost-plus" and "price-cap" methods of regulation, with special attention to the assumption that future costs are not known with certainty and that regulated firms react to the constraints put on them. His discussion also focuses upon the cost-sharing fraction.

He evaluates numerically the comparative benefits of cost-plus and price-cap regulation for a wide range of values of uncertainty and other parameters. The results are striking. Cost-plus regulation emerges as superior to price caps when future costs are relatively uncertain. When uncertainty is high, then the price cap must be set high to allow for possible unpredictable exogenous cost rises. That high level of the price caps means that the eventual price-cost ratio is likely to be high, thereby transferring large amounts of profits from consumers to the firm. Only when future costs are known with relative certainty are price caps to be preferred. But such certainty is rare; also, it is analytically not interesting because then any regulatory approach would work easily.

Moreover, price caps tend to benefit the firm's share-owners rather than its consumers. Therefore, when maximizing consumer surplus is the goal of good public policy -- rather than consumer plus producer surplus -- then cost-plus regulation does even better on a comparative basis. Since Schmalensee does not include regulatory lag as an important element, his results actually understate the relative effectiveness of conventional regulation.

As Schmalensee puts it, "Generally, this study suggests that price caps have been oversold relative to simple alternatives, particularly if regulators are (or should be) more concerned with consumers' surplus than with the profits of regulated firms" (p. 434). Standard regulation with an element of cost sharing via regulatory lag emerges as generally the best approach. That is close to what actually happens in real regulation, with its moderate regulatory lags.

Braeutigam and Panzar

Also in 1989, Ronald R. Braeutigam and John C. Panzar (1989) compared "cost-based" and "price-based" regulation, in an extensive theoretical analysis. They identified a number of distorted incentives which cost-based regulation would cause, when the firm operates both in a natural-monopoly for "core service" and in a competitive market for a "non-core service." For examples of such services: a core service might be local telephone service, while a non-core service might be information services or long-distance service.

In such a situation, Braeutigam and Panzar identify the distorted incentives as: "incentives for cost misreporting, choice of technology, cost-reducing innovation, choices of prices and output levels, and diversification into competitive markets" (p. 373). Braeutigam and Panzar did not attempt to indicate the quantitative strength of the distortions, but the cumulative impression of their individual findings comes across as very strong.

Unfortunately, the assumptions underlying their analysis make it narrow and inconclusive for real cases. They assume that there is a natural-monopoly situation in the core service. If that is true, then Ramsey prices (that is, price discrimination within a zero-total-profit constraint) would give efficient outcomes. Braeutigam and Panzar assume that there is a binding zero-profit constraint at all times. That is of course a highly restrictive assumption, given the performance of actual lagged regulation, which is usually moderately liberal.

If that constraint does hold, then departing from Ramsey prices might be an inefficient distortion. But if natural-monopoly conditions don't hold, then Ramsey prices are not efficient. And if the zero-profit-constraint doesn't hold, then prices will also be inefficient.

Another assumption made by Braeutigam and Panzar is also troublesome: that there is perfect competition in the non-core service. By this assumption, the firm is forced to be merely a price-taker, passive to the market-wide setting of price.

That assumption, while convenient for analysis, assumes away much of the content of the problem. The central problem occurs when the firm can adopt below-cost predatory pricing or other strategic actions to defeat competitors in the non-core

market -- and thereby attain market power. By assuming perfect competition at the start, Braeutigam and Panzar eliminate that set of possibilities in advance.

These several rigid assumptions vitiate much, perhaps all, of the conclusions about distorted incentives. Moreover, the analysis teaches little about the quantitative strength of the incentives' actual impacts, even though that is the ultimate question. An incentive may be distorted in theory, but it may actually change the real outcomes in only negligible amounts. Even where their analysis may be valid, Braeutigam and Panzar do not establish that the effects are substantial. Therefore, it is not clear what they have shown about real problems in real markets.

In sum, theory has identified several possible costs of regulation, but their size is highly debatable. The recent literature has reduced the apparent costs, particularly when actual regulation is compared with price caps or ineffective competition in typical real situations.

6. Empirical Research

Before turning to the empirical studies of specific regulated industries, we need to consider two basic attributes of traditional regulation before 1970. One is the extent of regulatory lag, and the other is the rates of return actually earned by regulated firms.

Regulatory Lag[10]

Although there is no standardized measure of the length of regulatory lag, it is well known that the lag was extensive for both telephones and electricity. In telephones, AT&T essentially set the pace of price reductions for service. The FCC merely supervised the industry and approved when AT&T periodically cut prices. In electricity, regulation before 1960 was generally regarded as passive, with slow procedures. Rates were cut as costs fell, but only after significant delays. After 1960, the Federal Power Commission became more active, but even then the lags remained long.

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[10] See Charles F. Phillips, Jr., 1965, Kahn, 1971, and Wilcox, 1970.

Actual Rates of Return

The two main indicators of profitability are rates of return on equity capital and total rates of return on assets. By either measure, profits of telephone and electric firms before 1970 were

1. constrained below pure-monopoly rates, but
2. not significantly different from profit rates of comparable-sized unregulated firms, with comparable risks (see Posner, 1969).

The utility firms' actual profit rates on equity were well above their costs of equity capital.

In short, regulation did exert substantial constraints on profits, preventing high monopoly profit rates. But regulation permitted profits well above the strict competitive, cost-of-capital criteria.

Therefore actual regulation departed widely from the A-J assumptions, because it had long lags and generous profit rates. The effective cost-sharing ratio was probably high, and so any effects toward rate-base padding may well have been small.

Specific Industry Studies

Now I turn in more detail to the main body of empirical research on regulation's possible economic costs. Again, I will deal only with a selection of the leading studies. Curiously, little empirical research has been done on the possible inefficiencies in telecommunications, other than the pricing patterns discussed by Wenders (1987) and Crandall (1989). Therefore the electricity industry has been the main target of research. Indeed, this vein has been mined over and over.

I consider five studies dealing with that industry. They focus mainly on the rate-base effect toward possible over-investment. Then I will discuss the contrasting research results on transportation industries, where regulation is recognized to have been more costly.

Among the best-known quantitative research on the rate-base effect toward overinvestment are studies by Thomas G. Moore (19720), Robert M. Spann (1974), Leon Courville (1974), H. Craig Peterson (1975), and William J. Boyes (1978). Some

of these studies found some significant evidence that an investment effect existed, but the scale of the effect emerged as unsure and probably moderate at most. Yet the studies were widely cited as showing that the A-J effect was large.

