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Water utility regulation: issues and options for Latin America and the Caribbean*

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Summary

Since the eighties, for a variety of reasons — some budgetary, some political/ideological, some technological, some arising from pressures from abroad, and some grounded in economic theory — the governments of Latin American and Caribbean countries have been transferring many publicly-owned companies to the private sector. Such transfers have been especially marked in manufacturing and other competitive industries as well as in energy and telecommunications, but privatisation has extended now to almost all sectors of the economy, including the provision of water supply and sewerage services.

Privatisation is often presented as a panacea for the failure of many publicly-owned water utilities to operate efficiently and make the investments required to meet community needs. The water supply and sewerage industry is, however, a classic case of a local natural monopoly. It is perhaps the most monopolistic of all public utility industries and, as such, is uniquely resistant to most forms of competition. Direct market competition in the provision of water supply and sewerage services within a given region would entail inefficient, wasteful and prohibitively costly duplication of the network of water mains and sewers. In addition, any such competition would be short-lived, because it will lead to the bankruptcy of the rivals and the consolidation of the monopoly.

Private ownership does not make the natural monopoly problem go away. Simply converting a publicly-owned monopoly into a privately-owned one provides few, if any, incentives to reduce costs, innovate, invest at the efficient level, and respond to consumer demands. The principal reason for this is that the normal forces of competition which operate to regulate prices, service quality, etc. in competitive industries do not operate in the water supply and sewerage industry. The argument that once poorly operated and money-losing publicly-owned water utilities are privatised, performance improvement will automatically occur, is therefore a gross over-simplification of the problem. In industries with natural monopoly characteristics, incentives for allocative and productive efficiency depend critically upon the regulatory framework adopted.

Natural monopoly regulation includes structure regulation, which is concerned with the way in which a market is organised (e.g., entry restrictions and measures of functional separation), and conduct regulation, which is concerned with behaviour within the market (e.g., price regulation, service quality regulation and investment regulation). The former determines which economic agents or types thereof are allowed to engage in which activities, and the latter determines the permitted behaviour of economic agents in their chosen activity or activities. Although in some cases structure regulation and conduct regulation are alternatives to one another, to be effective, the regulation of natural monopolies usually requires a combination of the two.

The issues to be confronted and options to be considered in developing an adequate regulatory framework for the water supply and sewerage industry in Latin American and Caribbean countries are the subject of this paper. It reviews a vast body of recent theoretical and empirical literature on economic regulation and private sector participation, including the experience of the countries where privatisation and regulatory reforms have advanced most and its applicability to the countries of Latin America and the Caribbean. Emphasis is given to the implications of the asymmetry of information between regulator and regulated utilities as well as to the regulation of prices, service quality, investments, and diversification. The possible underinvestment problem arising from the limited commitment powers of governments and regulators, and the implications of the existence of separate regulators with different duties and powers are also discussed, as are the possibilities of introducing competition and facilitating regulation through horizontal and vertical restructuring.

Introduction

Economic theory presents convincing evidence that under specific conditions competition is a very powerful and effective force which directs privately motivated actions to socially desirable outcomes and ensures that markets automatically achieve economic efficiency and maximise social welfare. These conditions are generally referred to as conditions of perfect competition. Under these conditions, the forces of competition ensure that: (i) economic agents produce all outputs at the minimum cost (productive efficiency); and (ii) these outputs are available to consumers at prices which accurately reflect these minimum costs (allocative efficiency).

Overall, an inconclusive, albeit growing, body of evidence suggests that privatisation of industries operating in competitive markets free from substantial market failures leads on the whole to significant efficiency gains. For example, a recent survey of empirical studies on privatisation world-wide concluded that: "The weight of academic research is now decidedly in favor of the proposition that privately-owned firms are more efficient and more profitable than otherwise-comparable state-owned firms ... Little doubt now remains that privatization 'works', in the sense that divested firms almost always become more efficient, more profitable, increase their capital investment spending, and become financially healthier. Both single-country, single-industry and multi-national, multi-industry empirical studies document significant (often dramatic) performance improvements" (Megginson and Netter, 1999).

The water supply and sewerage industry is, however, a classic case of a local natural monopoly. A natural monopoly is an industry where, by virtue of its inherent technical characteristics, total costs of production are lower when a single service provider produces the entire industry output than any collection of two or more service providers divide the total among themselves, thus making entry unprofitable and making it efficient for there to be a single service provider within a given geographical area. The water industry is perhaps the most monopolistic of all public utility services and, as such, is uniquely resistant to direct market competition.

Direct market competition in the provision of water supply and sewerage services within a given region would entail inefficient, wasteful and prohibitively costly duplication of the network of water mains and sewers. In addition, any such competition would be short-lived, because it will lead to the bankruptcy of the rivals and the consolidation of the monopoly. This conclusion is supported by empirical evidence. Initially, in the nineteenth century, service providers laid competing water pipeline systems in many towns in a number of countries, for example Canada and the United Kingdom (Klein, 1996b). Even though duplicative systems came into being, "the nature of the competition was ruinous and short lived" (Swartwout, 1992). As it is usually efficient to have just one network of

water mains and sewers, "the competing networks of the nineteenth century soon turned into monopolies" (Klein and Irwin, 1996). So history "seems to indicate that, when such industries function in a competitive mode, they tend to return to or toward monopolistic operation" (Swartwout, 1992).

Privatisation is often presented as a panacea for the failure of many publicly-owned water utilities to operate efficiently and make the investments required to meet community needs. Private ownership does not, however, make the natural monopoly problem go away. Simply converting a publicly-owned monopoly into a privately-owned one provides few, if any, incentives to reduce costs, innovate, invest at the efficient level, and respond to consumer demands. The principal reason for this is that the normal forces of competition which operate to regulate prices, service quality, etc. in competitive industries do not operate in the water supply and sewerage industry. The argument that once poorly operated and money-losing publicly-owned water utilities are privatised, performance improvement will automatically occur, is therefore a gross over-simplification of the problem (see Box 1).

A free market will fail to provide an economically efficient outcome when a natural monopoly exists, because there will be no competition to regulate the behaviour of the monopoly in the interest of society. Monopolies, whether natural or not, usually yield lower productive and allocative efficiency than companies operating in competitive industries.

On the one hand, where competition is not possible and consumers have no alternative sources of supply if the service is poor or the price is high, a monopoly will try to maximise its profits. It can do this by charging monopoly prices, arbitrarily reducing service quality, under-investing relative to the efficient level, and discriminating against customers with inelastic demands for its products and services. In the words of Adam Smith (1776), "The price of monopoly is upon every occasion the highest which can be got. The ... price of free competition, on the contrary, is the lowest which can be taken ... The one is upon every occasion the highest which can be squeezed out of the buyers, ... the other is the lowest which the sellers can commonly afford to take, and at the same time continue their business". Welfare losses from monopoly prices can be expected to be especially high in the water supply and sewerage industry because these services have extremely low price elasticity of demand: "the more inelastic the demand ... the more the profit maximizer will raise prices ... Lower elasticities generate greater maximum potential allocative losses from monopoly" (Jones, 1993).

On the other hand, because the threat of entry by rivals is absent or insignificant, incentives for cost reduction and innovation are diminished. With no threat of competition from rivals, monopolies, whether privately- or publicly-owned, usually prefer a quite life rather than having to make a constant effort to reduce costs, innovate and improve efficiency. As a result, a monopoly does not normally operate at the greatest possible level of efficiency, rather it tends to permit a considerable degree of sloth and slack in its organisation — inefficiently low levels of effort to improve performance and correspondingly high levels of leisure. As Adam Smith (1776) said, "Monopoly ... is a great enemy to good management, which can never be universally established but in consequence of that free and universal competition which forces everybody to have recourse to it for the sake of self-defence". It is important to note that empirical studies

Box 1

Efficiency and ownership in the water supply and sewerage industry: empirical evidence

It is frequently argued that the private sector is more efficient then the public sector. For many the term "private" is synonymous with efficiency and innovation, and the term "public" with waste and incompetence. Although there are many theoretical and practical arguments that suggest that privately-owned water utilities should be more efficient than their publicly-owned counterparts, the few available empirical studies provide conflicting evidence on the effect of type of ownership on efficiency. These studies provide an indirect test of the trade-off between two sources of inefficiency in publicly-owned and privately-owned water utilities: (i) inefficiency from attenuation and non-transferability of property rights in publicly-owned utilities; and (ii) inefficiency from conflicts between the regulators' and the shareholders' goals in privately-owned utilities.

The United States

- *Mann* and *Mikesell* (1976) found that privately-owned water utilities had higher unit operating costs than their publicly-owned counterparts. Their analysis also indicated that capital investment in large publicly-owned utilities could result in diseconomies.
- *Morgan* (1977) found that privately-owned water utilities appeared to have a cost advantage over publicly-owned utilities.
- *Crain* and *Zardkoohi* (1978) found that, although privately-owned water utilities exhibited over-capitalisation (see page 44), they had higher degrees of economic efficiency and lower operating costs than their publicly-owned counterparts.
- *Bruggink* (1982) found that publicly-owned water utilities had lower operating costs and that ownership did not affect the structure of the cost or underlying production functions.
- *Feigenbaum* and *Teeples* (1983) found no significant difference in the relative efficiency of publicly-owned water utilities versus privately-owned utilities.
- *Byrnes*, *Grosskopf* and *Hayes* (1986) found no significant difference in efficiency across ownership types, and no evidence that publicly-owned water utilities were more wasteful or operated with more slack than privately-owned utilities.
- *Teeples*, *Feigenbaum* and *Glyer* (1986) found that cost performance of water utilities was very similar across all ownership forms.
- *Teeples* and *Glyer* (1987) found no overall efficiency differences by ownership type, and suggested that debate should be shifted to considerations of which type of ownership would be more efficient for given types of production environment.
- *Raffiee* et al. (1992) found that publicly-owned water utilities had a statistically significant higher cost for each litre of water delivered.
- *Lambert*, *Dichev* and *Raffiee* (1993) found that publicly-owned water utilities were more efficient overall, as well as in the technical efficiency associated with the employment of labour, capital, energy, and material inputs. However, neither publicly nor privately-owned utilities were found to exhibit a high degree of overall efficiency compared to the most efficient utilities within the sample.
- *Bhattacharyya*, *Parket* and *Raffiee* (1994) found that publicly-owned water utilities were more efficient than privately-owned utilities on average, but were more widely dispersed between best and worst practice.
- *Bhattacharyya* et al. (1995) found that both groups of water utilities were inefficient, but the average level of inefficiency of privately-owned utilities was higher than that of their publicly-owned counterparts. For the utilities operating at small production levels, private ownership was found to be more efficient than public ownership. On the other hand, publicly-owned utilities were found to be comparatively more efficient when producing a higher level of output. They conclude that, in the case of water supply industry, it appears that public ownership has "not resulted in any inferior process for water production as compared with private firms, perhaps because private utilities are relatively more burdened with the cost of regulation."

