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## Price-Cap Regulation: The British Water Industry

### Price-Cap versus Cost-of-Service Regulation

Price-cap regulation, which is often called incentive regulation, had become the dominant form of discretionary regulation by the end of the twentieth century. Price cap was developed by the British when they began privatizing their utilities in the 1980s, although it has its roots in related incentive schemes that regulators have experimented with since the nineteenth century. Many U.S. and European regulatory agencies have adopted some of the elements of price cap, and price cap is the most common alternative to concession contracts in developing countries, particularly for industries such as telecommunications or electricity, where it is difficult to draft a complete contract.<sup>1</sup>

Price cap was designed as an alternative to the cost-of-service approach practiced at the time by most regulatory agencies in the United States. Cost-of-service regulation is often called rate-of-return regulation. Under this approach, the regulator sets prices so that the firm can cover reasonable costs, including a fair rate of return on its investments.

The British academics and officials who designed price cap believed that cost-of-service regulation provided few efficiency incentives, since a company that cut its costs risked seeing its tariffs cut commensurately. Price cap addresses this shortcoming by conducting price reviews at fixed intervals, usually every five years, and by setting a formula to “cap” the annual price increases allowed between reviews. The typical formula is  $RPI - X$ , where RPI is the change in the retail price index and X is the expected rate of productivity improvement in the industry. The commitment to a five-year price cap motivates efficiency improvements because a firm can increase its profits by cutting costs between reviews.

In effect, price cap is a hybrid of the discretionary and contractual approaches to regulation, and it is the contractual elements that are central to its efficiency incentives. Price cap is usually thought of as a form of discretion-

ary regulation, since the regulator has substantial latitude to reset initial prices and the  $X$  at each periodic review. Price-cap regulators also typically enjoy the protections from political pressure associated with discretionary regulation, such as appointments to fixed terms. But the regulatory statute or the company license usually prohibits the regulator from changing  $X$  between reviews. Moreover, there is an implicit understanding that the regulator will not try to claw back excess profits or restore losses from the previous review period when he sets initial prices and  $X$  for the coming period. The regulator considers past profitability only to estimate the prices the industry needs to attract capital in the coming review period. But changing  $X$  between reviews, or setting  $X$  so as to recoup past profits or losses, would undermine the scheme's incentives.

Price cap is widely credited with strengthening the efficiency incentives of regulation. The incentives are limited to improvements that pay back in a single review period, and review periods longer than five years are rare because of the economic and political risks of committing to an  $X$  for distant years. This means that the regulator must encourage long-lived improvements by other means, such as enforcing related quality standards or mandating specific investment programs. Price cap also introduces opportunities for the firm to mislead the regulator by, for example, delaying the implementation of efficiency improvements until just after a price review. Even with these limitations, most observers regard the efficiency features of price cap as a major advance over cost-of-service regulation.

Empirical studies tend to support the argument that price cap should improve efficiency, although so far most of the evidence is restricted to telephone companies in the United States. The United States provides a natural laboratory for comparing regulatory regimes, since some of the fifty state public utility commissions shifted to price-cap regulation during the 1980s and 1990s while others continued to use the cost-of-service approach. Most studies show that telephone companies in states using price-cap regulation charge lower basic rates and install more modern, cost-saving equipment than companies in states with cost-of-service regulation. The reported differences are often modest and may not apply in other industries or contexts, but they are consistent with the efficiency incentives expected from price cap.<sup>2</sup>

Price cap has been less successful, however, in solving other problems associated with cost-of-service regulation. The designers of price cap had hoped that it would reduce the risk of regulatory capture and the heavy procedural burdens often placed on utilities and regulators. Capture would be less likely because the firms would have incentives to reveal their true costs between reviews, so that the regulator would be less dependent on the industry for information. The procedural burdens would be reduced by holding price

reviews only every five years (instead of when the industry or customers requested) and by not mandating the extensive public hearings, opportunities for testimony, and the other time-consuming procedures that had developed under U.S. cost-of-service regulation.

In essence, price cap's designers hoped that the prospect of long-term efficiency gains would reduce the need for the time-consuming and intrusive regulatory procedures found in the United States. The genius of price cap was that it didn't matter, at least in theory, that the regulator could never know as much as the industry did as long as the industry was motivated to improve efficiency. The regulator would set  $X$  for the coming five years as best he could, and the firms would try their hardest to find efficiency gains. The industry might make excess profits in some review periods and losses in others. But over the long run costs would decline, leaving consumers much better off than they would have been under a stagnant cost-of-service regime.

At least in Britain, however, price cap has evolved to include cumbersome fact-finding and consultative procedures similar to those found in the United States. The basic reason is that while setting  $X$  reasonably accurately may not matter much in theory, it matters a lot in politics. If  $X$  is set too low and the utilities earn high profits, consumers may not understand that they are still better off in the long run than they would have been with cost-of-service regulation. The price-cap "contract" that the regulator establishes every five years must anticipate what will happen reasonably well, or the political pressure to break the contract will build quickly. Intensive fact-finding and consultation helps both by reducing the likely errors and by making it clear that the errors that do occur were not caused by a lack of concern or effort on the regulator's part. In short, the British found themselves forced to adopt burdensome regulatory procedures in order to maintain political support for the efficiency incentives of price cap.

The experience of the British water industry illustrates the evolution of price-cap regulation. The water regulator was among the first British regulators to recognize the political benefits of the fact-finding and consultative procedures now common in the price-cap approach.

### **The Privatization of British Utilities and the Origins of Price Cap**

Britain's Conservative Party came to power in 1979 with a mandate to revive the British economy by improving the efficiency of public services and reducing the size of the state. Beginning under Margaret Thatcher (prime minister, 1979–1990) and continuing under John Major (prime minister, 1990–1997), the Conservatives privatized many industries that had been nationalized since World War II. The government began with companies that

operated in competitive industries, such as Jaguar, British Steel, and British Airways. But it soon tackled infrastructure industries thought to have elements of natural monopoly, beginning with telecommunications in 1984 and going on to airports and gas in 1986, water in 1989, electricity in 1990, and railroads in 1994.<sup>3</sup>

The government's 1982 announcement of its intention to privatize British Telecommunications (BT) triggered a debate about how best to regulate private utilities. It was clear that competition in telephony would be limited for some time. The government had licensed Mercury to compete with BT that same year, but Mercury was obviously handicapped by BT's overwhelming lead in subscribers. And in 1983, in an effort to increase the chances for a successful flotation of BT stock, the government committed to not licensing any more fixed-line providers until the end of the decade.

The Department of Industry officials working on BT's privatization were leaning toward a form of cost-of-service regulation that they called "maximum rate of return" (or MRR). But British academics and government officials were painfully aware of the situation in the United States, where criticism of regulation had recently led to the deregulation of the airline and railroad industries and to calls for the breakup of AT&T.<sup>4</sup> Professor Alan Walters, a senior economic advisor to the prime minister, proposed an alternative scheme, which he called the "output-related profit levy" (OPRL), in which BT's allowed profits would depend upon how much it increased outputs. The Department of Industry hired a second professor, Stephen C. Littlechild, to review the alternatives, and Littlechild came up with the plan for price cap.