Against these indications, it has been generally recognized that utility managements and engineers have ingrained goals and technical methods which generally prevent wasteful overinvestment. Moreover, if excess of dollar investment levels do occur, they might merely embody accounting adjustments and choices, rather than raised levels of real capital.

Table 4 summarizes the findings of the five studies. I will discuss these studies in some detail, because they are fixtures in the case against regulation.

Moore. Thomas G. Moore provided one of the earliest assessments of the A-J hypothesis by testing the effect of regulation on electric power pricing. Moore econometrically estimated a demand function and a marginal cost function on the basis of 1962 operating data from sixty-two private firms and seven municipal systems. Marginal cost was estimated by ranking plants on the basis of average operating costs, and the marginal cost of power at any hour was the average cost of the plant judged to be marginal.

Moore's results provided mixed support for the A-J hypothesis. First, he used the estimated supply and demand equations to predict monopoly prices which he compares with actual regulatory prices. His central conclusion here is that regulatory prices, in 1962, were essentially equal to the predicted monopoly prices or at best only about 5 percent below. But municipally owned systems in the sample had prices 10-20 percent below a predicted monopoly price.

Second, he performed several indirect tests of A-J type effects. He found that in fact the ratio of peak output to total capacity was marginally higher for municipal systems rather than private companies. Hence, private companies did not use a more capital intensive technique than did the municipal systems. It is possible -- even probable -- that municipal firms make reasonably optimal input selections, though that is not assured. While the difference between private and public was not statistically significant, the data appear to suggest that private firms actually built cheaper plants than comparable municipal firms did.

TABLE 4
Empirical Studies of Inefficiency in the Electricity Industry

Author	Finding
Moore	Prices were not significantly reduced by regulation. Compared to public systems, private investment is smaller, less capital intensive, and less expensive. This contradicts the A-J hypothesis.
Spann	Existence of an A-J effect is confirmed for generating plant, but not for other investment. No estimates are made of the extent of the effect nor of its costs.
Courville	From complicated, questionable tests of factor shares, A-J effects are confirmed for generating plant only. "Relatively small" costs of 12 percent above "minimum cost" are estimated.
Peterson	Tight regulation may constrain costs but it causes an A-J effect. The size of the effect is not estimated.
Boyes	An A-J effect is not confirmed.

Moore's conclusion was that although prices haven't been significantly reduced under regulation, it is also the case that regulated private companies do not appear to have distorted input selection procedures vis-a-vis their municipal counterparts. Moore did seem to imply that removing regulation would lower prices by significantly increasing the elasticity of the demand faced by any one firm.

In short, Moore's indirect test did not find the presence of an A-J effect.

Spann. Robert M. Spann took a more direct approach by using a direct production function model, in order to make estimates of the factor share functions involved. Spann's data consist of observations on all new steam generating plants built from 1959-1963 and a cross-section of large companies for 1963.

Spann sought mainly to test whether the profit constraint was binding, so that an A-J effect might occur. His results implied that the constraint was binding, and he concluded that the A-J bias did exist. But he provided no indication of the strength of the biasor of how large the distortions might be. His results are consistent with a small A-J effect.

Spann's work was severely criticized by James Giordano in his doctoral dissertation (1982). He pointed out that Spann's estimates are biased because his measure of the capital stock and the other inputs are not exogenous. In order to be consistent, capital, labor, and fuel should all be exogenous to the estimating model. Giordano used predicted values of the variables to generate an unbiased estimate of the parameter over 1964-1977. Giordano found some support for an A-J bias in 64-73, but no support for that claim in 74-73. With rising fuel costs and regulatory lag after 1973, it appears that firms disinvested excess capital, despite the presence of a possible A-J bias.

Courville. Léon Courville provided still another test of the A-J effect, and Courville's results allow for an estimate of the actual cost of an A-J type distortion. Courville concentrated on data from the power generation activities of private, regulated fossil fuel plants over 1948-1966.

His approach was to estimate a production function for power generation. Using the estimated coefficients, Courville generated estimates of the marginal product

of capital and fuel. His estimates suggested that in the majority of situations, Courville could consistently reject the null hypothesis:

$$H_O: \quad \frac{MPK}{MPF} - \frac{P_K}{P_F} = O$$

Taken altogether, Courville's analysis indicates that over three-fourths of the plants in his sample were overcapitalized in an A-J sense.

But Courville concluded that the annual average cost of the inefficiency appeared to be "relatively small." Even so, the percentage deviation between minimum predicted and actual cost is 6 percent at peak output, and 12 percent at average output levels. His results suggest that had the total U.S. power needs for 1962 been efficiently produced, a savings of from $219.5 to $436.5 million would have been realized through reduced costs of production.

Courville's approach was ingenious, but it encountered a series of problems which leave its results highly debatable. The focus exclusively on generation plants is artificial and narrow. That is only one part of the regulated firms' activities. Also Courville's method for defining the "normal" level of operation (using the year after completion) is shaky. The first year may involve special problems and interruptions; the second year would seem more reliable.

Courville's measures of capital are also debatable. Another serious problem: "Because of limitations on the number of observations, plants of all sizes were grouped together" (p. 63). Courville reported that some methods were adopted because they "produced better results" (p. 64). Courville also noted that the price index for deflating capital values over time was "questionable" (p. 65).

The results for the 1955-1959 vintage of capital were sharply different from the rest; yet Courville merely concluded that "during this period the measurement of capital was subject to error" (p. 66). The methods for estimating the cost of capital and the average life of electric utility plant were also open to question.

In general, Courville was forced to venture a complicated, relatively indirect test of impacts on capital-intensity with weak data. Given the shaky nature of the procedures, the results are open to substantial doubt, and the estimated costs are essentially conjectures.

Peterson. H. Craig Peterson provided a further empirical test of the A-J effect and its magnitude. Peterson used data from steam plants which had at least a 50 percent expansion during 1960-1965, and the actual data observations are from 1966-1968. Peterson's estimates are derived by still another approach, and he estimated a total cost function. Peterson did not estimate the inefficiency itself. He merely tests the hypothesis that some effect can be observed. His results do not provide a specific basis for concluding that the effects are substantial.