The United Kingdom

- *Lynk* (1993) found that the average level of inefficiency in the privately-owned water sector was substantially higher than that prevailing in the publicly-owned water sector in the period immediately preceding privatisation.
- *Shaoul* (1994) found that efficiency gains were largely achieved in the run-up to privatisation when the water industry was state-owned, and that efficiency levels were only in 1993 reaching those that had been obtained at privatisation.

Conclusion

The main conclusion that can be drawn from these studies is that, where utilities face little competition and are extensively regulated, "there is little empirical justification for a general presumption in favor of either type of ownership, and case-by-case evaluation of the various trade-offs is therefore in order" (Vickers and Yarrow, 1988). They "not only serve as a warning against over euphoric expectations about the possible achievements of privatisation but also show quite clearly that private-sector ownership or management is not necessarily the crucial determinant of future industry performance" (Rees, 1998).

Source: Bhattacharyya et al. (1995); Bhattacharyya, Parket and Raffiee (1994); Byrnes, Grosskopf and Hayes (1986); Feigenbaum and Teeples (1983); Lambert, Dichev and Raffiee (1993); Lynk (1993); Mann and Mikesell (1976); Rees (1998); Teeples and Glyer (1987); Teeples, Feigenbaum and Glyer (1986); Vickers and Yarrow (1988).

suggest that the relative inefficiency of publicly-owned enterprises stems largely from the isolation from effective competition rather than the public ownership per se (Caves and Christensen, 1980).

The main policy options open to governments regarding natural monopolies in public utility industries are two: public ownership, as has traditionally been the case in most countries, and regulation of privately-owned monopolies, as in the United States. If public ownership is abandoned, then government intervention in the form of regulation is necessary to provide the incentives for productive and allocative efficiency that competition cannot provide in this naturally monopolistic industry. The need for regulation is underlined by the fact that water utilities are suppliers of essential and indispensable services to society and industry, and their operation has wide-reaching economic and social effects, beyond those typical of most other economic activities. An appropriate regulatory framework must, therefore, be in place before private sector participation is introduced in the provision of water supply and sewerage services.

The purpose of regulation is to replicate the results that the competitive market system would achieve in the way of allocative and productive efficiency (Morin, 1994; Swartwout, 1992). This is known as the market surrogation principle. In industries exhibiting the characteristics of a natural monopoly, "the regulator acts as a substitute for the market, taking on some of the functions of a competitor" (Helm, 1994b), attempting to compel the regulated utility to behave in essentially the same way in which it would behave if free from regulation but subject to the market forces of competition. In these industries, incentives for allocative and productive efficiency depend critically upon the regulatory framework adopted.

One example is afforded by a recent study of the macroeconomic and distributional impacts of the privatisation of public utilities in Argentina. Chisari, Estache and Romero (1997) found that the gains from efficient regulation are non-trivial: while the gains from the private operation of utilities are about US$ 2.3 billion or 0.9% of GDP, effective regulation can save the economy an extra US$ 0.9 billion or 0.35% of GDP. They conclude that "ineffective regulation is equivalent to a 16% implicit tax on the average consumer paid directly to the owner of the utilities' assets ... How serious governments are about the fair distribution of gains of reform is revealed by how serious they are about regulation".

The development of effective regulatory frameworks remains a major challenge. A recent review of privatisation programmes world-wide found that "it is observed in cross-country studies that profitability increases more and productivity less in regulated or less competitive sectors. This shows that firms are exploiting, at least partially, their market power" (Sheshinski and López-Calva, 1998).

The shift from the reliance on public ownership and administrative control for the provision of water supply and sewerage services to the reliance on private participation and regulation completely changes the role of the state from being a producing state to that of a regulating state. It requires not only that the state withdraw from many activities but that it take on new ones, often of a very different nature and requiring different skills and knowledge on the part of public sector personnel. In public utility industries in general, and in the water supply and sewerage industry in particular, all the experiences show that

privatisation does not just stop with the transfer of assets, but requires continuing regulatory action. The design of effective regulatory frameworks for the water supply and sewerage industry is the subject of this paper.

I. Regulation and information

A. Modes of regulation

The purpose of regulation is to replicate the results that the competitive market system would achieve in the way of allocative and productive efficiency (Morin, 1994; Swartwout, 1992). This is known as the market surrogation principle. In industries exhibiting the characteristics of a natural monopoly, "the regulator acts as a substitute for the market, taking on some of the functions of a competitor" (Helm, 1994b), attempting to compel the regulated utility to behave in essentially the same way in which it would behave if free from regulation but subject to the market forces of competition. In these industries, incentives for allocative and productive efficiency depend critically upon the regulatory framework adopted.

Although the distinction between them is not always clear-cut, it is useful to distinguish between two broad modes of regulation: structure regulation, which is concerned with the way in which a market is organised (e.g., entry restrictions and measures of functional separation), and conduct regulation, which is concerned with behaviour within the market (e.g., price regulation, service quality regulation and investment regulation) (Kay and Vickers, 1988). In other words, the former determines which economic agents or types thereof are allowed to engage in which activities, and the latter determines the permitted behaviour of economic agents in their chosen activity or activities (Vickers, 1991). Thus, conduct regulation exercises direct control over the objectives of the regulated utility, while structure regulation exercises direct control over its structural environment (Perry, 1984). Although in some cases structure regulation and conduct regulation are alternatives to one another, to be effective, the regulation of natural monopolies usually requires a combination of the two.

The basic difference between structure regulation and conduct regulation is that the former aims to reduce or remove the opportunity and incentives for undesirable behaviour rather than to prohibit it from occurring, while the latter addresses undesirable behaviour directly rather than focusing on the underlying incentives that induce it (Kay and Vickers, 1988). These considerations imply that structure regulation largely determines the scope, content and nature of conduct regulation.

To what extent should public authorities rely on structure and conduct regulation is an empirical problem that necessarily depends on the characteristics of the industry in question, especially the scope for new entry and competition afforded by the underlying technological and market conditions, the rate at which these conditions change, and the degree of the asymmetry of information between regulator and regulated utilities.

It is useful to distinguish between two groups of industries (this discussion is based on Beesley and Littlechild, 1989). At one extreme, there are industries, such as electricity and telecommunications, that can in principle be restructured to ensure workable competition in some of their segments. These industries are usually characterised by fast changes in the underlying technological and market conditions. The effect is twofold: on the one hand, rapid change provides the very circumstances in which new entry is feasible; and, on the other, it tends to increase the asymmetry of information between regulator and utilities and hence reduces the effectiveness of conduct regulation.

In the industries belonging to this group, structure regulation is likely to be more effective and should probably have priority over conduct regulation. As a matter of general principle, it should seek to foster competition in potentially competitive segments (e.g., electricity generation and long-distance telephone service) where direct market competition may be an effective way to allocate resources, while conduct regulation should be targeted on natural monopoly segments (e.g., electricity transmission and distribution, and local telephone service) where direct market competition can not be relied upon to yield satisfactory performance. In this way, structure regulation will help ensure that the scope of conduct regulation matches as closely as possible with the extent and size of the market failure that provides justification for government intervention.

At the other extreme, there are industries with severe natural monopoly characteristics (e.g., water supply and sewerage) where there is virtually no scope for direct market competition of any kind. These industries are usually characterised by slow changes in the underlying technological and market conditions. The effect is again twofold: on the one hand, slow change makes it more likely that the regulator will come to acquire more relevant information and will be in a position to set realistic productivity targets for the regulated utilities; and, on the other, it makes new entry less attractive. In these circumstances, conduct regulation, rather than structural reforms and the promotion of competition, is the appropriate policy response. The principal role of structure regulation in industries belonging to this group is to facilitate conduct regulation, in particular by improving the quality and quantity of the information upon which regulators make their decisions.

B. The problem of asymmetric information

Information is a prerequisite for effective regulation. In modern economic theory, regulation is usually analysed as a principal-agent problem in which the controlling party (the principal) is the government or the regulatory agency representing the customers, and the agent is the management of the regulated public utility (Laffont and Tirole, 1993). Regulation is viewed as a game in which the principal wants to induce the agent to act in accordance with the public interest. The principal, however, is constrained by the lack of information on the agent it regulates and cannot observe its behaviour with precision: “The regulation problem is essentially a control problem under incomplete information” (Laffont, 1994). The asymmetry of information makes the principal dependent on the agent, reduces economic efficiency by blunting the effectiveness of regulation, gives the agent the opportunity to act strategically in response to the policy established by the principal, and

allows the agent to earn a rent, in the form of excess profit and internal slack, from its informational advantage.

The agent typically has or can acquire better information than the principal about the circumstances facing it (e.g., the operating characteristics of its facilities, the costs of its services, the effort it expends to reduce these costs, the quality of its services and the costs of improving that quality, etc.). In public utility industries, this information asymmetry arises because of such factors as proximity to the production process, closer contact with customers, greater awareness of the underlying characteristics of the product or service, differences in financial resources, staff size, incentives, technical training, etc. (Sappington, 1994; Berry, 1998). The information available to the agent is not in itself perfect, but it is better than that available to the principal. If the principal had the same information as the agent (i.e., knew what it would cost an efficient utility to provide services), it could simply instruct the latter to implement the socially optimal plan or, better still, run the utility itself rather than leave this responsibility with the managers of the utility. However, it is difficult for the regulator, who is at an informational disadvantage in relation to the agent, both to compose instructions and to monitor compliance with them with precision.

It is useful to distinguish between two types of information asymmetries between the principal (regulator) and the agent (regulated utilities): the problem of hidden action and the problem of hidden information.

- The problem of ***hidden action*** or ***moral hazard*** refers to endogenous variables that the principal cannot observe with precision. It implies a situation where the agent can alter the environment in which it operates by its discretionary actions but the principal cannot observe these actions (e.g., cost-reducing effort) with precision. Examples of hidden action include the regulator being unable accurately to judge the effort managers put forth to improve the utility's performance or whether utilities are obtaining materials and equipment at minimum cost. When actions are unobservable, direct regulation tends to become less efficient given that it is difficult for regulators to specify, dictate, monitor and enforce them directly, rather they must increasingly rely on indirect incentives to achieve desired goals. This can be done by basing the utility's compensation on observable performance measures that are correlated with its unobservable behaviour (Sappington, 1994).[1] For example, it is extremely difficult for a regulator to observe directly whether water utilities faithfully maintain their networks of water mains. It is possible, however, to make a

[1] The use of observable performance measures to motivate the regulated utility to undertake unobservable actions depends on the characteristics of the performance measures that are available, particularly their sensitivity and variability (Sappington, 1994). The former refers to the extent to which the observable measure is correlated with the underlying unobservable activity, while the latter characterises the noise in the relationship. The regulator should seek to base the utility's compensation on those observable performance measures which are closely and systematically associated with the unobservable activities. Since the unduly noisy relationship will tend to increase the risk involved and hence the cost of capital, the regulatory policy should seek to reduce variability in performance measures. This can be accomplished, for example, by limiting the responsibility of the utility for outcomes that are largely beyond its control (e.g., weather conditions), and basing the utility's compensation on the entire history of its performance rather than on isolated events.

judgement as whether the capital maintenance carried out by a utility has resulted in stable, improving or deteriorating serviceability of its water mains networks by examining the trends over several years of the following observable indicators: extent of low pressure problems, number of bursts, scale of interruptions of supply to customers, and quality compliance (OFWAT, 2000d).