There were precedents for many of the elements in Littlechild's proposal.<sup>5</sup> Previous schemes had built in incentives for efficiency improvements, the best-known example being the "sliding-scale" concession contracts popular in Britain and the United States in the late nineteenth and early twentieth centuries. Sliding-scale contracts usually did not limit profits or dividends; instead they required that the firm share a portion of its profits over certain levels with customers in the form of price reductions. The sliding scale established weaker efficiency incentives than price cap, however, since excess profits were effectively taxed by the requirement to share them with customers.<sup>6</sup> A closer precedent for price cap lay in the observation by U.S. scholars that it often took regulators several years to respond to cost reductions by reducing prices, and that this "regulatory lag" provided an incentive for firms to cut costs. In 1967 William Baumol, a well-known U.S. regulatory economist, had proposed mandating a three-year regulatory lag to encourage efficiency improvements.<sup>7</sup>

The idea of regulating the average price of a representative basket of prod-

ucts instead of the prices for individual products also had been proposed earlier. Economists had realized in the 1920s that the pricing strategies of a profit-maximizing monopolist and a social-welfare-maximizing public enterprise were similar when the public enterprise faced a budget constraint that forced it to price above marginal cost.<sup>8</sup> Both the monopolist and the public enterprise would charge the highest markups over cost for products or services with the least elastic demand and the smallest markups for products or services with elastic demand. Thus it was safe to use the average price to control a monopolist's profits, since the monopolist would realize that average through the same pattern of markups as a public enterprise would.

Nevertheless, Littlechild is universally credited with bringing these elements together in a persuasive and comprehensive proposal. Littlechild called his plan the "local tariff reduction" scheme, because it applied only to tariffs for local service, where BT had an effective monopoly, and not to tariffs for long-distance service, where the potential for competition was strong. He compared price cap, as the local tariff reduction scheme was known, and the alternatives (including no regulation) on five criteria: protection against monopoly pricing, incentives for efficiency and innovation, regulatory burden, potential to promote competition, and the ease of selling BT (see Table 9.1). Littlechild argued that the MRR or ORPL schemes might be worse than al-

**Table 9.1** Littlechild's ratings for alternative regulatory schemes for telecommunications

Criteria	No explicit controls on prices	MRR (maximum rate of return)	ORPL (output-related profit levy)	Local tariff reduction scheme (price cap)
Protection against monopoly	4	3	2	1
Efficiency and innovation	1 =	3 =	3 =	1 =
Burden of regulation	1	4	3	2
Promotion of competition	1	4	3	2
Prospects for sale of BT	1 =	3	4	1 =

*Source:* Stephen C. Littlechild, *Regulation of British Telecommunications' Profitability* (London: Department of Industry, 1983), p. 2.

*Note:* The "=" indicates a rating equivalent to that of another scheme. Littlechild evaluated five schemes in his original report, and ranked the schemes from 1 to 5 with 1 being the best and 5 being the worst. One of the schemes that involved a ceiling on profits has been omitted here because of its similarity to MRR, and the scale of the rankings has been changed to 1 to 4. BT—British Telecommunications, the state-owned telephony company that was to be privatized.

lowing BT to charge whatever it pleased: “with respect to all criteria except the protection against monopoly, both schemes are significantly worse than the absence of constraints. Moreover, [given the potential for capture,] it is not clear that either MRR or ORPL provides adequate protection [against monopoly] in the longer run. In both cases, the ‘cure’ seems to be worse than the ‘disease.’”<sup>9</sup> The local tariff reduction scheme, by contrast, combined strong protection against monopoly with strong incentives for innovation and a modest regulatory burden.

Littlechild devoted little attention in his report to the process by which the X should be set, saying only that the initial X should be negotiated between BT and the Department of Industry.<sup>10</sup> He did not worry much about reset-

**Table 9.2** Regulatory agencies and regulators in Britain, 1984–2002

Industry	Year privatized <sup>a</sup>	Regulatory agency	Regulators
Telecoms	1984	Office of Telecommunications (Ofotel)	Bryan Carsberg (1984–1992) Bill Wigglesworth (acting, 1992–1993) Don Cruickshank (1993–1998) David Edmonds (1998– )
Gas	1986	Office of Gas Supply (Ofgas) and Ofgem after 1998 <sup>b</sup>	James McKinnon (1986–1993) Claire Spottiswoode (1993–1998)
Airports	1986	Civil Aviation Authority (CAA)	Commission <sup>c</sup>
Electricity	1989	Office of Electricity Regulation (Offer) and Ofgem after 1998 <sup>b</sup>	Stephen Littlechild (1989–1998)
Water	1990	Office of Water Services (Ofwat)	Ian Byatt (1989–2000) Philip Fletcher (2000– )
Railroads	1995	Office of the Rail Regulator (ORR)	John Swift (1994–1998) Chris Bolt (acting, 1998–1999) Tom Winsor (1999– )
Gas and electricity	— <sup>b</sup>	Office of Gas and Electricity Management (Ofgem)	Callum McCarthy (1999–2000) Commission (after 2000)

a. The year when the first companies were sold to private investors.

b. The gas and electricity industries were privatized in 1986 and 1989, respectively, but the two regulatory agencies were given the same regulator as of January 1, 1999. The agencies were later consolidated into Ofgem, and in 2000 Ofgem was reorganized to be governed by a commission.

c. The Civil Aviation Authority was established in 1986 with a commission rather than a single regulator.

ting X because he hoped that increased competition would soon make regulation unnecessary. As Littlechild explained: “Competition is indisputably the most effective—perhaps ultimately the *only* effective means—of protecting consumers against monopoly power. Regulation is essentially . . . a means of ‘holding the fort’ until competition arrives.”<sup>11</sup> The local tariff reduction scheme would help promote entry and competition, Littlechild argued, since it applied only to the prices of BT’s monopoly services.<sup>12</sup>

The British went on to use price cap for all the utilities they privatized in the 1980s and 1990s, adapting it in various ways to the requirements of each industry. For the electricity distribution companies, for example, the formula became known as  $RPI - X + Y$ , where Y was a measure of the change in wholesale electricity prices. The Y was added to allow the distribution companies to pass on wholesale price increases, on the theory that the companies should not be vulnerable to key input prices they could not control. Littlechild himself was asked to adapt the price cap scheme to the water industry in 1986, and was appointed as the first regulator of the privatized electricity industry in 1990.

Price cap evolved in slightly different ways in each industry, both because of the different economic problems they faced and because of the varying strategies and personalities of their regulators. Britain chose to have a separate regulatory agency for each industry, although the gas and electricity regulatory agencies were combined in 1999 (see Table 9.2). The regulatory agency for the water industry was called the Office of Water Services, or Ofwat for short. Initially, most agencies were headed by a single regulator rather than by a commission and given a relatively small staff, apparently on the theory that price cap required less work. More regulators and staff might encourage unnecessary meddling. The regulators were appointed to fixed terms.<sup>13</sup> Their decisions could be appealed to the antitrust authority, which was called the Monopolies and Mergers Commission until 1998, when it was renamed the Competition Commission.