First, Peterson finds that electric power generation is in fact characterized by a "natural monopoly" market structure. Unit cost fall throughout at least 90 percent of the range of observed firm outputs. Second, the share of total cost going to "capital" rises 3 percent in regulated states, and another 3 percent in states which employ an "original cost basis." Additionally, as regulatory constraints tighten (the allowed rate of return $S \rightarrow P_K$), the share of total costs going to "capital" increases at a decreasing rate. However, Peterson does find that technological change has not worked to exacerbate A-J effects. Plants incorporating newer technology did not exhibit a larger percent of total cost paid to "capital."

Yet, like the other studies, Peterson's suffers from major problems of weak evidence. The data are relatively few and possibly not representative of the population. The choice of linear vs. nonlinear forms are debatable, and the weightings of variables are questionable. The assumption that the tightness of a state's regulation is measured by the permitted rate of return is dubious; it is well known (and Peterson acknowledges) that state regulators' rate-base definitions (original cost vs. fair value) interact with their permitted rates of return in offsetting ways. Thus, fair-value states were often in the 1960s liberal on rate base but tight on the rate of return; and vice versa for original cost states.

Peterson's use of a simple dummy variable for the two rate-base approaches is probably too simple to fit the gradations in actual practices. Finally, the method for estimating the difference between the firm's allowed returns and cost of capital are complex and debatable.

Peterson's regression results are mixed and often insignificant or inconsistent. The interpretations of them can be at best suggestive rather than confident. Peterson

himself seems to find contradictory meanings. At one point, tighter regulation is said to increase costs; at another point, "the cost inflating effects of regulation can be reduced if the firm is regulated very tightly" (p. 122). Altogether, Peterson's study provides only weak indications that some effect on capital may have occurred.

Boyes. William J. Boyes estimated a constant ratio of elasticity of substitution (CRES) production function for sixty steam generating plants, privately-owned that were started in the 1957-1964 period. He included a term representing the presence of effective regulation.

The estimated value of the term's coefficient could not be distinguished statistically from zero, and so the presence of an Averch-Johnson effect was not confirmed. Boyes' results further suggested that the elasticity of substitution between capital and labor for these plants, at that time, was relatively small, especially compared to the substitutability between capital and fuel.

Summary

The studies compared regulation with ideal results that full competition and technical perfection would have given. They did not compare the regulated situation with market dominance or with imperfect alternative forms of regulation. To that extent, they are biased toward finding an appearance of inefficiency.

If these results are evaluated carefully, one might infer that some sort of A-J effects may have existed in the electric power generation process during the 1960s, but not after 1973. If the effects did exist, they were mild at most. Only one study (Courville's) offered specific estimates of cost effects, but that study was especially marked by technical problems and data weaknesses. Other studies (Spann, Peterson) also contained weaknesses, but they only suggested that, at most, some effect (of unspecified size) might be present.

Further, Joskow and Mishkin (1977) studied the choices of utilities in choosing between coal, oil, natural gas and multi-fuel methods of generation. During the 1952-67 period, they found that in 75 percent of cases the least-cost plant type was chosen. Again, any biases were apparently small.

As a final wrinkle, Boyes (1976, p. 31) notes that the utilities' adoption of pollution control equipment may have been speeded by the existence of an A-J effect. To that degree, the A-J effect would probably have promoted efficiency, rather than hindered it.

In any event, none of the studies provided evidence that the possible costs were larger than the probable benefits of regulation.

7. Specific Episodes in Electric Power and Telephones.

In addition to these studies, one may learn from specific prominent episodes in regulatory history. Three specific episodes may in fact show the A-J effect at work: the rush to adopt nuclear power technology in the 1960s, the huge excess capacity margins in the electric power industry in the 1980s, and high reliability standards in telephone service during the 1950s and 1960s.

The Rush to Nuclear Power

After the pioneering Peach Bottom nuclear plant was ordered in 1963, the rest of the industry rushed to order nuclear plants, which were then built for the next twenty-five years or so. The plants were much more capital-intensive than conventional generators, and so there was suspicion that much of the shift was driven by the A-J effect, in an effort to increase the rate base.

Yet that is only a conjecture, and many other factors were at work. There was a massive promotional effort by the equipment makers to encourage orders for their equipment. This also encouraged a herd mentality by the electric companies; once the safety concerns seemed to be allayed, then the whole industry felt secure in trying the plants. Further, environmental concerns had begun to be important, and this new "clean" new technology seemed to be a solution.

If the A-J effect was involved at all, it may well have played no more than a minor role.

Preference for Turnkey Contracts in Building Nuclear Plants

Utility firms showed a preference for turnkey contracts (on a cost-plus basis) for the nuclear plants they bought. That has been interpreted as a reflection of the utilities' indifference to investment costs (Burness, Montgomery and Quirk, 1980). But a somewhat different view is The utilities merely took advantage of a chance to shift the risk of cost over-runs from themselves to their customers. That was merely a general tactic by firms, not a specifically A-J effect. It was not inherent in the situation, and it could be corrected by the regulators by requiring different forms of contracts.

Excess Capacity in the 1980s

Large reserve margins in electric capacity, some as high as 50 percent and more above peak requirements, emerged in the late 1970s and lingered through most of the 1980s. They might reflect an over-investment in capacity, beyond economic margins.

In fact, they probably do not. They reflected mainly the electric companies' inability to predict the sharp rise in oil prices after 1973, with the cartel pricing by OPEC. Instead of 8 percent yearly growth, electricity use was slow growing or virtually stable. The long lead times and inertia of plant building opened up the large excess capacity.

There is no clear evidence that an A-J effect caused any of this excess capacity.

High Reliability Standards in Telephone Service

It has been observed that the Bell System's high technical reliability standards might have reflected both an A-J effect and excess use of all inputs (e.g., for staffing, supplies, etc.). Indeed, the system seemed able to handle traffic at virtually all times, including needle peaks at Christmas. That suggested that capacity and maintenance reserves were unnecessarily large. Charges that AT&T was unnecessarily providing "Cadillac" quality service were made.

The issue can only be settled by detailed analyses of quality requirements. It has not been shown objectively that excess service quality did exist. Indeed, starting in 1968, serious failures in service quality began to emerge in several parts of the Bell System, including especially New York. There have not been accusations of "excess" service quality since the 1960s.

In any event, any "excess" quality that did occur might have had significant social benefits, beyond those of a strictly private nature for subscribers. An ample telephone system promotes rapid communication in ways that promote economic activity and progress. Therefore, even if the Bell System did maintain an "excess" margin or capacity and quality by narrow standards, it may have had a wider social justification.