- The problem of ***hidden information*** or ***adverse selection*** refers to exogenous variables about which the agent knows more than the principal. It implies a situation where the agent is better informed than the principal about the environment in which it operates (e.g., the cost and demand conditions in the industry) but cannot influence this environment. It may be, for instance, that a water utility has better estimates for the cost of water pollution control than the regulator. Since the utility's management is usually better informed that the regulator about industry conditions, it is advisable to focus performance or compensation schemes on broad performance measures, such as reducing operating costs, rather than on very specific performance measures, such as specific components of operating costs (Sappington, 1994). Specific performance measures become more attractive where regulatory goals are very specific or where broad performance measures are insufficiently sensitive or excessively variable.

The asymmetry of information "blocks the simultaneous attainment of productive and allocative efficiency, and leads to a trade-off between them" (Rees and Vickers, 1995). While the level of costs incurred by utilities and the level of their earnings are (to a degree) observable, it is difficult for the regulator to establish with precision whether this is due to exogenous variables (favourable external developments) or endogenous variables (cost reducing effort). So the regulator faces a dilemma. On the one hand, if the utility is rewarded in a way that is insensitive to its actual observed costs, then productive efficiency is achieved because the utility retains any gains from cost reduction, but allocative efficiency may be poor because prices are likely to get out of line with costs. If, on the other hand, the utility is rewarded on the basis of its actual observed costs, then these benefits and problems are reversed: since prices track costs closely, there are good incentives for allocative efficiency but weak incentives for cost reduction.

In general, the smaller the degree of the asymmetry of information between regulator and regulated utilities, the more effective will be regulation. The degree of the asymmetry of information largely depends on two main parameters (Beesley and Littlechild, 1989):

- ***The rate at which the underlying technological and market conditions change***. The faster the change, the more difficult it is to acquire information for regulatory purposes, and the more likely it is that the regulator's knowledge will become obsolete faster than it can replenish it, hence the greater the utility's informational advantage. Conversely, the slower the change, the more likely it is that the regulator will acquire information at a rate faster than at which it decays. Since the water supply and sewerage industry is characterised by a low rate of technological change, the problem of asymmetric information is likely to be less acute in it than say in the telecommunications industry. On the other

hand, as many water utility assets have very long working lives and are located underground, which makes their condition and value difficult to determine, the investment and maintenance plans are likely to require more careful monitoring and certification in the water supply and sewerage sector than elsewhere.

- ***Access to multiple sources of information***. Where there is only one utility (or few utilities which differ substantially one from another) in an industry, the utility is in a monopoly position with respect to the supply of information to the regulator. This means that, with only one utility in the market, the regulator will be more dependent upon that utility for information, its bargaining position will be weaker, the utility will be better able to control and manipulate the flow of information to the regulator, and the danger of regulatory capture (i.e., the regulator's falling under the undue influence of the regulated industry)[1] will be greater. This is a known problem in the Buenos Aires and other water supply and sewerage concessions in Argentina, where regulation is basically utility by utility, as the responsibility for regulation lies with each province (FIEL, 1999). Conversely, where there are many utilities in an industry, the regulator can improve the effectiveness of regulation by the use of yardstick competition (see page 26) rather than by regulating each utility independently. Since in most Latin American and Caribbean countries, water supply and sewerage utilities are local or regional, the problem of asymmetric information is likely to be less acute in this industry than in the sectors where the regulator has to rely on a single source of information. The implication is that "The prospects for generating information for regulatory purposes should ... be an important argument in a government's decisions about the structure of the industry and the nature of the regulatory regime" (Beesley and Littlechild, 1989).

Regulators are often forced to rely on information provided by regulatees to reach decisions, because that information is frequently particular to the regulated utility and, therefore, not open to independent verification (Helm, 1993). On the other hand, the regulator's objective is to pursue the public interest (i.e., maximise social welfare), while the regulatee is interested in maximising its own profits. Since the regulator's and the

[1] Since regulatory decisions affect the regulated utilities' welfare, there is an incentive for them to use resources at their disposal to try to influence regulators. The utilities are almost always better organised, motivated, and financed than any other group, and so are often viewed as the single greatest threat to regulatory decisions being made in the public interest: "Their tenacity and creativity in pursuing favorable regulatory decisions is driven by their knowledge of the substantial impact of regulatory decisions on their income and quality of life" (Zearfoss, 1998). Regulated utilities have various instruments at their disposal to influence regulators: (i) monetary payments (bribes) are feasible, although not common due to their illegality; (ii) much more common are the hoped-for future employment opportunities for the regulatory agencies' staff with the regulated industry (in many countries, there is a long history of regulators subsequently finding attractive careers in industries for which they formerly exercised responsibility); (iii) personal relationships provide incentives for the regulatory agencies' staff to treat their partners from the regulated utilities kindly; (iv) the regulated industry may cater to the regulatory agency's bureaucratic desire for a quiet life or for larger resources (e.g., by refraining from publicly criticising it); and (v) the regulated industry can make indirect transfers through a few key elected officials who have influence over the agency (e.g., monetary contributions to political campaigns, the votes and lobbying of employees, shareholders, suppliers, etc.) (Laffont and Tirole, 1991 and 1993). In addition, in the political arena, regulated utilities often support candidates sympathetic to their point of view; lobby governments and legislatures; and attempt to manipulate the public through the media and sometimes their own bill inserts (Zearfoss, 1998).

regulatee's objectives are in part divergent, the regulator cannot rely on the regulatee to divulge the truth, rather the latter has an incentive to use information to bias the regulatory outcome in its favour: "Since the regulatee's objective is ... to be confronted with the weakest constrains, and since the regulatee has an element of control or even monopoly over the information provided to the regulator, there is an incentive to present information selectively. In the case of utilities, this takes the form of providing business plans which may inflate operating costs and investment requirements and underestimate demand (the lower the estimated demand, the higher the prices needed to raise a given amount of revenue), and in selectively fitting the information to suit their interests" (Helm, 1994b).

Owen and Braeutigam (1978) describe other common tactics used by public utilities to manipulate information: "Agencies can be guided in the desired direction by making available carefully selected facts. Alternatively, the withholding of information can be used to compel a lawsuit for 'production' when delay is advantageous. Delay can also be achieved by overresponse: flooding the agency with more information than it can absorb. Sometimes, when a specific item of information is requested and it is difficult or impossible to delay in providing it, the best tactic is to bury it in a mountain of irrelevant material ... It is also sometimes useful to provide the information but to deny its reliability and to commence a study to acquire more reliable data. Another option is to provide 'accurate' information unofficially to selected personnel of the agency who are known to be sympathetic. If another party has supplied damaging information, it is important to supply contrary information in as technical a form as possible so that a hearing is necessary to settle the issues of 'fact'".

One example is afforded by the experience of the Office of Utilities Regulation (OUR) in Jamaica, where it is charged with the responsibility of regulating the provision of utility services in the electricity, telecommunications, water supply and sewerage, and public passenger transportation (by road, rail and ferry) sectors. Its Consumer Affairs Department (CAD) describes in the following way its experience with requests for information to public utilities: "A recurrent problem has been that initial responses by the utility companies to the OUR's request for information invariably lacks important detail. Specific questions asked are sometimes not addressed and some responses either do not offer the comprehensive information required to complete an independent review of the matters raised or are otherwise not coherent. It remains a matter of concern that in some instances JPS [Jamaica Public Service Company] and NWC [National Water Commission] submit responses which refer to enclosures that were not included and which often take an inordinately long period to be located and forwarded to the OUR, after enquiries are made with the company. Of far greater concern however is the fact that C&WJ [Cable and Wireless Jamaica] has never submitted documentary evidence in support of its findings in its responses to complaints from the OUR" (Jamaica/OUR, 2000).

C. Information discovery mechanisms

The asymmetry of information between regulator and utilities is a real problem, and in many countries, as for example in Argentina (Crampes and Estache, 1997) and Chile (Espinosa, 1997), it is acknowledged that regulators are constrained by their lack of information on the utilities they regulate. This problem is especially acute in developing

countries because they usually lack resources and human expertise for monitoring, auditing, and enforcement.

There are several information discovery mechanisms which regulators can use to reduce, but not to eliminate, the informational asymmetry, and hence lessen the informational advantage which the regulated industry enjoys and improve the effectiveness of regulation. These mechanisms should not be seen as alternatives, but rather as complementary approaches which reinforce and increase the effectiveness of each other.

1. Access to internal information

In the water supply and sewerage industry, the main source of information is usually the regulated utility itself. In Latin America and the Caribbean, regulatory agencies, unfortunately, often do not have adequate access to the internal information of the utilities they regulate (ECLAC, 2000). This is further aggravated by the fact that in many countries of the region regulatory agencies are inexperienced, under-staffed, under-financed and vulnerable to politically motivated interventions in their decision-making, and seldom have sufficient authority and powers to compel the utilities under their jurisdiction to provide the information they need. In addition, in many countries, as for example in Chile, "due to their sheer economic size, utility companies have acquired an influence in the political system and in society as a whole, against which it is hard for regulators to contend" (Bitrán and Serra, 1998).

For regulation to be effective, it is essential for a regulatory agency to have sufficient authority, powers and resources both to compel the utilities under its jurisdiction to provide the information it needs to assess their behaviour and performance, and to prescribe the type of information and data that they must provide. Public utilities are normally under obligation to provide their regulators with physical, financial, service and other information, and regulators usually put a great deal of effort and resources into collecting, auditing, analysing and processing this information (see Box 2). One of the central features of the regulatory process in the United States is full access to information: "What information must an American utility make available to the public? In theory, all of it: every single document, record, memo, report, computer tape, file, photograph, any hand-scrawled note on any executive's desk which reflects on the costs and decisions of the utility" (Palast, 1996).

Although access to internal information is necessary, it is worth emphasising its inherent limits: "While the regulator can ... verify the total expenditures through audits of the company books, it cannot observe whether the firm is producing output at the minimum possible total cost" (Braeutigam, 1992). "Audits can verify that costs are recorded according to standard accounting procedures and that no major improprieties (e.g., embezzlement) have been committed by the firm. They also measure the firm's total cost; they usually cannot disentangle its various components. Most dimensions of moral hazard and adverse selection do not show up in accounting statements ... the small size of the stuff of public auditing bodies, and their imperfect knowledge of the technology, considerably limit the scope of intervention" (Laffont and Tirole, 1993).