## The Design of Price Cap for the Water Industry

### *The Industry before Privatization*

Water and sewage companies first appeared in Britain during the nineteenth century.<sup>14</sup> Most sewage companies began as municipal enterprises, but the early water companies included private as well as public firms. During the mid-twentieth century, the water companies consolidated to gain the advantages of economies of scale in water collection and treatment, and by the early 1970s there were only 198 water companies, including 101 that were

cooperative ventures of two or more local governments and thirty-three private firms. Sewage escaped consolidation, however, so that in the early 1970s there were still over 1,300 different sewage companies with only a few owned jointly by more than one local government.

Growing environmental awareness soon forced a further consolidation of the industry. In 1965 the government created twenty-nine river authorities to be responsible for, among other things, the control of water pollution and extraction in their river basins. The division of responsibility between the water and sewage companies and the river authorities came to be seen as a problem, however, and in 1973 the government established ten regional water authorities in England and Wales to consolidate the control of all water uses for each region in a single body. The new water authorities absorbed both the river authorities and the municipally owned water and sewage companies, but the private water companies remained independent. Three years earlier, the government had created a Department of the Environment to supervise the development and enforcement of environmental policies and standards. Within the department, the Drinking Water Inspectorate (DWI) was responsible for setting and monitoring standards for drinking water.

In 1986 the government decided to privatize the water industry because of the enormous investments needed to bring it up to modern standards. The water authorities had been starved for capital for years in an effort to hold down public sector borrowing. This policy could not be sustained, however, once the European Commission (EC) began to establish strict standards for the quality of drinking water, coastal and bathing waters, and urban wastewater treatment.<sup>15</sup> The government saw privatization as a way to meet the new EC standards without raising public debt and taxes. If the industry were in private hands, the needed investments could be financed by private debt and equity and repaid through a combination of efficiency improvements and higher water prices.

### *The Privatization Proposal*

The government's proposal to privatize water was highly controversial, because water service seemed so basic and so clearly a natural monopoly. Initially, the government proposed to privatize the ten water authorities in their existing form, maintaining their responsibilities for regulating river water quality and water extraction as well as for supplying drinking water and treating sewage.<sup>16</sup> Environmentalists were outraged about the potential conflict between regulatory and commercial responsibilities, while British industry feared that it would be left at the mercy of ten private companies with complete control over all the water sources and sewage disposal options in their territories. In 1987 the government modified its proposal to include a new

National Rivers Authority that would assume the water authorities' regulatory functions when they were privatized. The National Rivers Authority was later absorbed by a new Environment Agency created to consolidate the pollution enforcement functions of the Department of the Environment.

Littlechild's report on how to regulate the water industry was released at the same time as the government's privatization white paper.<sup>17</sup> Littlechild noted that water was more clearly a natural monopoly than any industry the government had privatized to date, and there was little prospect that technological innovation would change that fact.<sup>18</sup> The water privatization forced Littlechild to adapt his price cap scheme so that it would work over a long term.

The key problem for Littlechild was how to reset  $X$  at each review without undermining price cap's efficiency incentives. It was clear that the regulator could not consider the regulated firm's past performance directly—he needed an independent yardstick that was outside the direct control of each company but still reflected actual or best practice in the industry. In this respect, Littlechild explained, water enjoyed a key advantage over the previously privatized utilities, because there were ten separate water and sewage authorities instead of just one.  $X$  could be based not on each individual firm's performance but on the average for the industry as a whole, so that each firm would always have an incentive to beat the average.

When the government finally privatized the water authorities, it decided it was easier to leave the existing private water companies, whose numbers had dwindled to 29, as separate firms rather than merge them with the ten regional water and sewage authorities. The Water Act of 1989 outlined the basic terms of the privatization, including the system for setting future prices for both the new and the existing private companies.<sup>19</sup> For water the  $RPI - X$  formula was changed to  $RPI + K$ , where  $K$  was expected to be positive to pay for the capital investments needed in water and sewage treatment. The regulator would set  $K$  for ten-year periods, although he would have the option of reviewing the  $K$ 's every five years. The Department of the Environment announced the investment program that would be expected and the price increases that would be allowed for each company over the first ten-year period, from fiscal year 1990/91 through fiscal year 1999/00.

The government was fearful that the water authorities could not be sold, or that, once sold, they might not be able to finance the investments required. To reduce these risks, the government strengthened the authorities' balance sheets by writing off more than £5 billion of their debts and injecting just over £1 billion in cash into the authorities with the biggest investment burdens.<sup>20</sup> Thanks to this so-called green dowry, shares in the ten new private water companies were successfully floated in 1989.

Ian Byatt was appointed the first water industry regulator in 1989 and

eventually served two full terms, stepping down in the summer of 2000 and being knighted for his service. Byatt was an economist who had spent most of his career in the government, rising to become the deputy to the Chief Economic Advisor of the Treasury. He had been involved in trying to improve the performance of nationalized industries and later in preparing the plans to privatize them, and he was fascinated by the opportunity to regulate a privatized water industry.

Byatt presided over two reviews of water industry prices. The first, in 1994, demonstrated the political benefits of a more open and consultative regulatory process. The second, in 1999, reinforced the point by demonstrating the difficulty of defending a regulator's decisions on purely technical grounds.

### The 1994 Price Review and the Benefits of Consultation

#### *Byatt's Strategy*

Byatt adopted a more open and consultative approach than that of other early British utility regulators not just because of his background in government service but also because of the pressure on water prices from stricter environmental standards. In telecoms and gas (and later in electricity and railroads), regulators expected prices to decline in real terms because of the incentives to improve efficiency. But in water, the investment needs were so great that prices were expected to increase rather than decrease.

The price caps set by the Department of the Environment before privatization called for K's averaging over 5 percent per year for the industry as a whole, and much higher for companies with unusual environmental burdens. The coastal and bathing water standards were particularly onerous, especially for a company like South West Water, whose territory had a small year-round population but much of the nation's coastline and many beaches and summer visitors. The government also expected the EC to issue new standards and tighten existing ones in the near future. As a result, the water companies' licenses included provisions to allow the regulator to make "interim determinations" by adjusting the K's between price reviews if either environmental standards or unit construction costs changed from expected levels.

The Department of the Environment had little incentive to resist tighter standards, because the funding no longer came from its budget and the department's primary constituency was environmentalists rather than water consumers. The companies were also enthusiastic about building new water and sewage treatment plants, because they thought they could build the plants for less than the department's estimates and because the new plants would be added to their regulated asset base for the purposes of calculating

future prices. The share prices of the water companies had been rising since flotation, moreover, indicating that investors were beginning to think that the government had been too lenient in setting the initial K's.

In this context Byatt believed that his constituency had to be the consumers, since no one else seemed to be looking out for their interests, and that he needed to ensure that they understood the difficult choices he might have to make.<sup>21</sup> Accordingly, Ofwat developed the practice of issuing consultation documents to solicit the views of affected parties in advance of decisions, and policy reports to explain the decisions once made. Moreover, Ofwat made a major effort to improve the quality of its data and analysis and to open both to public comment, so that its decisions would have strong analytic support.