8. Effects in Transportation Industries

The efficiency results in transportation industries have appeared to be clearer and more reliable. Yet, of course, none of those industries involved the standard regulation of a natural monopoly. Instead, oligopoly was poorly controlled by odd forms of regulation that were known at the time to be largely inappropriate. The findings of inefficient effects were obvious.

Railroads

Studies of regulation's impact on railroads include Robert W. Harbeson, 1963, Anne F. Friedlaender, 1971, Kenneth D. Boyer, 1977, Richard C. Levin, 1978, and Clifford Winston, 1985. The reported inefficiencies ranged from about 1 percent (Boyer and Levin) to as much as 36 percent (Friedlaender) of freight revenue. The question is still controversial, but by the 1970s most observers regarded the case for deregulation as persuasive.

Yet this case is mostly irrelevant to this study, for two reasons. First, the ICC was largely passive to the railroads, not enforcing constraints on earnings and rate structures. That in turn was true because: second, the railroads were in structural disequilibrium during the decades after 1920. Their capacity was too large, because

demand was taken away by private motor cars, trucking, buses and airlines. Many railroads were unable to make standard rates of return because of their overcapacity.

Regulation did not apply conventional constraints to profitability. Whatever inefficiencies occurred were for other reasons, particularly on eastern railroads. The ICC's powers should have been revised and reduced soon after the 1920s. But that is a separate issue from the one here.

Airlines

Airlines also were given substantial research attention, focusing on the tendency of airline costs to rise to the permitted fare levels (Caves, 1962; Jordan, 1970; Keeler, 1972). Jordan, Keeler, and others found that prices rose to about 30 to 50 percent above minimum-cost levels on some routes, because competitive and regulatory pressures were both weak. In the 1970s, there was in effect an excess of planes in service, flying more frequently than was efficient, and flying about half empty (with load factors around 50 percent). Moreover, the airlines seemed to adopt new airplane types more rapidly than was efficient, because they were diverted into service competition in place of cost-reducing efficiency.

But these outcomes were not caused by classic cost-plus and rate-base effects. Airlines had never been subject to standard regulation, with full evidence on costs of capital and rate structures. Instead, the airlines inefficiency was caused by minimum-price fixing via the CAB, which diverted airlines' competition into cost-raising forms (frequency of flights, luxury of interiors and meals, etc.). Although "regulation" was associated with inefficiency, that fact is not relevant to the context here.

9. Summary

Altogether, there is little evidence that standard regulation has caused more than moderate possible harms to efficiency in natural-monopoly cases, and any losses of innovation are debatable. The research literature does not support the notion that regulation's harms have been large and certain. In some cases regulation may have promoted efficiency, rather than undercut it. Any serious harms to regulatory

efficiency in transportation industries have been irrelevant to natural-monopoly cases such as electricity and telephones.

Meanwhile, regulation has commonly provided significant improvements in equity, by reducing the exploitation of consumers by the few, generally-richer stockholders. In contrast, the two main alternatives to traditional regulation -- (1) price-cap methods of regulation and (2) deregulation which leads to market dominance -- tend to confer benefits on stockholders at the expense of consumers. If equity is a goal, then regulation's comparative performance may be even stronger.

Therefore, the weight of research findings about natural-monopoly regulation are generally positive, compared to the most commonly discussed alternatives.

Chapter III

WHEN COMPETITION IS NOT EFFECTIVE

Though this paper is primarily about the design and effects of regulation, the meaning of effective competition is also related intimately to the choices about regulation. As we have seen, regulation is commonly compared to competitive outcomes, in appraising regulation's faults. But if competition in former natural-monopoly markets is actually ineffective, then regulation's comparative faults would be smaller. Also, the justification for shifting from regulation to competition would be weaker. And if effective competition is <u>not</u> likely to result from deregulation, then deregulation is riskier than its advocates have asserted.

Ineffective competition is in fact a serious problem. The competition that actually emerges under the deregulation of former natural monopolies may well be imperfect, as has been noted above. I will now analyze that problem more fully. Unfortunately, the problem is not simple: there are several alternative criteria for judging competition, and conditions that contain high monopoly power are often claimed instead to be effectively competitive. Accordingly, one needs to begin by discussing the basic criteria of effective competition.

1. <u>Criteria of Effective Competition</u>

The core meaning of effective competition is basic and obvious: competition is effective when there is <u>strong mutual pressure among numerous comparable rivals</u>.[1] Then no one firm dominates the market, and there are enough firms to assure that they will not collude together to fix prices.

As developed in the mainstream literature during the last century, these conditions are in large part -- but not exclusively -- judged by the <u>internal structure</u> of

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[1] See especially the comprehensive summary in Scherer and Ross (1991), and other summaries in Bain, 1968, Greer (1992), and Shepherd (1990).

the market. That structure involves the size distribution of the market shares of the firms that are actually direct competitors in the market.

Numbers

The number of firms does not have to be high: ten or more roughly equal competitors will usually be enough to provide "hard competition" and to rule out collusion. Even as few as six or seven may provide independent mutual pressure most of the time.

Parity

The rivals need to be comparable to each other, so that they provide strong pressure against each other. Usually, tiny fringe firms simply lack competitive staying power. If one or two firms hold most of the market, then their dominance will create an imbalance rather than competitive parity. The dominant firm will have overwhelmingly superior resources, and so it will not be significantly constrained by its tiny rivals, no matter how numerous they are. Parity need not require roughly equal size, but it does require an ability to apply strong mutual pressure and threats.

Accordingly, the first requirement of effective competition is that there not be market dominance by one firm. If there is dominance several firms, then they may collude with each other, and that too prevents effective competition. Therefore, both dominance and tight oligopoly are incompatible with effective competition. The lesson for regulation is: the market must evolve down through dominance and tight oligopoly to reach a state of loose oligopoly. The extreme conditions of atomistic competition are certainly not needed, but competition must be effective.

Price Discrimination

All firms try to use selective pricing as a competitive weapon, using price discounts to win customers. Such flexible pricing is pro competitive in a competitive market setting.

But such pin-point pricing tends to be anti-competitive when it is done by dominant firms. That is true because dominant firms can often overwhelm small

rivals and new entrants with strategic pricing, smothering the competition and retaining the dominance. Relentless selective pricing tactics can block entry entirely, as effectively as any other more tangible barrier to entry.