Box 2

Information for regulation in the water supply and sewerage industry in England and Wales

The Office of Water Services (OFWAT), the economic regulator of the water and sewerage industry in England and Wales, needs information to enable it to carry out its duties. It obtains this information from a number of sources including: other governmental agencies, the regulated companies, and customers, as well as specialist advisers and commentators.

All the regulated companies are required to make an annual return each June to OFWAT covering their activities in the previous year. This return provides a framework for the companies to submit the majority of information required by OFWAT. The information required in the June Return is divided into:

- ***Key outputs*** consist of: (i) Levels of Service Indicators (companies must report their achieved performance on: the availability of water resources, restrictions on water use, low pressure, interruptions, flooding from sewers, responses to billing queries and written complaints, the answering of telephone calls and frequency of meter reading); and (ii) Company Performance under the Guaranteed Standards Scheme (see page 66).

- ***Non-financial measures*** include: population supplied; number of households and non-households receiving measured and unmeasured supplies of water and sewerage services; new connections; meter installations; the components of water delivered including leakage; volumes of sewage and effluent collected, treated and disposed; lengths of water mains and sewers inspected, repaired and renewed; types of water source; treatment needs; types of water and sewage treatment works; etc.

- The ***regulatory accounts*** cover: profit and loss accounts and balance sheets (on both a historic cost and a current cost basis) for the core business; cash flow statement for the core business; operating costs analysed by types of direct cost; maintenance and other expenditure for water and sewerage services; revenue from measured and unmeasured supplies of water and sewerage services and other sources; values and types of asset; movements in working capital; and transactions with associated companies.

- ***Financial measures*** cover: asset additions; maintenance and depreciation by type and asset life; expenditure by purpose for water and sewerage services (base service, quality enhancements, enhanced service levels and improvements to the supply/demand balance); and proceeds from land disposals.

OFWAT also collects annually from each company a Principal Statement. This contains companies' intentions and the rationale behind their tariff proposals for the coming charging year. This is used to check that price increases are within the limits allowable, and that there is no undue preference and undue discrimination in their charges.

OFWAT's aim is to make public as much information as possible. Some of the information it collects, however, is submitted on a commercial in confidence basis. The burden of proof is on those wishing to impose confidentiality restrictions on information to justify their decision. The objective is to publish sufficient information to make OFWAT's judgements and determinations transparent.

After analysing companies' June Returns, OFWAT publishes reports each autumn setting out companies' performance in delivering service to customers, on leakage and water efficiency, the costs of service provision and efficiencies achieved by the companies and a comparison of the financial performance and capital investment of companies in delivering outputs. Each Spring OFWAT publishes a report on the companies' tariff structure and charges. The individual company June Returns and Regulatory Accounts (except the commercial in confidence sections) are placed in the OFWAT library (and can be purchased on compact disks) together with relevant information supplied by other governmental agencies.

The information provided by companies to OFWAT is scrutinised by independent professionals, who examine and test its confidence and report their opinion to OFWAT. There are four different categories of independent professionals: Reporters, Auditors, Valuers and Assessors (in practice the roles of Reporter and Assessor are combined in the reporter role). All are professionally qualified, with appropriate experience to comment on information supplied by the companies. Usually, Reporters and Assessors are consulting engineers, while Auditors and Valuers are, respectively, accountants and surveyors.

Reporters. Reporters help the DGWS gauge the comparability of information between companies. They scrutinise both historical and forecast regulatory information. Historical information is submitted in the companies' June returns. The Reporters check and report on: (i) whether companies have systems to collect and record accurately the required information; (ii) whether they have allocated expenditure correctly; and (iii) whether progress and performance, particularly in respect of capital investment programmes and standards of service to customers, is properly demonstrated. For the 1999 Periodic Review Reporters scrutinised and commented on each of the information submissions required from the companies. These covered the costs of the quality programme; company cost databases; asset inventory and system performance; and customer consultation and strategic issues.

The companies' Business Plans set out their proposed strategies for the years 2000/05, and detailed their

Box 2 (continued)

proposed: (i) price limits and bills; (ii) customer service performance; (iii) activities and investment to maintain the serviceability of their assets; and (iv) compliance with environmental and drinking water quality standards. Reporters scrutinised these Plans and the companies' decision making process. They were asked to expose, scrutinise and challenge all material assumptions underpinning the Plans. They paid particular attention to the companies' allocations of projected expenditure between the different purpose categories, particularly for the quality programme and capital maintenance.

Reporters must be demonstrably independent of the company and provide a professional opinion to the DGWS. The companies must: (i) give Reporters reasonable access to their premises, staff, books and records; and (ii) allow them to carry out any inspections, measurements and tests required to complete their reports.

Auditors examine companies' statutory accounts in the same way as they would for any other company. They are also required to examine the Regulatory Accounts (i.e., financial statements prepared in accordance with OFWAT guidelines to ensure common practice), and comment in the same way as they would with ordinary accounts. In addition, they are required to submit a detailed report on each company's compliance with OFWAT's transfer pricing guideline (see page 90). Auditors also examine the Principal Statements and report on whether they have been properly drawn up. In addition, they work with the Reporters in scrutinising the financial aspects of companies' Business Plans.

Valuers are required in cases where water supply and sewerage companies wish to dispose of land. They certify that the price obtained for the land is the best that might be reasonably obtained.

Source: OFWAT (1997a) and (2000e).

Manipulation of accounting is a serious concern in the regulation of public utilities (Laffont and Tirole, 1993). For example, the early years of utility regulation in the United States, before the adoption of the Uniform Systems of Accounts (see below), had been characterised by notorious accounting abuses: operating expenses were overstated, the investments in plant and equipment was impossible to ascertain, and utility and non-utility businesses were not separated (Phillips, 1993). For these reasons, regulators usually devote considerable attention to the methods of accounting used by the utilities they regulate. In general, a regulator cannot do an effective job if it does not have the authority to define accounting systems for the utilities under its jurisdiction. It is important to emphasise, however, that regulation can never be reduced to a mechanical process by which the correct decision can be made by reference to accounting data alone, in part because: (i) the accounting valuations shown in utilities' books typically bear little relation to the underlying economic valuation of the assets; and (ii) there are always many important differences of opinion with respect to scope, content and applications even of the most detailed accounting guidelines.

In the United States, the Supreme Court has long upheld the right of regulatory authorities to control accounting procedures: "If the Commission is to successfully perform its duties in respect to reasonable rates, undue discriminations, and favoritism, it must be informed as to the business of the carriers by a system of accounting which will not permit the possible concealment of forbidden practices" (United States Supreme Court, 1912). As a result, transparency of accounts in a very important feature of regulation in the United States where regulators prescribe, for each regulated industry, Uniform Systems of Accounts that determine accounts to be used, together with specific instructions for use of individual accounts and general instructions as to the basis of accounting (NYPSC, 1998).

In England and Wales, the Office of Water Services (OFWAT), the economic regulator of the water and sewerage industry, also specifies the regulatory accounts in the form of Licence Conditions and Regulatory Accounting Guidelines. It has issued the following five Regulatory Accounting Guidelines: (i) guideline for accounting for current

costs; (ii) classification of infrastructure expenditure; (iii) guideline for the contents of regulatory accounts; (iv) guideline for the analysis of operating costs and assets; and (v) transfer pricing in the water industry. These guidelines are considered to provide a benchmark of good regulatory practice (Burns and Estache, 1998).

2. Direct market competition

Hayek (1978) sees competition "as a procedure for the discovery of such facts as, without resort to it, would not be known to anyone, or at least would not be utilised". In a competitive market, prices aggregate and communicate dispersed information and motivate appropriate levels of individual action in response to changing demand and supply conditions. Obviously, the extent to which market prices are able to fulfil this role depends upon the extent to which the characteristics of the market approximate those of the competitive paradigm.

In the industries that can be restructured to ensure effective competition, structural reforms are usually the most effective way to solve the problem of asymmetric information. Even limited competition is desirable in principle because it both reduces the need for conduct regulation and enhances its effectiveness by improving the information available to regulators. Unfortunately, technological characteristics of the water supply and sewerage industry are such that, except at the cost of a major loss of substantive economies of scale and scope, the opportunities for promoting direct market competition are extremely limited (see page 99) and regulators must, therefore, resort to other information discovery mechanisms, particularly internal information (see page 15) and yardstick competition (see page 26).

3. Competition in the capital market

The transferability of private ownership rights in the capital market reveals information via changes in share prices that, to the extent to which the market is efficient, capitalises the consequences of current actions for future profits (Vickers and Yarrow, 1991). Capital markets are, therefore, an important source of information for regulators both on the cost of capital and on the relative efficiencies of utilities listed on the stock exchange. The main impediment to greater use of the capital market as a source of information in Latin America and the Caribbean is that capital markets are underdeveloped in many countries of the region and most regulators "face a scenario where the regulated companies are unquoted or undertake a wide range of activities across a range of industries and even sectors" (Alexander, Estache and Oliveri, 1999).

Capital markets also provide a useful feedback to regulators, political authorities and consumers, about the nature of regulatory decisions. Share prices usually change following any regulatory decision: if the market regards this decision as less favourable to the regulated utility than originally expected, its share price is likely to be marked down and its cost of capital to increase, and the opposite is likely to happen if the decision is regarded as more favourable than expected (Beesley and Littlechild, 1989). This information can be used in a number of ways. For example, comparing the stock market returns for a regulated public utility or group of utilities with the returns for a comparable sample of

unregulated companies, or utilities regulated by another regulator, provides a useful way to test whether regulation is lax (Dnes, 1995b). Abnormally high returns associated with changes in the regulatory environment (e.g., regulatory decisions) could indicate lax regulation or capture by the regulated industry, while abnormally low returns could suggest unduly strict regulation or capture by consumer interests. Since take-over bids for public utilities can disclose unanticipated potential cost savings and future earnings gains, they provide useful information for regulators and can also reveal deficiencies of regulation. It is important to note, however, that all this information should be used with caution: "market values in turn reflect expectations of future regulatory behaviour, and ... there is an inherent circularity in trying to base regulation on market values" (Mayer and Vickers, 1996).

4. Franchising

Franchising is an old idea. It was originally advocated by Chadwick (1859) in the United Kingdom and later promoted by Demsetz (1968) in the United States. The basic argument is that although, in a natural monopoly situation, only one operator will provide the services (*ex post*), many operators are capable of providing them (*ex ante*). In order to exploit competition among potential producers, the regulator announces that it will accept bids from all qualified parties, will award the contract to the competitor offering the most attractive terms, and the winner will become the monopolist. In theory at least, where many parties enter non-collusive bids for the right to be the monopolist, the competition for the market among *ex ante* producers will hold in check the potential monopoly power of *ex post* supplier by the competitively determined terms of the franchise contract. The idea is that the auction will transfer the benefits of any monopoly power the successful bidder may enjoy to consumers (if the contract is awarded to the bidder who proposes to charge the lowest price), to government (if the contract is awarded to the highest bidder) or shared by the two (if a combination of the above-mentioned criteria is used to award the contract). Thus competition for the market acts as a kind of discovery mechanism which destroys the monopoly of information that hinders conduct regulation.