Through this process, Byatt developed a framework for explaining the basic dilemma facing water customers, water companies, and environmental regulators:

There are in effect two elements in the K factors in the RPI + K formula adopted for water—an X element, relating to usual utility operations, and a Q element, relating to mandatory improvements in quality and the environment (that is, RPI – X + Q). If overall objectives of customers are to be achieved, these elements are not interdependent. The bigger the scale of obligations under the Q element, the more severe the downward pressure must be on the output components of the X element if price increases are to be affordable.<sup>22</sup>

Byatt also argued that customers' bills should list separate charges for water and sewage, with no cross-subsidies between them. Separate charges were necessary because some consumers got their water and sewage services from different companies, but they were also desirable if customers were to understand the causes of the price increases, which were mainly on the sewage side. The strategy was self-consciously political; as Byatt would later explain, "If a regulator expects to be politically independent, then he had better adopt some of the habits of politicians."<sup>23</sup>

### *The 1994 Price Review*

Byatt soon decided that he should exercise his option to review water prices for the second five-year period (from fiscal year 1995/96 through fiscal year 1999/00), because of the continuing rise in water company stock prices and the changes in the environmental standards. The review, announced in August 1991, had to be completed by the end of 1994, since the 1995/96 fiscal year started on April 1, 1995.<sup>24</sup>

To lay the groundwork, Ofwat issued several additional series of consulta-

tion documents. One series was addressed primarily to the investment community, and dealt with the cost and value of capital, important issues in setting utility rates.<sup>25</sup> Byatt argued that the 7 percent real post-tax cost of capital the government had assumed in its 1989 price determinations was too high, and that water utilities were an inherently low-risk business that might justify a post-tax return closer to 5 or 6 percent.

Another series of documents was addressed primarily to policymakers at the Department of the Environment. In the initial paper, provocatively titled “The Cost of Quality,” Byatt laid out the implications of different environmental standards for customer prices and asked the environmental regulators to make explicit the standards they expected to apply.<sup>26</sup> After the Department of the Environment responded, Byatt released a second report outlining the costs of the new standards and asking the secretary of state for the environment to reconsider.<sup>27</sup>

Other Ofwat reports considered the issue of setting X, the rate of productivity improvement that could be expected in the industry. Littlechild’s original idea had been to set X on the basis of the average rate of cost reduction for the industry as a whole. Byatt thought that the target should be tougher than the industry average. If he were to set tougher targets, moreover, then he had to recognize that the cost-saving opportunities might vary among the companies because of local circumstances beyond their control, such as low population density or difficult topography.

The solution was to identify the most efficient water company by using statistical methods to adjust the companies’ costs for relevant local circumstances. The efficient firm’s performance then could be used as a benchmark for the others. Benchmark analyses would not tell the regulator how much more efficient the best firm could become, but it would tell him how much the other firms could improve just by catching up. The Department of the Environment had done a crude benchmark analysis when setting the water companies’ original K factors in 1989. But Ofwat went further by trying to make sure that the data submitted by the companies were comparable, applying more sophisticated statistical techniques, and then circulating the results to the industry for comment.<sup>28</sup>

The desire to maintain benchmark competition also led Ofwat to oppose many mergers in the water industry. The Water Act of 1989 had anticipated the problem by requiring that the Monopolies and Mergers Commission review all mergers involving water companies with assets of over £30 million. In a series of cases beginning in 1990, Ofwat proposed, and the commission agreed, that mergers should be allowed only if the merged firm committed to price reductions that were substantial enough to justify the loss in the number of comparators for the benchmark analyses. In practice this meant that

mergers between water and sewage companies were prohibited, since ten was already a very small number of comparators. Fourteen water-only companies were allowed to disappear, however, most through merger with other water-only companies and some through acquisition by a water and sewage company.

The Water Act of 1989 had established ten regional Customer Service Committees, and Ofwat developed them as vehicles for soliciting consumer views. Byatt thought special efforts were necessary, because water consumers had fewer vehicles for expressing their preferences than the customers of other utilities. Water meters were rare in Britain, so the water bill for most households was based on the value of their property. Thus a water customer could not economize by consuming less or choose among different packages of services in the way a telephone or gas customer could. Ofwat and the Customer Service Committees surveyed consumers about their problems, discovering, for example, that avoiding the occasional sewage backup and flooding was a more important priority for consumers than it appeared to be for the companies.

Byatt's goal for the 1994 review had been to reduce the K factor to 0, which would have provided substantial relief after years of real annual price increases averaging over 5 percent for the industry as whole and over 10 percent for some companies. In the end he was able to reduce the average K to +1.5. Although the Department of the Environment had delayed the implementation of some standards, environmental and capacity improvements were expected to add £47 to the average annual household bill of £201 over the next ten years. Greater operating efficiency and reduced capital costs would cut £24 from the average bill, however, so the net increase would be only £23.<sup>29</sup>

### *Dividends and Drought*

In the year that followed, it gradually became clear that Byatt could have set the K's even lower. Only two companies appealed Byatt's decision to the Monopolies and Mergers Commission, and the commission eventually issued rulings essentially upholding Ofwat and even tightening the prices slightly.<sup>30</sup> A clearer sign came in the fall of 1994, when other companies began to announce special dividends for stockholders. Stockholders had been pressing for dividends in part because many water companies had embarked on unsuccessful diversification programs. Those that invested far afield—in electric companies and hotels, for example—had fared badly. But even the companies that had gone into closely related businesses—such as bidding for foreign water concessions—were having trouble with their new investments. In addi-

tion, the Labour Party was running strongly in the polls, raising fears that it might win the next general election, which had to be scheduled before the summer of 1997. Labour was making an issue of the high profits in the privatized utilities, and there was talk of a tougher regulatory environment if Labour won. The stockholders wanted some of their earnings returned before they were lost to poor investments or a new government. And the scale of the special dividends—over £500 million between the summers of 1994 and 1995 alone—made it clear how profitable the water companies had become.

As if these difficulties were not enough, Britain suffered from a drought in 1995–1996 that exposed weaknesses in some water companies. The most serious problems were with Yorkshire Water, which had to go to significant lengths—including tankering in water—to maintain essential supplies for some of its customers. But many other companies were forced to impose bans on outside water use, and public outrage grew when critics pointed out that some of the companies lost as much as 40 percent of their water to leaks compared with standards of 15 percent for large cities in the United States. The industry thought the comparison unfair, because losses were primarily a function of the kilometers of mains rather than the amount of water consumed. British water systems were bound to have higher percentage losses, the industry argued, because they were more rural and thus had more kilometers of main per customer or liter consumed. Right or wrong, the popular impression was that the water companies had chosen to pocket big profits instead of making the investments that might have avoided the shortages.