This crucial role of pin-point pricing is ignored almost entirely by the theoretical literature on deregulation, which focuses instead mainly on simple single-price situations. All of the analyses which claim that potential competition can nullify monopoly are based on such simple models, which simply omit selective pricing.[2] They have little relevance for complex real cases, such as telephone service and electricity.

Therefore, the role of selective pricing is a critically important topic, which belongs in any judgment about effective competition and deregulation.

Entry

If there is free entry for potential competitors, that may inject competitive pressure in some cases. That possibility has long been known, from writings by John Bates Clark (1887), Bain (1956), and others. But the threat of new entry is usually a peripheral and indirect influence on the existing firms, less important than is direct competition. If there are imperfections in the market (lags, lack of information, customer loyalties, etc.), then a dominant firm may be able to exploit them so as to avert any substantial entry.

Yet such firms will often claim instead that entry is a powerful force, which nullifies all of their market power and forces them to adopt competitive behavior. The "contestability" literature especially gives rise to claims of this sort. Unfortunately, the contestability literature has exaggerated the possible force of entry, while providing little practical basis for judging the actual power of entry in real cases.[3] The theory is largely irrelevant to significant real markets, as its authors have

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[2] For example, see Baumol, Panzar and Willig, 1982, Sharkey, 1982, and Spulber, 1989.

[3] For critical reviews of "contestability" theory, see Schwartz, 1986, and Shepherd, 1984.

acknowledged.[4] Regulators must be particularly cautious in judging claims that "contestability" has eliminated any chance of monopoly behavior.

Profitability

Another relevant condition in judging monopoly power is the firm's degree of profitability. Sustained high rates of profit suggest that monopoly power is present. Of course, high profitability might instead reflect lower costs. Therefore a complete assessment would try to evaluate the relative efficiency of the firm. But high profitability for a dominant firm suggests a presumption that some degree -- probably a high degree -- of market power is present.

And regardless of what may cause them, those high profits can also provide resources for future tactics to sustain the firm's dominance.

2. Mixed Cases with Patches of Monopoly and Competition

Within any sizable and complex market, there will often be a patchwork of monopoly and competition in various parts. If the leading firm can pool its revenues and profits among those parts, then its rational strategy is often to use the profits to support sharper tactics in the competitive parts. Such pin-point pricing (discussed above) may prevent competition from gaining, thereby protecting the whole firm from broader competition.

Examples of this are numerous. One is telephone service, where smaller customers often have narrower choices than do large national companies. A second example is oil-products pipelines, where some delivery areas have competition from several pipelines while others have only one monopoly supplier. A third example is airlines, where the business customers' demand is often much less elastic than the demand of other groups.

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[4] See their discussion of airline markets: Bailey and Baumol, 1984. Also, the Baumol, Panzar and Willig book (1982) and the Baumol and Willig follow-on article (1986) note that practical examples of perfect or near-perfect contestability are probably few. Their academic writings have stressed instead the theoretical insights provided by the theory.

The policy choices are difficult in these cases. If most sub-markets have market power, then major protections are still needed to restrain monopoly behavior. Often, instead, competition will be strong in a few and moderate in others, while monopoly is still strong in some others. As the regulatory literature has recognized, deregulation would then permit the firm to cross-subsidize, so as to retain its position. Finally, if only a few parts of the larger market have market power, then the temptation is to deregulate them all while trying to retain some protection in the few monopolized parts. Yet effective protections may not be possible in practice.

These patchwork cases remain among the most baffling on the regulatory scene, and there are no straightforward solutions.

3. Reliance Upon Antitrust Policies to Enforce Competition

In discussions of deregulation, there is commonly the claim that antitrust will "take over" as regulation is eliminated. Defective regulation can be confidently removed, it is said, because antitrust will assure that competition will be effective and deliver ideal performance.

Unfortunately, that is a classic error, based on a false comparison. Antitrust has indeed been the U.S.'s most general industrial policy, often capable of decisive action.[5] But it has been highly fallible and often ineffective, particularly since 1980 under the influence of hard-line "Chicago-school" doctrines and weak enforcement. Antitrust has always been particularly weak in dealing with market dominance, as has long been recognized (see Mason, 1957; Kaysen and Turner, 1959; Bain, 1968; Shepherd, 1975; Scherer and Ross, 1991).

Since 1980, antitrust action toward dominance has virtually ceased altogether: there have been no significant new suits filed against dominant firms under Section 2 of the Sherman Act (Shepherd, 1991). Since 1980, antitrust officials have also deliberately abandoned most enforcement against the pricing strategies that are commonly used by dominant firms. In the future, the post-1980 conservative Reagan-Bush appointees to the courts may well prevent any attempts at effective actions

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[5] See such policy surveys as Scherer and Ross, 1991, Shepherd, 1991, and Greer, 1992.

against dominance during the coming decades, even if antitrust officials might try to resume enforcing Section 2.

Therefore, it is prudent to expect that the deregulation of monopolies will lead to market dominance, not to effective competition. In that light, the relative defects of regulation compared to market dominance are smaller than has been suggested by the comparisons with the results of ideal antitrust policies. This simple point is an important offset to the deregulation crusade. This point also warns that premature deregulation is particularly hazardous, because antitrust will usually not provide a remedy for any mistakes.

4. Practical Examples

The general conditions and lessons are clarified in real cases, where deregulation has not led to lasting effective competition.

Airlines provide a particularly apt example. Deregulation was effective during 1978-1984, because competition became effective. Market shares receded, pricing was flexible, and entry was relatively free. But then American Airlines established systematic price discrimination in fares, which other airlines copied. And no significant antitrust opposition restraint occurred when a series of major airline mergers during 1985-1989 created dominant market shares at most large airports. Dominance became much more important than it had been before deregulation, pricing became much less flexible than it was in 1979-83, and new entry was blocked at most major airports. Airlines have become perhaps the most thorough example of price discrimination in U.S. industrial history.

Antitrust not only permitted these changes; it has been powerless to reverse them once they occurred. Antitrust agencies are now largely passive to the industry, with no important legislative or policy initiatives toward reducing the current dominance at major airports.

Long-distance telephone service offers parallel behavior, though at an earlier stage in the process. During 1985-1990, AT&T's share of the national market receded to about 70 percent, at a rate of about 4 points per year. AT&T demanded deregulation and the FCC complied with its price-cap approach. Yet AT&T has been

able to make special pricing-discount deals with some 100 of its major customers, thereby blunting its small rivals' efforts to progress in the large-business segment of the market. Such pin-point pricing is a main device in AT&T's retaining or increasing its market share. Accordingly, AT&T's market share has apparently stabilized in the 65-70 percent range.