This approach has been successfully applied in various local services (e.g., street-cleaning, trash collection) where sunk costs are low, where there are many potential competitors with the requisite skills, where, because of insignificant technological and market uncertainty, contract terms and conditions can be readily defined, and where contracts are of short duration and can easily be rebid without significant inconveniences. Although franchising appears to provide an attractive alternative to conduct regulation, there are major practical problems with this approach in the water supply and sewerage industry as well as in most other public utility industries: "franchising is prone to a number of difficulties in some circumstances, and unfortunately the industries where regulatory problems are greatest ... are especially prone to such problems" (Kay and Vickers, 1988). Williamson (1976) and Goldberg (1976) made a number of strong criticisms of this approach. These include the following:

Bidding for the franchise may fail to be competitive (Kay, 1993). There may be very few competitors due to scarcity of requisite skills or resources. There is also a danger of collusion between bidders, especially if they are few in number: "Auctions presume noncooperative behavior between firms. This assumption is somewhat naïve once it is

realized than an auction is a deus ex machina aimed at extracting a maximal surplus from firms. A natural reaction of those firms is to protect themselves by collusion" (Laffont, 1994). An additional limitation is the fact that an incumbent franchisee is likely to enjoy such strategic advantages (e.g., arising from the experience gained from the operation of the system or from reluctance on the part of the franchiser to accept the disruption associated with a change of operator) that would deter potential competitors.[1]

Lack of competition in the awarding of franchise contracts is a common problem in the water supply and sewerage industry, especially in the case of relatively large projects, where only a very small group of major companies are currently involved in the franchising business: from one to five depending on the region in question (Silva, Tynan and Yilmaz, 1998). In addition, the companies belonging to this small group often operate jointly. "In electricity, hundreds of western firms, especially privatised electric utilities faced with declining profits at home, are scrambling to win contracts to build the developing world's power plants; in the process they have bid down the returns these contracts are likely to generate. In water, though, there are only a handful of firms in the international market, and competition is less fierce" (The Economist, 1998).

Short-term contracts may encourage greater competition, but are also likely to considerably reduce incentives for maintenance and investment, especially in long-lived industry-specific assets which are very important in the water supply and sewerage sector. The organisation of auctions involves major costs and considerable time. For example, the bidding for the water supply and sewerage concession in Buenos Aires, Argentina is said to have cost each of the bidders some US$ 5 million (Klein, 1996b). The cost of the preparation work by the government was about US$ 4 million (Triche, Mejia and Idelovitch, 1993). The process, from bid preparation to award, took about two years, including approximately one year between prequalification and award of the contract (Richard and Triche, 1994). Furthermore, short-term contracts reduce incentives for cost reduction, thus increasing the risk of mediocre performance, and imply that the sector would constantly be in a state of turmoil and that the problems of asset valuation and handover (see below) occur more often.

For these and other reasons (see below), most water supply and sewerage concessions are typically long-term (25 to 30 years). However, the longer a franchising contract lasts, the less effect the terms determined in the initial auction will have on the terms of the service provision over the full life of the contract. In the early part of this century, in the United States, in "a few cities, a degree of competition for franchises to build and operate waterworks facilities did occur at the outset, but since substantial

[1] It is for this reason why care needs to be taken in using short-term or limited forms of private sector participation (e.g., management contracts and leases) as an interim arrangement in the transition to longer-term or more comprehensive forms of private participation (e.g., concessions and divestiture). For example, it is sometimes suggested that such contracts can be used to assess the conditions of the system and its potential. This is a very attractive argument given that in most Latin American and Caribbean countries there is a general lack of knowledge about the conditions of the existing asset base and of patterns of consumption. The downside is that the incumbent will have a considerable strategic advantage over other potential bidders and also over the regulatory agency, as it is highly unlikely to truthfully divulge all the available economic and financial information about the system. The result is that the operator of a future long-term concession contract will in effect be selected on the basis of criteria for a short-term management or lease contract (Nankani, 1997).

investments in fixed facilities (such as water mains) were required, contracts were typically of long — or even indefinite — duration and recurrent bidding almost never took place" (Jacobson and Tarr, 1995).

Problems associated with asset valuation and handover in the event of an incumbent franchisee being displaced by a rival may distort incentives to invest and the nature of competition for the franchise (Bishop and Kay, 1989). In the water supply and sewerage sector, assets usually have a longer productive life and a higher component of sunk costs (i.e., costs that once undertaken cannot be recovered through transfer or sale) than in most other industries. With most of the assets underground, their valuation tends to be difficult and costly (e.g., Was the equipment originally bought on competitive terms? Was it adequately maintained? What depreciation method should be used? What is the quality of past investment decisions?). This fact in turn has implications for incentives to invest in new assets and maintain existing ones: if the incumbent expects that the investments made during its tenure will be undervalued (overvalued), then its incentives to invest in new assets and maintain existing ones would be correspondingly low (high). In any case, since the condition of underground assets is hard to assess, as the franchising contract nears the end, the concessionaire usually has an incentive to cease maintenance or even strip the assets. A longer-term contract might reduce (or at least postpone) the difficulties of asset handover, but it will also reduce competition and aggravate the problems of contract specification, monitoring and enforcement (see below), and the problem of incentives to skimp on investments and maintenance as the end of the contract approaches will remain.[1]

Underbidding or post-contract opportunism (Dnes, 1995a and 1998; Klein, 1998b). Since once the contract is awarded it would be disruptive and costly to replace the incumbent and governments are usually understandingly reluctant to terminate concession contracts, there is an incentive to present speculative bids at the auction and to try to renegotiate them later. As a result, attempts to secure private sector participation would tend to attract mainly those entrepreneurs who have greater lobbying power or with greater willingness to take risks. It has been suggested, for example, that the winning bid in the Buenos Aires concession was aggressive and that it was made in the expectation that tariffs would be renegotiated later, essentially shifting the information risk to consumers (Alcázar, Abdala and Shirley, 2000).

Problems of contract specification, monitoring and enforcement (Train, 1991). Perhaps the principal limitation of the franchising approach arises when it is recognised that, in a changing world, the optimal price and other contract conditions (e.g., service quality, expansion targets) change over time. Since costs and demand conditions change over time, locking the franchisee into a price or other contract condition that was optimal at one point in time is likely later either to force it into bankruptcy or to allow it to earn windfall profits. There are two principal solutions to this problem: (i) complete (contingent claims) contracts, that specify how contract conditions will change for every future

[1] In Chile, the option to use franchising was rejected in favour of divestiture in part because "there was a perception that end-point problems in fixed-term franchises were difficult to deal with, especially when significant investments were required close to the end of the franchise. Setting up mechanisms to encourage investment right up to the end of the franchise period, without affecting the transparency of the system, seemed a difficult task" (Bitrán and Serra, 1998).

contingency that might arise; and (ii) incomplete contracts, that establish a procedure by which contract conditions are revised periodically. Short-term contracts reduce the difficulties of contract specification, monitoring and enforcement, but seriously aggravate over problems (see above).

Given the vast number of eventualities that might occur in the life of even a short-term contract, complete contracts in public utility industries in general, and in the water supply and sewerage industry in particular, are impossibly complex to write, negotiate, administer and enforce. Furthermore, the asymmetry of information between regulator and franchisee means that the former might not be able to observe directly whether an even occurred (e.g., technological changes). This means that complete contracts require careful monitoring and enforcement and periodic renegotiation. Hence, this approach is either infeasible and undesirable or ends up being essentially the same as conduct regulation. This conclusion is confirmed by a recent review of water supply and sewerage concessions in Latin America: "Under the best of circumstances, the assumptions behind the expectations in a concession contract will be quickly outdated. Economic factors change, as do political needs. In circumstances where the condition of the water system is not well known to either party and information on consumption and bill collections is absent, invariably one or both of the parties is likely to want to revisit the contract within a short time period. If the concession contract has no mechanism to resolve these differences, it is not likely to be sustainable" (Lee, 1998).

As for incomplete contracts, they imply the renegotiation of some of the contract terms from time to time. These reviews, which involve a continuing task of contract renegotiation, monitoring and enforcement, are the same as conduct regulation. In the United States, rate-of-return regulation (see page 38) was a development of incomplete long-term contacts that offered public utilities a fair rate of return in exchange for the ability to adapt the terms of the contract to changing circumstances without excessively costly disputes (Newbery, 1998). Initially, most cities offered long-term franchise contracts, which inevitably had to be renegotiated as circumstances changed. Soon explicit provisions were made in franchise contracts for renegotiation, subject to arbitration or reference to an independent committee. As the power of these committees grew, they evolved into state public utility commissions.

Finally, it is important to note that reliance upon auctions and contract-based regulation is fraught with danger especially if a government lacks the skills and bargaining leverage to ensure that the contract fairly balances public and private interests. This is a major problem in many Latin American and Caribbean countries. According to a recent review of the working of water utility contracts in different parts of the world in which the examples were drawn from Latin America in particular: "Private sector companies working in water have made excessive profits in some of the poorest countries in the world by exploiting the twin evils of corruption and lack of knowledge ... Through the lack of knowledge of host governments ... the contracts are often biased towards the contractor ... In general such contracts have been negotiated with institutions incapable of supervising the performance and behaviour of the contractors. ... companies ... have developed robust marketing techniques, often playing on the endemic corruption in the host country and the influence greed can have" (Booker, 1999).

These and other difficulties are real problems which are known to have affected franchising of public utility services in many countries as, for example, in France in modern times (see Box 3), and in the United States in the late nineteenth century (see Box 4). Because of these problems, in practice, franchising has not been an important substitute for conduct regulation (Breyer and MacAvoy, 1998), rather it should be seen as a potentially useful complement to it that seeks to harness some of the desirable information and incentive properties of competition, and thereby helps somewhat reduce the regulatory burden.

The apparent attractiveness of franchising is one of the reasons explaining the recent interest in concessions, which are now the dominant form of private sector participation in the water supply and sewerage industry in Latin America and the Caribbean (ECLAC, 1998a and 1998b) as well as in other developing countries (Johnstone, Wood and Hearne, 1999; Silva, Tynan and Yilmaz, 1998). The lesson to be drawn from the discussion presented above is not that the franchising approach is bad or that it should not be used when a public utility is to be privatised (in general, some form of competitive selection is usually preferable), but that the water supply and sewerage industry will always need permanent and detailed conduct regulation.