The government also faced growing pressure from large industrial water users who wanted to avoid price increases by contracting with alternative bulk water suppliers. Electricity had been restructured to allow large consumers to buy directly from independent generators, so why not water? The original privatization bills had allowed independent water companies to serve users within an incumbent company's territory if the user was at least 30 meters away from the incumbent's mains or consumed at least 250 megaliters a day.<sup>31</sup> This provision was rarely used, so in 1996 the Department of the Environment and Ofwat reduced the threshold for independent supply to 100 megaliters per day and proposed rules to require that the water companies make their pipes available for transportation of water from independent suppliers to their customers for reasonable fees.<sup>32</sup> The number of industrial consumers purchasing from independent water suppliers increased only slightly over the next several years, but the threat encouraged water companies to offer more discounts for bulk water buyers.<sup>33</sup>

Despite the problems, Ian Byatt was still regarded as one of Britain's best utility regulators. Others had fared worse in recent price reviews, most spectacularly Stephen Littlechild, who was then serving as the electricity regula-

tor. Littlechild had released the results of the first periodic review of electricity prices in August 1994, three weeks after Byatt had announced the new water prices. In the months that followed, two dramatic takeover fights provided graphic proof of the electric companies' large profits. Littlechild had cut tariffs by 11 to 17 percent, but industry insiders claimed that he could have made cuts of up to 25 percent if he had asked the right questions.<sup>34</sup> In March 1995, just before his new tariffs were to go into effect, Littlechild responded by ordering further price reductions. The new price caps earned him cheers from consumers but a storm of criticism from the electricity industry and from academic economists, concerned that he was undermining the incentive system that he had designed.

It is conceivable that Byatt's underestimate of the potential for price cuts was greater than Littlechild's, although comparisons of this type are difficult. Certainly both were surprised by large increases in the value of their companies. Moreover, Byatt had a drought to contend with while Littlechild did not. But Byatt's underestimate seemed to be more quickly forgiven because he had tried so obviously to conduct a comprehensive review.<sup>35</sup> Littlechild, by comparison, had issued only one major consultation paper during the course of his review, and the other regulators had also been relatively secretive up until that point. The lesson of the 1994 reviews was not lost on the other regulators, who adopted a more open and consultative process in the coming years.

In May 1997 Tony Blair led the Labour Party to victory in a general election, ending eighteen years of Conservative Party rule. High utility earnings had been an important theme in the Labour campaign, and in July the new government imposed a onetime £5 billion "windfall" tax on utility profits. The water industry's share was £1.8 billion.

The new government commissioned a review of the system for regulating private utilities that resulted in proposals to keep the system pretty much intact but with an added emphasis on consultation, transparency, and protecting low-income consumers. The most striking change was a proposal to gradually move from individual regulators to small commissions for each sector. The study explained, "there are risks in concentrating too much discretion on an individual," especially those of "unpredictable and unaccountable decision making."<sup>36</sup> In addition, regulators were to establish and publicize their consultation procedures and to explain their decisions in writing, much as Byatt had done.

The government had decided to merge gas and electricity into a single energy regulatory authority, and it took the opportunity to try out a commission in that sector. For water, however, there were few major changes. The Competition Act of 1998 obligated the water regulator to not just "facili-

tate” but also “promote” competition, a change that stimulated Ofwat to investigate ways to further encourage competition for bulk water customers. And in the Water Industry Act of 1999, the government increased protections for residential customers by requiring that meters be optional, that meter installation be free, that Ofwat develop tariffs to protect “vulnerable groups” of customers that might face hardship from being charged by meter, and that companies not shut off households who had not paid their water bill.

### The 1999 Review and the Limits of Technical Analysis

#### *The Methodology for Estimating X*

Byatt had been reappointed to a second term in 1995, before the Labour victory, which ensured that he would supervise the second periodic review to be completed in 1999 (in time to apply to prices in fiscal years 2000/01 through 2004/05). Ofwat used the same process as in the 1994 review, releasing a series of consultation papers on the key issues. If anything, however, Byatt wanted to be more thorough, because this time he hoped to give consumers a rate reduction while still funding environmental improvements.

One key battle was over Ofwat’s estimate of  $X$ , the expected rate of productivity improvement. Other disputes—over the cost of capital or environmental goals, for example—would affect the final tariffs as much or more. But the estimates of  $X$  came to illustrate the limits of technical analyses in price reviews. Ofwat’s  $X$  had a “catch-up” and a “frontier” component.<sup>37</sup> The first was the scope for the less efficient companies to catch up to their most efficient peers; the second was the scope for the most efficient companies to improve their performance further.

The possibilities for catch-up were estimated through benchmark analysis. Ofwat had applied the technique only to operating expenditures in the 1994 review, but in the 1999 review the agency benchmarked capital maintenance and construction activities as well, important additions since those activities accounted for roughly half of water industry costs. Ofwat also adjusted the variables used in its analysis to reflect changes in the industry and improve the accuracy of the cost models. The 1994 analysis had used operating cost per unit of water *supplied* as a key efficiency measure, for example, but the 1999 analysis switched to cost per unit of water *delivered* to reflect the increased attention to leakage since the 1995–1996 drought.

Ofwat’s analysis of water operating costs was in many ways typical. Reported operating costs in 1997–1998 varied by a factor of two, from 25 pence per cubic meter at the cheapest firm to 52 pence per cubic meter at the

most expensive. Once adjustment was made for local conditions beyond the firms' control, however, the gap between the most efficient and the least efficient firm was reduced to 30 percent. Ofwat made these adjustments by dividing operating costs into four components and estimating a separate equation for each. The equations were fairly simple, using at most two explanatory variables as shown in Table 9.3. For example, water distribution costs per capita were assumed to be a function of only one variable: the proportion of water mains that were over 0.3 meters in diameter. In the case of a few companies, however, Ofwat would make additional adjustments to compensate for variables not included in the equations, such as unusually high wage costs and contaminated water supplies (which affected London area companies) or unusual water softening requirements.<sup>38</sup> Ofwat used the analysis to sort water companies into five "bands," from most efficient (A) to least (E). A company might be classified in band A for one cost category and in band D for another, and its overall catch-up target was based on its weighted average rating.

The equations used in the benchmark analyses were a source of great controversy. The industry complained that the equations were too simplistic and that some made no sense at all. The water distribution equation implied that the companies could cut costs by installing two small mains instead of one large one, for example, while the industry's experience was exactly the opposite.

Ofwat responded that it had to keep the equations simple because the data set was small. The agency had (at the time) only twenty-eight water companies and ten sewage companies to compare.<sup>39</sup> Ofwat also preferred to use data only from the most recent year, because it felt the rapid improvements in the industry made older data misleading. The small number of observations meant that Ofwat could include only a few carefully picked explanatory variables. In the water distribution model, for example, the agency had chosen the percentage of mains over 0.3 meters in diameter as a proxy for the degree of urbanization. Urbanization was the single most important factor affecting water distribution costs, Ofwat argued, and the alternative measures, such as the population density of the service area, disguised important differences among the companies.<sup>40</sup>

Ofwat was reasonably responsive to industry comments about the specifications of the equations and changed the models when it thought the criticisms valid. But in the end it had a fair amount of latitude, because there was little consensus within the industry as to what the best equations might be. Each company wanted to include variables that made it look good, but the variables that favored one company often disadvantaged others.