MCI and US Sprint are the only substantial competitors, and since 1988 they have virtually stopped using price cuts as a competitive weapon against AT&T. Little significant new entry is occurring. Meanwhile, AT&T continues to record rates of return on equity higher than 20 percent in this market.

These facts conflict squarely with contestability theory, which predicts that AT&T would be instantly and totally displaced if its prices were higher by a penny and if they gained any excess profits. Instead, AT&T's dominance and unusual profitability continue after more than a decade.

Trucking is a third example (particularly the less-than-truckload part of the business). Deregulation was long overdue when it occurred in 1980. It raised efficiency in many directions. But a national "big three" has emerged -- Yellow Freight, Consolidated Freightways, and Trailways -- which holds over 60 percent in most regions. Entry is formally free, but there are important economic barriers, primarily from the leading firms' ability to use deep price discounting to repel entrants.

The big three are able to use the remaining regulatory systems (of regional price setting) for their advantage. Therefore, the possibilities for flexible pricing have been distorted toward pin-point pricing that supports market power.

Electricity markets for bulk power have been emerging since the 1960s, and some of them have become effectively competitive.[6] But in others there is still dominance and too few rivals. Free-entry doctrines might suggest that the dominance is not significant, and potential competition might nullify monopoly power. But that hope may be illusory in many cases, for the reasons I have noted earlier. Caution will be especially needed in assuring wheeling rights, so that customers have choices over wide geographic areas.

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[6] See Joskow and Schmalensee, 1986, among others.

Chapter IV

QUASI-REGULATION EMPLOYING INCENTIVES

Not only is imperfect competition an unreliable substitute for regulation. We must also be cautious about the other possible substitutes for regulation: especially various forms of "incentive regulation." "Price caps" have become a popular current proposal, but there are also demands for "light-handed regulation," "forebearance," and other catch phrases.

I turn now to those alternatives for regulation, particularly "price caps." They have attracted extensive controversy in recent years.[1] These variants of deregulation have been proposed in both complete and partial forms, so there is a wide range of specific alternatives as a matter of concept. There has also been some brief early experience with some of these methods, particularly with what is called "price caps."

1. Versions of Incentive Regulation

As is so often true, the recent ideas have been long known, in this case nearly a century. As early as 1911, John Maurice Clark noted a need for regulatory incentives. The incentive mechanism might be quite simple:

> Certainly if the principle of a fixed rate of return on the investment were enforced rigidly and all the time, there would be little [incentive to innovate and bear risk]. The...way of handling the situation, and the one that seems best to meet the need in question, is to let the company earn higher profits, but only for a reasonable

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[1] Including Richard Schmalensee, 1979, D.S. Czamanski, J.S. Henderson, C.J. Odle and V. Witkind, 1980, D. Goins, M. Fisher, Robert H. Smiley, and Ronal G. Ehrenberg, 1983, Leland L. Johnson, 1985, 1989, Paul L. Joskow and Richard Schmalensee, 1986, D.P. Baron, 1989, Timothy J. Brennan, 1989, Richard Schmalensee, 1989, Lorenzo Brown, Michael Einhorn and Ingo Vogelsang, 1989, Michael Einhorn, 1990.

See also the excellent summary and review in Raymond W. Lawton and Kenneth Rose, 1992.

period of time, if it has earned them by an improvement in its service to the public [486-487].[2]

This is regulatory lag.

Traditional regulation has included numerous efforts to encourage efficiency. In Douglas N. Jones' summary: "These importantly included cost disallowances, prudence reviews, employment of regulatory lag, occasional ordering of management audits, making invidious comparisons with other utilities, selective public jawboning, and of course direct shaving of the allowed rate of return" (Jones, 1991). Though some of them seem to be negative ("disincentives for utility misbehavior" Jones, p. 2), they actually operated in a positive fashion, by providing higher profits when the preferred actions were taken. And regulatory lag actually added to actual profits, in a strictly positive way.

There has recently been theoretical interest in explicit cost-saving devices, but designing practical mechanisms has proven difficult. That is clear from Joskow and Schmalensee (1986) and Jones (1991).

Principal-Agent Problems

The pure disincentives for efficiency occur in the pure theoretical model of regulation. Regulators are thought to be wholly uninformed about the company's costs and wholly passive to them, while also enforcing instantaneous price adjustments to align prices precisely with costs. Regulation is cast in a principal-agent role: regulators are the principals, while company managers are their agents in reaching good outcomes.

In fact, the designation of principals and agents is open to doubt, and much principal-agent analysis may be beside the point in real-world regulation. Regulators are not principals: they are in fact merely agents for the diverse set of interests called the "general public." The regulators' task is complex: not only
(1) to understand and resolve complicated matters of utility technology, cost trends, pricing and performance, but also

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[2] The quote from Clark, from "Rates for Public Utilities," is slightly rearranged in order to clarify the central point.

(2) to resolve contradictory interests among the populace (e.g., between business and residence customers).

No simple maximand can represent this complex set of best outcomes.

Worse, the regulators can often become agents for principals who are the regulated companies themselves. Especially because utility firms may influence the size of regulatory budgets and appointments of commissioners, and because they shape the regulatory process, regulators in some degree serve company interests. That is equally true of efforts to design and apply "optimal incentive regulation": company interests are involved in that too.

Also, many regulators are short-timers, in office only about three or four years. Their decisions are particularly subject to change. Therefore, principal-agent theory can misrepresent actual conditions, and it must be used carefully. Also, its lessons need to be tested carefully against experience and intuition.

Returning to the standard model of perfect regulation with its assumption of perfect ignorance plus perfect price controls. Regulators force all prices into line with all costs, at all times. But that idea is simply bizarre: it would be idiot-savant regulation, not perfect regulation. Instead, reality is always in between. Imperfect information is the common situation, which David Sappington (1980) and others (Sappington and Sibley, 1988, and Sappington and Joseph E. Stiglitz, 1987) have explored.

The general lesson is that when regulators have less information, the firm has higher chances for excess profits. But the firms also have a higher effective cost-sharing ratio, because they can keep more cost savings. Therefore, regulatory incompleteness can foster efficiency, if not fairness.

If regulators improve their knowledge, they may still retain informal incentives. Also, they may adopt direct actions to promote efficiency, such as efficiency audits, comparisons with other firms, etc..