5. Contestability

The theory of contestable markets proposed by Baumol, Panzar and Willig (1982) holds that in a contestable market (i.e., one in which entry and exist are costless (involve zero sunk costs)), the mere threat of hit-and-run entry precludes excessive profits and prices as well as waste and inefficiency, and hence limits the monopolist's capacity to extract informational rent. According to this theory, so long as sunk costs are zero, even where economies of scale are significant, a potential entrant can undercut any excessive prices of incumbent utilities yet earn an attractive rate of return (Baumol and Lee, 1991).

The theory of contestable markets has provoked considerable controversy. Although it features prominently in public debate on regulation, is used to advocate free entry in infrastructure industries, including water supply and sewerage (Ehrhardt and Burdon, 1999), and, in antitrust cases, "is one of the favourite arguments of incumbent monopolists" (Stefanadis, 1999), the theory is often strongly criticised because of its unrealistic assumptions on costless entry and exit, because it assumes an unnatural sequence of events when entry occurs (i.e., profitable entry and exit can occur before the incumbent responds), and because it ignores the entrenched dominant position of the incumbent utilities: "Implausible assumptions have been applied on an abstract plane to reach not only 'insights', but also emphatic conclusions and wide policy lessons. The system hangs in the air, lacking a foundation or even plausibility. If the adjacent technical analysis of multiproduct conditions were less formidable and the authors less famous, these ideas and claims would seem naive and premature ... their analysis only treats a specialized, extreme set of conditions, which are probably found in no real markets which have significant ... market power ... Moreover the ... model rests on assumptions which are contradictory ... and which reverse reality" (Shepherd, 1984).

The theory of contestable markets has minimal, if any, relevance to real-world public utility industries: "many industries, certainly including the core activities of the utility

Box 3

The French model of delegated management and its limitations

Municipalities or "*communes*" (of which there are about 36 800) are responsible for the provision of water supply and sewerage services. The municipalities can provide the services either themselves (direct management or *"régie direct"*) or by delegation (*"gestion déléguée"*) to a private operator. Delegated management does not involve the transfer of assets, these remain the property of the municipality, even when they are financed by the private operator.

Today, private companies provide water supply services to about 75% of the population and sewerage services to more than 35%. They are particularly active in the urban sector.

Municipalities have a wide degree of flexibility in the selection of contractual arrangements for the provision of water supply and sewerage services. The most common arrangements are: (i) lease contracts (*"affermage"*), in which a private company is responsible for managing the system and the municipality for investments; and (ii) concession contracts, in which the private operator also undertakes investments. Some municipalities also use management contracts but these have gradually been replaced by leases and concession contracts. Concessions are more common in water supply and leases in sewerage.

Although this system of delegated management appears to offer an attractive combination of competition and efficiency with light and decentralised regulation, this approach is not without its problems.

Delegation contracts are generally for a very long term and this reduces the potential for competition. The government has recently limited delegation contracts to a maximum of 20 years (with some exceptions), but previously concessions could last 50 or even 75 years since no maximum limits existed. It is very rare for an incumbent franchisee to be displaced because of its "insider" knowledge and contacts.

An important constraint on effective competition for the market is that there are now only three companies in the field, and they sometimes form joint ventures between themselves. There have reportedly been cases of collusion among them as well as extensive allegations of political party contributions and corruption. The system of delegated management is alleged by some to have become an elaborate technique for financing municipal budgets at the expense of consumers. Nonetheless some experts allege that there is often fierce competition for the initial contract. Other reports criticise the inadequate competition when concessions are awarded, in particular the repeated use of negotiated procedures, and a tendency to extend existing contracts without subjecting them to competitive tender, which has created substantial profit margins.

Difficulties in generating effective competition for the market are compounded by the fact that the companies have diversified into many other activities such as solid waste management, energy, communications, transport, etc. This means that when a municipality grants a delegation contract for water supply and sewerage, it effectively determines its supplier for a wide range of services, making objective bid evaluation extremely difficult. In addition, contracts are often ambiguous with subcontracting going to affiliated companies.

The fact that economic regulation is carried out at the municipal level has created a number of problems. Municipalities are not always in a good position to exercise control on service providers. They find delegation contracts, which are said to suffer from lack of clarity, too complicated and difficult to understand. Supervision is said to be inadequate or non-existent. Municipalities are also often ill prepared to bargain with giant water companies with the best expertise in the field and which wield immense political, economic and financial power.

Tariffs are set on the basis of competitive bidding or through negotiation, and are subject to indexation on the basis of price indexes for salaries and other inputs. The problem is that the price index adjustment formula is often based on parameters that a municipality cannot verify and monitor, and that can be manipulated by the companies.

It is often said that the threat of a return to direct management creates a margin of competitive pressure and strengthens the bargaining position of municipalities. In reality, this threat is largely ineffective and contract termination is extremely rare. The principal reasons for this are: (i) many municipalities do not have, and cannot acquire in a short period of time and at an affordable cost, adequate in-house capacity to operate their systems and thus become hostages to private operators; (ii) many systems use advanced technologies which are controlled by the companies and which the municipalities can neither acquire nor manage; and (iii) contract termination and a return to direct management entail significant costs.

In recent years, in part because of the highly critical report on the water industry published in January 1997 by the *Cour des Comptes* (national audit office), the government has adopted a number of measures to strengthen the regulatory framework, promote competition and improve transparency in the awarding and management of delegation contracts. On the whole, at home, "the French model operates within a highly distinctive political and socio-cultural environment where it remains well regulated by a unique combination of institutional and market forces. Implementation of the model beyond the confines of this native environment is unlikely to succeed without the elaboration of tailor-made regulatory mechanisms" (Franceys, 1997).

Source: Andrew (1997); Briscoe and Garn (1995); Burns and Parker (1997); Chéret (1994); Clark and Mondello (1997); Cour des Comptes (1997); Elnaboulsi (1997); Hall (1997); Kay (1993); Neto (1998); Nickson (1996); Owen (1998); OECD (1998); PSIRU (undated); Rees (undated); Water and Environment International (1995).

Box 4

Experience with franchise regulation in the United States

In the United States, public utility regulation relied on franchising in the late nineteenth century to about 1920. In the early twentieth century this approach was replaced by state regulatory commissions. *Phillips* (1993) describes this early experience with franchising as follows: "While use of the well-drawn franchise had some merit, in the main the franchise, as actually used, proved a defective instrument for ... regulation ... little regard was paid to the interest of the public ... franchises ... tended to be poorly drafted ... And even when they were well-drawn, the company often benefited, since it was common for the utility's lawyers to draft the franchise and then present it to the city council for approval. Changes in the prescribed rates or in the service standards were made with great difficulty ... As expected, the companies resisted downward rate changes, and the city councils, upward adjustments ... Service often became poor as the termination date on the franchise drew near. The company would try to keep its investment as small as possible to avoid loss if the contract were not renewed. The agreements also failed to provide for administrative machinery to keep check on the company to see it met the terms of its franchise ... It was often impossible ... for franchise ... provisions to be changed ... Detailed requirements were unsatisfactory under changing conditions".

Garfield and *Lovejoy* (1964) summarise the main lessons of this experience with franchising as follows: "First of all, franchise regulation was largely ineffective. This was largely due to the fact that it was impossible to regulate a dynamic industry in a rapidly growing economy by rigid franchise terms that were not readily capable of adjustment to changing circumstances. In addition, the drafting of franchise terms often left much to be desired. Second, franchise regulation encountered the problem of inadequate jurisdiction. Effective regulation requires the jurisdiction of the regulatory authority to be coextensive with the area served by the utilities regulated. This was made increasingly difficult under franchise regulation as cities grew beyond their defined limits and, more important, as advancing public utility technology made it more economical for one utility to serve a number of cities within an area instead of only one city, as had been the case earlier ... A third weakness ... was that city governments generally failed to equip themselves to undertake the conduct of effective regulation. Even if cities were to do so, it would be unnecessary duplicative".

Source: Garfield and Lovejoy (1964); Phillips (1993).

industries ... do not come close to satisfying the conditions of contestability. Entry involves substantial sunk costs and dominant incumbents have at their disposal a range of instruments of strategic entry deterrent" (Vickers, 1991). The principal reason for this conclusion is that all these industries, and especially the water supply and sewerage industry (with the exception of water trucking and similar technologies), have vast sunk costs (the larger is the sunk cost portion of the potential entrant's investment the greater is both the cost and risk of entry because in the event of failure and subsequent exit sunk costs are unrecoverable) and dominant incumbents have at their disposal a wide range of instruments of strategic entry deterrence and exit inducement, so there are always significant entry and exit barriers. The theory of contestable markets also ignores the strategic behaviour, asymmetric information, and other features that characterise many real-world markets.

As an answer to this criticism, the proponents of the theory of contestable markets claim that a market can remain highly contestable if an entrant can achieve contractual relations with prospective customers (Baumol and Lee, 1991). Such long-term contracts, it is said, provide a way to obtain total entry before response can occur and render the entrant immune from retaliation. In that way the theory of contestable markets provides a justification for the franchising approach to private sector participation: "the theory of contestability, although it operates in a different way than repeated auctions, is actually, at its most fundamental level, a formalization and generalization of the idea that motivates repeated auctions" (Train, 1991). For example, it is sometimes said that, in France, "the water supply market of each municipality is contestable" (Kessides, 1993). Although potentially attractive, the franchising approach has important limitations, which are

especially pronounced in the water supply and sewerage industry, and, as explained above, it should be seen more as a complement than an alternative to conduct regulation (see page 19).

6. Yardstick competition

Yardstick or benchmark competition, also called relative performance evaluation or competition by comparison, describes the simultaneous regulation of identical or similar public utilities (Shleifer, 1985). This scheme is possible where there are several geographically distinct public utilities in the same industry. Yardstick competition promotes competition between public utilities indirectly by making the rewards of a given utility contingent upon the performance of other utilities as well as its own performance. This form of indirect competition is particularly important in the water supply and sewerage sector, because in this industry the scope for other forms of competition is extremely limited owning to the fact that the local networks of water mains and sewers have natural monopoly characteristics and account for the bulk of the total costs of service provision.

By relating the public utility's rewards to the costs of utilities operating in similar environments, the regulator can both improve its ability to set prices in line with efficiently incurred costs and force public utilities serving different geographical markets effectively to compete via the regulatory mechanism. For example, if allowable prices are based on the average cost in the industry, every public utility has a strong incentive to reduce its costs below the average: if it reduces costs when other utilities do not, it profits, and if it fails to reduce costs when other utilities do, it incurs a loss. This "virtual competition" gives individual utilities the incentive to reduce costs to below the average level, and when all utilities seek to do this, the average cost itself falls.