Estimating the frontier component of X was no easier. Since the basic for-

**Table 9.3** Water service operating expenditure equations used in the 1999 review

Dependent variable	Coefficient and (standard error)	Explanatory variable	Number of observations and $R^2$
<i>Water resources and treatment cost model</i>			
Cost per capita	+0.866 (+1.23)	Constant	Obs = 28 $R^2 = 0.50$
	+17.16 (+3.82)	Number of water sources/total water distribution input	
	+6.72 (+1.43)	Proportion of supplies derived from river sources	
<i>Water distribution cost model</i>			
Natural log of cost per capita	-5.13 (-0.11)	Constant	Obs = 28 $R^2 = 0.39$
	+4.74 (+1.21)	Proportion of mains over 0.3 meters in diameter	
<i>Water service power cost model</i>			
Natural log of costs	-8.97 (-0.25)	Constant	Obs = 28 $R^2 = 0.985$
	+0.94 (+0.02)	Natural log of (total water distribution input $\times$ average pumping head)	
<i>Business activities cost model</i>			
Natural log of costs	-4.15 (-0.25)	Constant	Obs = 28 $R^2 = 0.96$
	+0.97 (+0.04)	Natural log of number of billed properties	

Source: Ofwat, "Efficiency Assessments: Econometric Models," directive RD 2/99, Birmingham, January 15, 1999, pp. 2–5.

Note: Based on data from the 1997–98 fiscal year. "Water distribution" is the term Ofwat uses for the amount of water put into the distribution network. The amount of water actually delivered to customers is the water distribution input less leakage, water used to flush mains or for other operational purposes, and water taken illegally.

mula was  $RPI - X$ , the key issue was whether the best-performing water companies could improve more rapidly than the best companies in other industries. If they could, the frontier component of  $X$  would be negative. If not, it would be zero or positive. The usual approach was to estimate the potential for improvement at the best water companies from trends in real costs per unit of output in other industries thought to be comparable. But there

was plenty of scope for disagreement about how real unit costs should be measured, over what periods of time, and for which comparator industries.

In the 1999 review, for example, consultants to Ofwat and the water industry produced conflicting estimates of the frontier component of X. Ofwat's consultants argued the component should be roughly  $-1.4$  percent per year based on analyses of three groups of comparators: private unregulated industries, private regulated utilities, and the water industry itself.<sup>41</sup> For the first analysis, the consultants divided the water industry into nine functional areas and found from one to three comparable private industries for each area. The trends in real unit operating costs in those industries averaged approximately  $-1$  percent per year. The consultants went on to argue that one comparator—the extraction and refining industry—should be thrown out because it was adversely affected by the depletion of natural resources, and with that industry out the trends in unit costs were  $-1.8$  to  $-2.7$  percent per year. The second analysis considered other privatized industries in Britain, where real unit costs had declined by 2.5 to 3 percent per year in many cases, and by as much as 3.9 percent per year in a few industries (electricity distribution and transmission). Finally, Ofwat's consultants estimated that the most efficient water company had reduced its real unit costs by 1.4 percent per year from 1992 to 1998. Assuming that roughly half the decline in unit costs observed in the first two analyses was due to catch up and half to pushing the efficiency frontier, the consultants argued that all three analyses pointed to a frontier cost reduction of 1.4 percent per year.

The largest company in the industry, Thames Water, hired the same consultants that Ofwat had employed to analyze efficiency issues in the earlier 1994 price review, and they estimated that the frontier component of X should be a reduction of only 0.2 percent per year for the coming five-year period.<sup>42</sup> Thames Water's consultants selected a set of comparator industries that had not performed as well as those picked by Ofwat's consultants. They also argued that it was important to decompose the trend in unit cost into the trends of its four components: real wages, labor productivity, real materials prices, and materials productivity. Materials prices paid by the water industry were projected to increase from 2000 to 2005, the consultants argued, offsetting part of the expected gains in materials productivity and reducing the expected savings in unit costs.

### *Ofwat's Decision and the Appeals*

Late in 1999, Ofwat announced that the average K for the next five years would be  $-2.1$  percent per year, which meant that the prices consumers paid would fall for the first time since privatization. Part of the savings came be-

cause the Department of the Environment was persuaded to delay some of the more costly quality improvements. The industry still would be required to make £15.6 billion in new investments over the next five years, however, which Ofwat projected would add £30 to the average annual household bill of £248. Price reductions were possible because Ofwat projected that the industry could cut its annual costs by £60 per household over the five-year period, allowing a £30 saving on the average annual bill.<sup>43</sup>

The bulk of the cost savings came from Ofwat's estimates of the catch-up and frontier efficiency gains.<sup>44</sup> In the case of water operating costs, for example, Ofwat stood by its consultants' estimate of a frontier efficiency gain of 1.4 percent per year for all companies and set the average catch-up targets at between 0 and 3.5 percent per year depending on the efficiency of the firm, as shown in Table 9.4. The expected savings in capital maintenance and for sewage operating costs were comparable, and for new capital improvements and their maintenance Ofwat expected an even more aggressive frontier gain of 2.1 percent per year. Instead of spreading the catch-up cost savings over ten years, as he had done in the 1994 review, Byatt took all of them in the first year. Thus while the K's averaged  $-2.1$  over five years, real prices would decline by 12.3 percent in the first year, followed by a further reduction of 0.4 percent in the second year and gradual increases of 0.1, 1.1 and 1.4 percent in the three years that followed (see Table 9.5).

Investors thought that Byatt's targets would be difficult to achieve, and

**Table 9.4** Ofwat's operating efficiency targets for 2001–2005

Percentage efficiency gap	Efficiency band	Number of companies in band	Average annual improvement (in percent)		
			Frontier efficiency savings	Catch-up efficiency target	Total efficiency target
<0	A	2	1.4	0.0	1.4
0–5	A/B	7	1.4	0.3	1.7
5–10	B	7	1.4	0.9	2.3
10–15	B/C	3	1.4	1.5	2.9
15–20	C	3	1.4	2.2	3.6
20–25	C/D	2	1.4	2.9	4.3
25–30	D	2	1.4	3.5	4.9
>30	D/E	0	1.4	5.6	7.0

*Source:* Competition Commission, *Sutton and East Surrey Water plc: A Report on the References under Sections 12 and 14 of the Water Industry Act 1991* (London: Stationery Office, August 2000), p. 265.