2. Specific Incentive Plans

The urge for incentive regulation is sound, as a way to minimize regulation's direct costs and indirect burdens, in a setting where competition is not yet effective.

"Incentive regulation" theoretically permits regulators to be ignorant and passive as principals, while trusting a specific mechanism to guide firms (as agents) to reach efficient results.

Yet that is risky. Each design works only for a specific setting of technology trends, price-of-input trends, and opportunities for shifting funds among multiple sets of products. Each design needs to be case-oriented, to fit different conditions. And the design needs to be changed when the setting changes. So regulators, after all, must monitor conditions and enforce changes quickly, as the need arises. They need to be informed, active, and prepared to intervene extensively.

But that is identical to their task under conventional regulation; and there, the changes can proceed smoothly within the process. Under "incentive regulation," in contrast, changed conditions require the regulators to interfere from outside the process in order to change the parameters or even to redesign the incentive structure. Such outside intervention to change the process is inherently more difficult and ad hoc than is standard regulation.

Some of the literature recognizes that incentive regulation is internally contradictory and difficult, but the political pressure for such schemes continues strong.

3. Price Caps

The main new form of incentive regulation has been the price cap. The rate-base regulation of profits, price levels and price structures -- with related restraints on inefficiency and investment -- is replaced by loose limits on the rates of rise in the averages of the whole set of prices.

Equity is abandoned as a goal, while static efficiency is installed as the exclusive goal. Price structures may be slightly constrained, but they too become largely a matter of regulatory inaction.

Therefore, although it is presented as merely a neutral, scientific improvement, incentive regulation actually involves decisive shifts among the social values sought by public policies. It also involves judgments about such complex conditions as how much the regulators know, or could know; what their powers and skills are; what

the effects are from many alternative regulatory methods; and how well the incentive structures can be designed and applied in practice. The judgments have often been arbitrary and unsupported, and they have often been influenced by special interests.

Price caps have been promoted aggressively, with promises that they fully solve the incentive problem. AT&T in particular has advocated price caps in scores of state and federal hearings, and they suit AT&T's interests. Versions of price caps have been adopted in several important settings, especially long-distance telephone service.

The idea was first developed, given its name, and applied in Britain in the early 1980s (Littlechild, 1983). Various British government officials declared their determination to avoid the great harms of American-style rate-of-return regulation, as they described it. A number of public-enterprise monopolies were being privatized -- notably British Telecomm (the telephone system), National Bus (the intercity bus system), and British Gas (the natural gas system) -- and their monopoly power posed difficult policy choices. The officials removed formal barriers to entry, and contestability theorists asserted that this would enforce competitive behavior. To avert the remaining danger of monopoly, "price caps" were advocated and applied.

The outcomes have been mixed, with large elements of failure.[3] Competition has been weak, with little new entry and with weak effects on the old monopolists. The dominant firms have earned high profit rates, and they have used strategic pin-point pricing to prevent new entry.

Yet the price caps has been heavily promoted in the U.S., and they have been adopted by various state commissions and the FCC. They are reported to be applied passively by the FCC. Even so, the method has turned out to be more complicated than its proponents originally promised.

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[3] For an excellent review of many of the specific features of price caps, and of the experience with applying them in the U.K. and the U.S., see Raymond W. Lawton and Kenneth Rose, 1992.

4. General Properties and Problems of Price Caps

The need is to constrain three dimensions of prices:

1. preventing average prices from being set too high,
2. preventing specific prices to consumer groups from being set too high, exploiting their inelasticity of demand, and
3. preventing pin-point price cuts against specific rivals from going too low.

To be justified, price caps must provide protections in both directions, and they must do it more effectively than conventional regulation.

A price cap simply limits the firm's average price increases to the rise of the consumer price index, minus a factor to reflect productivity gains. The formula is:

Permitted rate of price rise	=	Rate of rise of general price index	-	x

where X is the expected rate of change in costs; it squeezes the firm a little to make it be efficient and innovative. The cap also usually involves a band or range, such as 5 percent either way, per year; individual price changes are supposed to stay within that band. Finally, individual services are usually grouped into separate "baskets" (by customer types, inelasticities, degrees of competition, etc.), for different treatments.

In principle, price caps apply a maximum company-wide cost-sharing ratio, applying strong incentives for efficiency. They also permit flexibility, as the firm makes efficient adjustments in production and pricing. The logic leans heavily on the Ramsey pricing rationale: price discrimination is permitted because it is supposedly efficient.

But there are important defects in the price-cap approach.

1. Ramsey Prices. To take Ramsey pricing first, its logic is valid only when there is a natural monopoly with marginal costs below average costs. Yet natural monopolies are generally the cases not covered by price caps. Instead, price caps are commonly applied to dominant firms supposedly evolving toward effective competition.

In that setting, price discrimination is not justified on efficiency grounds. Price discrimination may instead function mainly as a strategic weapon, in the form of pin-point pricing designed to remove or intimidate specific smaller rivals.

2. Initial prices. The formula's basis accepts the current prices that exist under regulation, constraining only the additional changes in them. Yet some or all of the utility's prices may already be at inefficient and/or unfair levels, particularly if prior regulation is as defective as price-cap advocates claim. The firm may have elements of X-inefficiency; the utility's overall profits may be too high or low; and specific prices may fit unfair and/or anti-competitive discriminatory patterns. Rather than examine and seek to correct these possible deviations, a price cap may ignore them and build them in as permanent conditions.

The other defects arise more specifically in the elements of the price-cap formula.

3. The Index of Costs. The consumer price index is inappropriate as a basis for changing the firm's prices. It is merely a broad indicator of general price trends, and so it is irrelevant to this firm's costs. Instead, a specific index reflecting price trends in the utility's inputs is needed. But such an index is complex to construct and adapt, as the weights among inputs change over time.[4]

If the price cap will apply only to some of the firm's outputs, then the task is virtually impossible. Overhead costs cannot usually be assigned by clear economic criteria, and the firm can often adjust its accounting costs enough to negate the constraints.

4. The Trend of Technology. The technology element, the "X factor," also poses notoriously difficult problems. The correct size of the "X factor" is largely guesswork, requiring debatable judgments about the rate of future technical progress in the industry. How much would autonomous, naturally-occurring progress reduce future costs? Objective criteria are often lacking.

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[4] The literature of public utility economics and regulation from 1900 to 1960 contains extensive discussion of these cost-indexing problems, as standard textbooks note: see especially Kahn, *The Economics of Regulation, op. cit.*. The current price-cap theorists have simply ignored that whole literature, while choosing the wrong index.