Yardstick competition is considered as possibly the most promising way to reduce the asymmetry of information between regulator and public utilities (Kay, 1993). This system is very attractive because it can help improve the terms of the trade-off between productive and allocative efficiency: (i) good incentives for productive efficiency exist because each utility can keep the benefits of its cost-reducing activities, for its rewards are decoupled from its own reported costs and profits, and it is unable to influence the regulatory decisions via manipulation of its own cost structure; and (ii) there are also good incentives for allocative efficiency, because industry prices are kept in line with industry costs. In other words, prices will be adjusted over time to reflect cost movements as conditions in the industry change while preserving incentives for cost reduction.

The effectiveness of yardstick competition depends on the existence of a sufficient number of public utilities in the industry. Although in theory implementing yardstick competition requires only two identical public utilities (Shleifer, 1985), in practice the level of information that the regulator acquires is likely to be an increasing function of the number of similar utilities between which yardstick competition can be made to work (Sobel, 1997). An important question for regulatory policy is thus how many public utilities are necessary to implement yardstick competition (see page 106). Where there is only one public utility in an industry, yardstick competition is not directly possible, except in a limited way through international comparisons.

Obviously, the greater is the degree of correlation in the public utilities' operating environments, the more effective yardstick competition can be made to be. The reason for this is that, when all utilities operate in similar environments, one public utility's cost is informative about the effort level of the other utilities. Conversely, if such correlation is completely absent, yardstick competition should be abandoned in favour of regulating each public utility independently, because using it would serve only to increase the uncertainty and risk facing the regulated utilities with no compensating benefit.

Other potential limitations of yardstick competition are that it creates incentives for public utilities: (i) to collude to implement uniformly low levels of performance; (ii) to intentionally undermine the performance of others; and (iii) not to collaborate with each other. Although some scope for these undesirable incentives is probably present, its magnitude depends upon the extent to which regulators can effectively exercise their oversight function. These incentives are likely to be weaker when there is a large number of public utilities in the comparison group, but might to be stronger if they are few in number and well informed about each others' behaviour. In any case, to guard against these possibilities, it would be advisable to reward each public utility on its performance relative to other utilities and on some absolute measure of its individual performance (Sappington, 1994).

Under ideal conditions, when the public utilities in question operate in similar environments and have essentially the same opportunities to improve their performance, the effectiveness of regulation can be considerably improved by the use of yardstick competition rather than by regulating each utility independently. But in practice, given that there are always differences in the economics of water supply and sewerage between geographical regions and that these differences are often substantial and difficult to identify and quantify with precision, it can be extremely difficult to factor out location-specific influences from local costs even with sophisticated statistical techniques. In the case of water supply and sewerage utilities, for example, there are large differences in the nature of the terrain where they operate, proximity to water sources and to the coast, the state and age of their distribution networks, the need for water and wastewater treatment, the customer density in each geographical area, etc., and these differences have important implications for local costs.

To cope with these problems, the regulator would have to determine the characteristics that make public utilities differ, and to correct for this heterogeneity. A number of statistical methodologies and techniques exist to do this. In principle, a simple way is to use a regression of unit costs on the factors which determine the costs that are being modelled ("cost drivers"), although in practice the procedure is fraught with many difficulties and "it has not been possible to apply yardstick competition in a mechanical way" (Cowan, 1997).

The costs incurred by a public utility depend on a very large number of factors, which are not easy to identify, measure and account for correctly and completely. For example, it is not always clear what factors are exogenous to utilities and what are not, or what output measure should be used and how they should be incorporated into statistical models. These models require a large amount of reliable data which is not easy to obtain. Their specification is somewhat controversial and different assumptions can result in very

different results. Determining whether differences in observed cost levels of the utilities being modelled are caused by (in)efficient operation or by other effects such as measurement errors and model specification errors is also not easy.

Furthermore, no statistical model is perfect and an element of judgement will always be involved in arriving at the final answer: "it seems unlikely that it will ever be possible to eliminate all significant elements of discretion in the model development process" (Jones, 1999). This means that, unless the regulator enjoys a great deal of discretion in the performance of its duties, there is likely to be endless argument about the appropriate way to conduct the statistical analysis, which factors to include, etc. Finally, statistical modelling is always subject to some degree of estimation error, which is likely to be larger the smaller the number of observations and the larger the number of independent factors.

These difficulties explain why it is not easy to implement yardstick competition and, in many countries, regulators have found it difficult to incorporate it explicitly in regulatory frameworks. In the United Kingdom, for example, yardstick competition has "proved much harder to perform than was originally envisaged" (Bishop, Kay and Mayer, 1995). Although the regional structure of the electricity and water supply and sewerage industries allows the use of yardstick competition, "at present little *explicit* use has been made of this" and "there are no explicit yardstick formulas in the price controls" (Armstrong, Cowan and Vickers, 1994). The burden on public utilities of information provision and on regulators of information processing has been heavy. All these and other problems have lead Jones (1999) to conclude that a decade "or more after privatisation, the water sector and electricity sector regulators ... still appear unable to develop systematic and transparent methods for assessing the relative efficiencies of the companies that they regulate".

As a result, despite its attractive properties, until recently, yardstick competition has not been used much in the regulation of public utilities (Laffont and Tirole, 1993). The principal problem is that "there is a considerable difference between the degree of comparability needed for a qualitative comparison of performance, and that needed for an objective basis for regulation which will stand up to scrutiny and (ultimately) legal challenge. For this reason, yardstick competition remains more a theoretical concept that a practical tool" (Kay, 1993).

Despite these problems, yardstick competition is more and more seen as an extremely desirable complement to other regulatory mechanisms which can help address the problem of asymmetric information and mitigate some of its undesirable effects. It is increasingly used, usually implicitly or informally, in the regulation of various industries (water supply and sewerage, natural gas, electricity, telecommunications, railways, etc.) in many countries (Sobel, 1997; Tangerås, 1999). Due to its attractive features, Laffont and Tirole (1993) expect "an increased use of yardstick competition in segments of regulated industries such as water and electricity distribution".

While it is clear that yardstick competition is potentially a very useful source of information for regulatory purposes, the development of a practical means of incorporating it explicitly into a regulatory framework remains a major challenge. As a result, it is rarely used explicitly in regulation, rather it is used informally or implicitly, as a means by which

the regulator can obtain more and better information to increase its confidence about demand and cost assumptions for regulated utilities. The advantages of yardstick competition are also part of the case for having horizontally separated public utilities rather than a single national utility in the water supply and sewerage, and other natural monopoly industries (see page 106) (Vickers, 1995).

In the water supply and sewerage industry in England and Wales, comparative information was used in the initial price setting in 1989, and OFWAT relies heavily on yardstick competition in subsequent periodic price reviews. It does this by comparing the performance of individual utilities in such areas as operating efficiency, capital efficiency, customer service, etc., and then setting price limits that give the utilities incentives to increase their efficiency (OFWAT, 1998a). OFWAT has developed with the industry a broad spectrum of indicators which are used to assess the relative efficiency of the utilities. These indicators include: (i) unit operating costs and other efficiency indicators; (ii) measures that, where possible, remove the effect of factors which legitimately influence utilities' costs, such as the level of treatment that the water requires or the amount of pumping needed to deliver it to customers; (iii) a range of indicators of the standards of service achieved; and (iv) capital costs for a range of standard capital schemes. OFWAT also encourages increased efficiency by publishing information which helps managers and shareholders compare the performance of utilities.

OFWAT analyses the scope for improvements in the water supply and sewerage industry as a whole separately from the comparative efficiency of the companies within it; each is further divided into operating expenditure, capital maintenance expenditure and capital enhancement expenditure (Waddams, 1999). OFWAT then examines the relations between the areas. This approach enables it to examine the relative efficiency in operating expenditure together with capital maintenance expenditure, categories which may be substitutes for each other. To determine overall potential efficiency improvements, comparisons are made between the water supply and sewerage sector and other industries, both for operating and capital expenditure.

OFWAT explored both stochastic frontier and regression approaches to assessing operating cost efficiency for the 1994 periodic review, and concluded that the regression approach was the most appropriate (OFWAT, 1998c). This is because stochastic frontier models rely on a number of assumptions about the form of the relationship between expenditure and explanatory factors. These assumptions may not hold for the information collected from the public utilities. The regression approach, in contrast, does not require such strong assumptions. There are alternatives to these two approaches, such as panel data analysis and data envelopment analysis. In 1994 periodic review OFWAT used the latter approach to confirm the results of the operating cost regression models, and considers that these alternative approaches provide a useful challenge to the results of the preferred method, regression analysis.

Armstrong, Cowan and Vickers (1994) expect that yardstick competition is likely to play an increasingly valuable role once the huge investment programme, which at present is the main factor in tariff-setting, has stabilised. The generally successful experience of OFWAT with yardstick competition suggests that the problems discussed above are not overwhelming and can be overcome by an efficient regulator.

Yardstick competition is also used in the water supply and sewerage industry of other countries. In Chile, the *Superintendencia de Servicios Sanitarios*, in charge of economic regulation in the water supply and sewerage sector, uses a "model" utility variant of yardstick competition. Tariffs are determined on the basis of a simulation of a model utility, which is defined as a utility whose aim is to provide water supply and sewerage services efficiently, within the existing regulatory framework, taking into account the geographical, demographic and technological constraints under which the utility must operate. The parameters used in the model are determined on the basis of a survey of Chilean companies and international standards (Shirley, Xu and Zuluaga, 2000). This represents a limited form of yardstick competition since the costs considered in the pricing process are those which the model utility would incur rather than those of its real-world counterpart, and this, at least in theory, prevents the institutionalisation of inefficiencies and encourages regulated utilities to improve productivity. Although in general successful, the approach is not free from problems. Bitrán and Serra (1998) describe in the following way the experience of Chilean regulators with this form of regulation: "The problem ... arises from the difficulty in agreeing on the costs of an efficient firm ... This leads to a negotiating game between the regulator and the regulated firm. Regulatory agencies do not seem well prepared to deal with this bargaining process, for they are at a disadvantage ... with respect to regulated firms ... Furthermore, the controlling groups behind public utility firms have acquired significant political and social leverage and exert an enormous influence on the definition of the efficient firm". There is also interest in yardstick competition in Argentina and other countries (Crampes and Estache, 1996).

In some large urban centres, the potential advantages of yardstick competition have been used to justify dividing provision of water supply and sewerage services between two or move different utilities. The limited data available on economies of scale in the water supply and sewerage industry (see page 99) would seem to suggest that there may be scope in very large urban centres to have more than one utility providing water supply and sewerage services. In the Philippines, for example, when the Metropolitan Manila Water and Sewerage System (MWSS) was privatised by concession, the city was divided into two zones and there had to be a different operator in each zone (Orwin, 1999). The division of the contract was expected to facilitate the task of the regulator by enabling yardstick competition to be implemented (Johnstone, Wood and Hearne, 1999). This approach not only gives the regulator some, albeit limited, opportunity to use yardstick competition for setting prices and service quality standards, and improves its bargaining position, but it also "makes it easier for local community and planning agencies to forge consultative links with" the utilities (Rees, 1998).