**Table 9.5** Average K factors set in the 1989, 1994, and 1999 periodic reviews

Periodic review and fiscal year	Water and sewage companies	Water-only companies	Entire water industry
<i>Department of the Environment review, 1989</i>			
1990/91	+5.4	+11.4	+6.3
1991/92	+5.4	+10.2	+6.1
1992/93	+5.4	+6.7	+5.6
1993/94	+5.2	+4.9	+5.1
1994/95	+5.2	+3.3	+4.9
<i>Ofwat review, 1994</i>			
1995/96	+1.5	+0.6	+1.4
1996/97	+1.5	+0.6	+1.4
1997/98	+1.5	+0.6	+1.4
1998/99	+1.5	+0.6	+1.4
1999/00	+1.5	+0.6	+1.4
<i>Ofwat review, 1999</i>			
2000/01	-12.3	-12.4	-12.3
2001/02	-0.4	-0.6	-0.4
2002/03	-0.2	-0.1	-0.1
2003/04	+1.3	0.0	+1.1
2004/05	+1.7	0.0	+1.5

*Sources:* The figures from the 1989 reviews for the water and sewage and the water-only companies are simple (unweighted) averages from Mark Armstrong, Simon Cowan, and John Vickers, *Regulatory Reform: Economic Analysis and British Experience* (Cambridge: MIT Press, 1994), pp. 337–338. The figures from the 1989 review for the entire industry are from the same source and assume that the water-only companies make up 15 percent of the industry. The 1994 review figures are from Ofwat, *Future Charges for Water and Sewerage Services: The Outcome of the Periodic Review* (Birmingham: Ofwat, July 1994), pp. 5–6. The 1999 review figures are from Ofwat, *Future Water and Sewerage Charges: Final Determinations* (Birmingham: Ofwat, November 1999), pp. 15, 41–66.

water company shares fell by 30 percent relative to the stock market average.<sup>45</sup> Some environmentalists were almost as unhappy as the companies, feeling that Byatt had bullied the Department of the Environment into making too many concessions, and that a minister had aided Byatt by publicly announcing that he expected water rates to decline. During 2000, the Environmental Audit Committee of Parliament held extensive hearings on the 1999 review and issued a report concluding that:

Ministers should respect the role of the independent regulator, Ofwat, to determine price limits and not influence customer and consumer expectations by publicly announcing its own price expectations. In turn, the Committee recommends that Ofwat seeks to insure that its own statements do not “demonise” environmental and quality investment by

portraying it as the key upward pressure on prices without equally emphasising the customer and public health benefits that it delivers.<sup>46</sup>

But for the first time Ofwat was also criticized on technical grounds by the Competition Commission. Only two small water companies appealed to the commission, reportedly because the other firms did not want to alarm their investors further. The commission explained in its ruling that it approved of Ofwat's basic approach to most issues, but pointed out that there was still substantial room for disagreement about the details, and thus about the results. In particular, where Ofwat had called for price reductions of 21.3 percent over five years for one company and 19.5 percent for the other, the commission ordered reductions of only 13.5 percent and 15.3 percent.<sup>47</sup>

The estimates of  $X$  for operating expenses were a central issue in the appeals, and the commission's views were typical of those it held on other issues. On the estimates of the catch-up component, for example, the commission rejected the argument of one company that statistical analyses of comparators should not be considered because the analyses could never fully capture the differences in local conditions. The commission was intrigued, however, when the second company, Mid Kent Water, presented an alternative statistical model that showed that it was far more efficient than Ofwat's models suggested. Mid Kent's model, shown in Table 9.6, explained 99 percent of the variation in operating costs among companies by estimating a single equation for all operating expenses with six years of data (instead of Ofwat's approach of estimating four separate equations with one year of data each). Ofwat's consultants responded that it was easy to explain most of the variance in total operating expenses simply by including a measure of company size as an explanatory variable. To make their point they presented a model, also shown in Table 9.6, which explained 98 percent of the variance in operating expenses by using the number of billed properties as the only explanatory variable.

Instead of discrediting Mid Kent Water's model, the new Ofwat model seemed to cast doubt on the whole science of benchmarking. Almost any statistical model—no matter how simplistic—could explain a good deal of the variance. How then could one choose among models that had plausible specifications but implied very different  $X$ 's? In the end, the commission decided that both Ofwat's original model and the Mid Kent alternative had merit.<sup>48</sup> The commission concluded, however, that the exercise had demonstrated the need to weigh evidence from many sources since no single statistical model was clearly superior to all others.<sup>49</sup>

The commission reached similar conclusions about the estimates of the frontier component of  $X$ . The commission worried that estimates based on

**Table 9.6** Water service operating expenditure equations presented to the Competition Commission

Dependent variable	Coefficient and (standard error)	Explanatory variable	Number of observations and $R^2$
<i>Mid Kent Water's proposed model</i>			
Natural log of costs (£ millions at 1997/98 price levels)	-2.63 ( <sup>a</sup> )	Constant	Obs = 156 $R^2 = 0.99$
	+0.704 ( <sup>a</sup> )	Natural log of total water delivered (millions of liters/day)	
	+0.269 ( <sup>a</sup> )	Natural log of total length of mains (kilometers)	
	-0.982 ( <sup>a</sup> )	Proportion of water delivered to metered nonhouseholds	
	-0.022 ( <sup>a</sup> )	Dummy for observation in 1993/94	
	-0.0685 ( <sup>a</sup> )	Dummy for observation in 1994/95	
	-0.111 ( <sup>a</sup> )	Dummy for observation in 1995/96	
	-0.130 ( <sup>a</sup> )	Dummy for observation in 1996/97	
	-0.137 ( <sup>a</sup> )	Dummy for observation in 1997/98	
<i>Ofwat's example in response to Mid Kent</i>			
Natural log of cost (£ millions)	-2.6279 (-0.0285)	Constant	Obs = 28 $R^2 = 0.98$
	+0.9612 (+0.1764)	Natural log of number of billed properties (thousands)	

Source: Competition Commission, *Mid Kent Water plc: A Report on the References under Sections 12 and 14 of the Water Industry Act 1991* (London: Stationery Office, August 2000), pp. 266–267.

a. The Competition Commission did not report the standard errors on the Mid Kent model, but it did say that the standard errors were small relative to the estimated coefficients for all variables except the dummy for 1993/94 year.

trends in water or other recently privatized industries might be misleading, particularly if productivity had been neglected when the industries were publicly owned. If so, the pace of improvement might slow in the future, becoming more similar to that found in other industries that had always been in the private sector. But the commission also recognized that it was not obvious what alternative private sector comparators to use, so that the range of plausible estimates might be fairly broad.<sup>50</sup>

Ian Byatt finished his second term as the water regulator in July 2000, the

month before the Competition Commission's report on the appeals was released. Byatt had not sought reappointment, and the government named Philip Fletcher, another longtime senior civil servant, as his successor.

The controversy over Byatt's last price review waned a bit in Fletcher's first years in office, as the industry seemed to grow a bit more confident about its ability to live within the new price caps and stock prices began to recover. Nevertheless, in 2001 Fletcher approved a novel, and many thought risky, application of one company to shift to nonprofit status and use all-debt financing so as to reduce financing costs and make it easier to live within the price caps.<sup>51</sup> And in 2002 a review of price-cap regulation in gas, water, electricity, and telecoms by Britain's comptroller and auditor general praised Ofwat for its efforts to monitor service quality and to assess shortage risks, but singled out Ofwat's 1999 review as an example of one that might have been too tight.<sup>52</sup>

## The Record of Price-Cap Regulation

### *Strengths*

Overall, price cap has to be judged a great success, primarily because of its stronger incentives to improve efficiency. It is difficult to determine how much of the productivity gains achieved by British utilities in the last twenty years were due to price-cap regulation and how much to the fact that the utilities were recently privatized. Nevertheless, the British utilities posted efficiency gains of 3 to 9 percent per year through the 1990s, an impressive record by any standard.<sup>53</sup> Water prices rose but only because of environmental improvements—the increases would have been much larger without the offsetting gains in efficiency. And it is unlikely that the cost savings would have been as great had these industries been privatized with conventional cost-of-service regulation.