If X is guessed wrong, in either direction, there can be harmful effects.

1. A too-low X will give the firm high profits with little effort; that removes the incentives. It also forces the regulators to intervene to raise X, but that may be impossible because they no longer collect adequate information.

2. If X is too high, the firm will soon demand an adjustment; that violates the idea that the formula can be left to run by itself. It will also require extensive information, which the regulators do not possess.

Nonetheless, price-cap experiments have gone ahead with sheer rough guesses about the X factor.

Accordingly, price caps require much of the same detailed attention to costs that established regulation has provided. In addition, it requires judgments about technological trends which current regulation is largely able to avoid.

5. The "Baskets" of Services. Most price-cap experiments have tried to define "monopoly" and "competitive" services. The "monopoly" services are price-capped, while the "competitive" services are freed of all constraints.

Unfortunately, the definitions are often poorly done. Theories of free entry are used to declare monopoly services to be actually competitive. Amateurish judgments are made, based solely on (1) the numbers of firms, without distinguishing between large market shares and trivial fringe firms, (2) "available substitutes," with dubious judgments about the degree of substitutability, and (3) the claimed irrelevance of dominant market shares, and the like.

Many states now apply lists of "competitive" and "non-competitive" services, which may in fact wrongly classify the services. If the trend toward competition is overwhelming, the errors may not matter. But if dominance can be retained, while entry is not actually free, then the policies may ratify and perpetuate ineffective competition.

To sum up on price caps: these devices to not alter regulatory reality. They may be weaker and more illusory than conventional regulation. Price caps are appropriate when (1) the outputs are few and simple, (2) reliable cost indexes can be constructed (with little overhead costs shared among capped and uncapped outputs), and (3) the rate of future technological progress is known.

If instead, outputs are numerous and complex, overhead costs are large, and the dominant firm uses extensive pinpoint pricing, then price caps are particularly dubious.

4. Other Incentive Devices

I have noted above some of Joskow and Schmalensee's (1986) specific criticisms of incentive schemes in electric power. Those points apply generally; electricity is perhaps the easiest sector to try incentive devices, and yet they do not work well even there.

Two main criticisms are most relevant. One, the schemes are not self-policing and automatic, able to be set in motion and then run unattended. Instead, the results need to be monitored, and maladjustments need to be corrected. If the resulting profits are too high or too low, the regulators will need to measure that, design adjustments and then intervene to make the corrections. The idea of objective, automatic systems is an illusion.

Second, the devices apply to narrow measures of productivity, and so they do not give general, unbiased incentives for efficiency. If they try to give general incentives, they tend to be little more than the established regulation-with-lag approach.

Chapter V

POLICY LESSONS

Historically, each set of regulated firms has asserted that their industries are too "dynamic" and rapidly-changing to permit "rigid" and slow regulation to interfere with their progress and efficiency. It is true that formal regulation had in the 1950s grown stodgy and stately and often passive. Economists noted correctly after 1960 that such regulation might encourage higher levels of costs and investment. Moreover, regulation (like any human institution) may be manipulated and distorted so as to yield inefficient effects. And regulation of U.S. transportation industries generally did raise serious questions of inefficiency.

But that did not necessarily show that actual regulation in electricity and telephone service was ineffective or harmful. The issue is much more complicated. Counterforces favoring efficiency were at work, and the regulators could take deliberate actions to prevent any inefficiencies. In practice, regulation involved significant amounts of regulatory lag, and therefore it raised the profit-sharing coefficient. Those results in turn generally promoted efficiency in the utilities.

This study has noted a series of such points, many of them important. They argue against the regulation-bashing that became popular after 1975. The inefficiencies of traditional regulation have not been unambiguously large. Section II found that the empirical evidence about them suggests only mild effects. And regulation has provided substantial other benefits.

Despite the recent hyperbolic claims, the traditional regulation of natural monopolies has not been shown to impose large efficiency costs. If regulation does carry risks, they may apply to isolated cases of where regulators are woefully uninformed and the firm is determined to be wasteful. Such cases have probably not existed since the 1960s, if they ever did exist.

When one compares regulation more carefully with the alternatives, as we did in Chapters 3 and 4, regulation's harms to efficiency seem relatively even smaller.

Chapter 3 showed that premature deregulation may lead to entrenched market dominance, rather than to effective competition. Such market dominance will erode efficiency, innovation and fairness, possibly more strongly than inept regulation would do.

Chapter 4 indicated that "incentive regulation" (especially the "price caps" versions of it) may have biases of its own and be difficult to apply. And even when it is performed well, incentive regulation may require regulatory efforts and information that are at least as great as those under traditional regulation. Far from an easy, simple solution, incentive regulation may be more arduous and fallible than traditional regulation.

Therefore it is important to avoid jumping to quick deregulation when competition begins to set in. Premature deregulation is the great danger. Only if the underlying natural-monopoly conditions are being fully replaced by natural competition (with room for at least 5 strong, comparable rivals) is it prudent to remove most regulation. Even then, the efficiency gains may be only moderate. If market power remains, then there may be losses of all three goals: efficiency, innovation and equity.

This picture contrasts with the strong 1980s rhetoric of deregulation. The expansive claims about enormous harms from "rigid" and "obsolete" regulation have had little basis in scientific fact. If there have been large harms in the electric and telephone-service industries, they have not yet been demonstrated. Of course some transportation industries had been ripe for deregulation, and some of them were indeed deregulated with reasonable success.[1] But those were not classic natural-monopoly regulation, and they are irrelevant to such cases as electricity and telephone service.

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[1] But airline competition was eroded by post-1984 pricing methods and airline mergers, so that by 1988 concentration was higher than before deregulation. And trucking deregulation has led to dominance of much of the industry by three large trucking firms: Yellow Freight, Consolidated Freightways, and Roadway.

Therefore, no general case has been made for strict deregulation, particularly if it will permit market dominance to remain. On balance, well-functioning regulation probably continues to deliver net gains in natural-monopoly cases.

Efficiency can be promoted in a number of specific ways. Regulatory lag can be managed so as to apply incentives for efficiency. And regulators can also apply familiar direct measures to promote efficiency and innovation. Regulators have learned to be more proficient in making regulation function well. The 1980s search for a mechanical, automatic method of "incentive regulation" was largely illusory. In complex situations, there is no easy substitute for sophisticated, effective regulation.

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