The incentives to improve efficiency seem to have survived despite the government's occasional renegeing on the explicit and implicit commitments that are central to them. Littlechild's March 1995 lowering of the electricity price caps for 1995–2000 was not illegal, since the price caps were not scheduled to go into effect until April 1.<sup>54</sup> But he had announced the “final” price caps the previous August, so the industry had reason to argue that he had broken faith. The windfall profits tax imposed by the incoming Labour government in 1997 was justified as a onetime event, provoked by the extraordinary circumstances surrounding privatization. But it was clearly the type of regulatory claw back that, if expected, would undermine incentives to reduce costs. In addition, some water company officials argued privately that Byatt had

been tough in his 1999 review because he wanted to “get even” for 1994, so that the 1999 review amounted to something of a claw back too. Nevertheless, most utility executives probably believe that events like Littlechild’s 1995 reversal or the 1997 windfall profits tax will prove to be relatively rare. And even if they now expect an occasional element of claw back in the periodic reviews, they probably don’t expect all the excess profits to be taken so that the efficiency incentives are weakened but not eliminated.

### *Limitations*

Price cap has proved less successful in providing incentives for capital investment, although in this respect cost-of-service regulation has its drawbacks too. With cost-of-service regulation, the traditional concern is that the regulated firm might overinvest. A regulator is likely to err on the side of overestimating the return the firm needs to earn on its invested capital, since an error in the other direction would leave the firm unable to raise money for new investments. But an overly generous return will give the firm incentives to “gold plate” its investments, so as to expand the asset base on which the return applies. As a result, cost-of-service regulators often must review the investments the firm proposes to make sure that they are really needed.<sup>55</sup>

With price-cap regulation, by contrast, the incentives are usually to underinvest. One reason is that price cap does not encourage efficiency improvements that have payback periods longer than the interval between price reviews. Indeed, firms are unlikely even to make improvements with short paybacks as the review date approaches, since by delaying until after the review they will capture the savings as profit longer. Firms will make improvements with long payback periods only if they are convinced that the regulators will recognize them as worthwhile investments and enter them into the regulated asset base to be recovered in future review prices.

A second reason for underinvestment is that price cap gives the firms incentives to cut back on investment programs agreed to with the regulators. The price-cap formula for the coming review period covers the regulator’s assessment of investment needs as well as operating costs. But many types of infrastructure are so durable and resilient that underinvestment does not result in a clear or immediate decline in the service quality or performance. In such cases, the firm will be tempted to cut back on the investment program and pocket the savings as profit. Price-cap regulators are usually forced to monitor the firm’s current investments to make sure that any underspend is due to efficiencies in investment rather than to a shirking of commitments. Controversies over underspend have been particularly intense in Britain’s railways, as discussed in Chapter 11.

It is hard to say whether the risk of overinvesting is worse than the risk of underinvesting. One might argue that price cap is less attractive for developing countries, for example, since their utilities often need substantial investments. But the importance of investment must be balanced against that of increased operating efficiency and of avoiding capture, which makes such generalizations difficult.

Price cap also seems to have failed to significantly reduce the burden of regulatory proceedings. It is true that prices are reviewed only once every five years under price cap, whereas reviews are generally more frequent in cost-of-service regulation. Because the reviews are less frequent, however, the stakes for each review are higher. As a result, most British regulatory agencies follow procedures roughly similar to those used by Byatt in his 1994 and 1999 reviews. The reviews begin three years before the end of the current review period, so that an industry is more often in the midst of a review than not. The regulatory staff develops a series of consultation documents about the overall framework and key issues in the review on which the companies and consumer groups usually feel compelled to comment, often with the aid of consultants. The companies submit business plans that explain their investment programs and their special circumstances, which the regulatory staff scrutinize and discuss with them. The result is reviews that are process-intensive, and intrusive—a far cry from the streamlined approach Littlechild seemed to have in mind in 1983.

These cumbersome procedures have evolved because setting price caps has proved to be both harder and more important than originally expected. Much of the attention has focused on the problems of forecasting  $X$  reasonably accurately. Even in the British water industry, with its relatively large number of companies, it is hard to standardize for differences across companies so as to make accurate estimates of catch-up efficiency. And these difficulties are not likely to decline significantly with more sophisticated statistical techniques.<sup>56</sup> There will always be room for argument, given that a variety of very different but plausible cost models can be estimated from the available data. Estimating the frontier efficiency gains is even harder, given the uncertainties about extrapolating from past trends and selecting comparator industries.  $X$  is not the only ingredient needed to set price caps, moreover, and there are comparable difficulties with the cost of capital and other elements.<sup>57</sup> In short, the technical analysis is seldom sufficiently precise or certain to provide the agency with adequate political protection.

The hope that efficiency incentives would make it less important to set  $X$  reasonably accurately has been disappointed, at least in part. The central insight of price cap was that excess profits or losses were tolerable, and even desirable, in the short run because they encouraged innovation and price reduc-

tions in the long run. But five years has proved to be a long time for the public to endure profits that they regard as excessive. And while Britain has not experienced it yet, five years would probably also prove to be a long time for the companies or their consumers to endure returns so low that the industry could not attract capital. Shortening the period between reviews would reduce the political and economic damage from setting price caps that were badly wrong, but a shorter period would also reduce the strength and scope of the efficiency and investment incentives as well. In sum, the fact- and process-intensive regulatory procedures are a compromise that seems to be essential to preserving the popular commitment to a price cap.

One question raised by this compromise, but still unresolved, is whether the evolving procedures will also subject price-cap regulation to greater risks of capture. Littlechild feared that the regulator might be captured by the companies, because the companies had more information. An equally troubling possibility is that the consultation- and fact-intensive process adopted may ultimately make it harder for the regulator to adapt to new challenges or changing circumstances.

Such a preference for the status quo, even at the expense of the long-term health of the industry, has characterized the telephone, railroad, airline, and other regulatory agencies in the United States at various points in their lives, particularly when beset by strong and conflicting pressures. Britain's water industry seems subject to similar risks, for example, inasmuch as the companies, residential consumers, industrial consumers, and environmentalists all have distinct and intensely felt concerns. Factual investigations narrow the scope for debate somewhat, but still leave plenty of room for disagreement. Consultation makes it easier for the varied interests to be heard and, it is hoped, strengthens their understanding and support for the regulatory system. But whether the processes will make it easier or harder for the regulator to make difficult choices remains to be seen.

In the end, the burden of intrusive regulatory procedures and the risk of capture seem unavoidable with discretionary regulation. Discretionary regulators can find some refuge in purely technical analysis but, as the Competition Commission pointed out, the technical analysis is seldom conclusive. In democracies, discretionary regulation seems to require the extensive factual investigations and consultation found in Britain and the United States. And it is arguably better to take the risk of capture with price cap than with cost-of-service regulation, especially where efficiency incentives are important.