In Australia, Sydney Water, the publicly-owned utility in charge of water supply and sewerage in Sydney, decided to grant build, own and operate (BOO) contracts for four water treatment plants to three different operators. The reason for this decision was that by opting for several operators, Sydney Water gained access to information from each that can be used as a benchmark in assessing the performance of the others and in negotiating tariff adjustments (Chapman and Cuthbertson, 1996 and 1999). It also gained access to a wider range of water treatment technologies, strengthening its hand in future expansions and upgrading.

A similar approach is used in Mexico, where, in 1993, the management contract to renovate and improve the water supply and sewerage services in Mexico City was awarded to four different consortia, each responsible for a separate similar-sized service zone. Although awarding only one contract for the city as a whole could have resulted in lower costs, it was decided that the benefits of having yardstick competition outweighed the costs arising from the loss of economies of scale (Casasús, 1994).

Obviously, the potential benefits of improved access to information may be counter-balanced by other concerns. For example, in Buenos Aires, Argentina, this approach was rejected: (i) because of the time and investment needed to divide the system; and (ii) because the least costly division was not very attractive (e.g., the parts would not be particularly comparable and one of them would be much less attractive for potential investors) (Alcázar, Abdala and Shirley, 2000).

There is also interest in yardstick competition in the United States, where this term has historically referred to the idea that, principally in the electric industry, publicly-owned utilities can serve as yardsticks against which the performance of private companies can be measured (Phillips, 1993). The origin of this approach dates back at least to the thirties when an important component of the regulatory policies in the electric industry was a series of initiatives designed to put competitive pressure on privately-owned electric utilities by providing financial assistance to municipal and co-operative electric systems. "One rationale for these policies was that yardstick competition would provide a meaningful comparison between rates of the public and private power, thereby setting a benchmark for state regulation of investor-owned utilities and providing an implicit threat of municipalization" (Nordhaus, 1998). Although there has been endless controversy over whether the publicly-owned utilities are really fair yardsticks for private power, the fact is that the competition-by-example or by threat of displacement by public enterprise has greatly improved the performance of this industry in the United States (Kahn, 1988). In general, a publicly-owned utility engaged in the same line of business as the regulated privately-owned utility is an attractive and obvious benchmark; the problem is that this benchmark is not necessarily useful both because publicly-owned utilities are often very different from privately-owned ones, and because they are not always efficient (Shleifer, 1985).

Less formal forms of yardstick competition can also play a useful role in regulation. For example, periodical publication of comparative information on key indicators of utility performance (e.g., tariffs, leakage levels, investment expenditure on standard infrastructure items) can act as informal pressure on public utilities to improve their performance and to refrain from monopoly power abuses (Rees, 1998). It also provides a useful management tool for public utilities' managers enabling them to compare and evaluate their organisation both internally and externally in various areas. No manager, shareholder, regulator, politician or customer would be happy to see his or her public utility at the bottom of a published performance league table.

7. Consumer participation

Consumer participation is crucial to effective regulation of public utility industries, especially water supply and sewerage where consumers cannot take their business

elsewhere. Giving consumers a voice in the regulatory process, so that they can obtain the information they need to formulate their views and have an opportunity to be heard before the decisions are made, is vitally important in the regulation of public utilities because:

- Consumer participation is a very useful source of information which otherwise regulators have only limited means of acquiring. For example, consumers are usually the best monitors of business practices, service quality and reliability.

- Perhaps more important is the fact that, without consumer participation, regulators will not necessarily know what consumer concerns and priorities are in their area (McKechnie, 1998). Consumer participation helps identify and specify consumers concerns and priorities, and can help ensure that both the regulator and the utilities are aware of, and are responsive to, them, leading to more considered outcome. When applied to the investment planning phase, consumer input promotes a demand orientation to investments, and consequently greater sustainability and commercial viability (Triche, 1993).

- Finally, giving consumers a voice in the regulatory process helps legitimise it, reduces incentives for ex post opportunism on the part of regulators and governments (see page 72), contributes to political and regulatory stability which is important in providing a basis for investment, and helps ensure that the interests of consumers are balanced with those of the other parties concerned. For example, consumer participation can help create acceptance of the higher tariffs that often accompany sector reform and builds public confidence in the changes (Triche, 1993). It is essential to recognise that, in the long-term, it "isn't the regulators who are deciding the permissible rates to charge. It's the customer ... New laws and regulations and the related economic implications are not in themselves the drivers of changes; they are the result of customer (... voter) attitudes and actions" (Graham, 1995b). Consumer participation can also help make regulatory authorities more responsive and accountable to customers and less subject to capture by interest groups.

Consumer participation will, however, only be effective and play a constructive and useful role in the regulatory process, if customers have unimpeded access to sufficient and unbiased relevant information. It is for this reason, that consumer participation should be supported by requirements for public disclosure of relevant information, including free access to legislation and other documents (e.g., contracts) relating to the regulation of public utilities and regular publication of key indicators of utility performance (financial accounts, service records, etc.)

Consumer organisations should also have adequate resources to do their jobs properly, including the ability to conduct research into consumers' needs, concerns and problems (McKechnie, 1998). In this context, in some countries, governments or utilities finance consumer participation in the regulatory process, for example, by paying for experts to help consumer organisations investigate utility accounts and present informed opinions. To help consumer organisations raise their own funds, it has proved useful to allow consumers to insert into utility bills an invitation to join an independent organisation

to represent consumers before regulators, the courts and legislatures, as is done in some states in the United States (Palast, 1996).

The United States regulatory approach, based on the concept of public hearing, in which decisions are made in a quasi-juridical setting based on administrative law, has important advantages in that: (i) a regulator must give public notice of the initiation of a process to make a policy decision; and (ii) all the parties that are going to be affected by proposed actions, including consumers, are provided with opportunities to participate in the proceedings, which include the right to obtain complete information from both the regulator and the utility, to present their views, submit oral and written evidence, to question others who are heard, and to appeal the decision through the court system. The chronology of a typical rate review in the United States is as follows (Palast, 1996):

- ***Month one***: the utility presents its cost records, studies and a written narrative justifying its prices, typically 500 to 2 000 pages long. Consumer groups, local governments and big customers always participate in rate reviews.

- ***Month two*** ("discovery"): the regulators and the customers demand supporting information from the utility which must comply with any and all requests for information, and answer all questions from any party.

- ***Months three and four*** ("cross-examination"): the management of the utility must answer questions (under oath) from regulators and customers about expenditures, accounting, justification for rate of return, etc.

- ***Month five*** ("the regulator's case"): the regulator publishes its preliminary findings, and then stands for questions from the utility and public.

- ***Month six*** ("the customer's case"): the consumers present their own recommendations, with the facts from their independent research, and withstand questions from the utility and regulator.

- ***Months seven to ten***: the cycle of position papers, calculations and attorney-led questioning repeats; and all parties and the regulator sum up their views in writing.

- ***Month eleven***: the regulator issues a detailed decision based on the evidence, often 100 or 200 pages long, subject to court appeal.

As can be seen, the process is open and transparent, and protects the interests of utility customers, the interests of the utilities and investors, and the interest of the general public. Although under this approach the regulatory process tends to be adversarial and decision-making is costly — in terms of both money and time, to say nothing of the costly lobbying on the part of interest groups — the gains obtained from transparent and open decision-making are seen by many experts as outweighing those costs (Stewart-Smith, 1995).

Most states in the United States have special state agencies (offices of consumer advocates) to represent the interests of utility customers before state and federal regulators and in the courts. These agencies operate independently from the regulatory commissions in their states and are designated by state law to act as consumer advocates. In states which do not have this office, the interests of customers may be represented by the attorney general or specialised staff within the commission (Zearfoss, 1998). According to Gormley (1981), the public's perception that information was a key element affecting regulatory decisions was the driving force behind the creation of offices of consumer advocates. These agencies were seen as the means by which information favourable to consumers could be brought before commissions and affect regulatory decisions, otherwise, it was believed, regulated industries would dominate the regulatory process through the control of information.

In England and Wales, the interests of customers are represented, at the regional level, by Customer Service Committees (CSCs), one in each of the ten water supply and sewerage companies' areas of operation. CSCs are established, financed and maintained by OFWAT (OFWAT, 1999a). Their duties are to investigate customer complaints and to represent the interests of water customers. CSC chairmen and members are local people, appointed on merit, the former by OFWAT in consultation with the government, and the latter by OFWAT in consultation with the relevant chairman. Each regional CSC is supported by a small team of staff who are appointed by OFWAT in consultation with the CSC chairman. Legal and technical advice, press and public relations support, personnel and office services are provided by the regulator's office. At the national level, representation of customer interests is the responsibility of Ofwat National Customer Council (ONCC), whose membership brings together the ten regional CSC chairmen. ONCC advises the regulator about the concerns of customers, provides a forum for the exchange of information between CSCs and helps promote good two-way communication between the CSCs and OFWAT, and represents customers' interests to the government and the media. To improve consumer participation in the regulatory process, the government proposes to establish new independent statutory Consumer Councils for energy (electricity and gas), telecommunications and water.

Consumer participation should be effective but neither undermine the private operators' confidence in the stability and independence of the regulatory system, nor create significant opportunities for administrative delay. This is a major challenge for most Latin American and Caribbean countries where historically price-setting in the water supply and sewerage sector has been subordinated to short-run political interests (ECLAC, 1990). One consequence is that many citizens have never had to face the realities of budget-constrained service choice (i.e., the fact that water supply and sewerage services are not free but have to be paid for, and that the choice of service level should be made collectively and rationally in light of the costs and benefits to the community at large), and, in some cases, tend to demand far better service than is realistic at a given price level and than they are prepared to pay for (Peterson, 1991). This suggests that electing, as done in a few states of the United States, rather than appointing, regulators is unlikely to be an acceptable approach in many countries of the region (see page 80).

II. Conduct regulation

The objective of conduct regulation is to determine the permitted patterns of behaviour of regulated utilities in their chosen activity or activities. Examples of conduct regulation are price regulation, service quality regulation, and investment regulation. An important question for regulatory policy is thus how to regulate prices, service quality, investment, and other aspects of behaviour of utilities simultaneously.

The water supply and sewerage industry has the most characteristics of a natural monopoly of all utility sectors. Duplication of the network of water mains and sewers would generally be inefficient and, as a result, the scope for direct market competition is extremely limited (see page 99). Conduct regulation in this industry needs, therefore, to be strong, detailed and permanent, and, since technology changes have been slow and limited, this need will not wither away in the foreseeable future.

To be effective conduct regulation must be concerned with many aspects of behaviour of public utilities. The reason for this is that constrains on any one, or on a small subset, of the regulated utility's decision variables (e.g., price) tend to lead to adjustments in other aspects (e.g., service quality, innovation and investment) of its behaviour that are designed to weaken the impact of regulatory policy on profits (Helm and Yarrow, 1988). Examples of the effect include the implications of price regulation for quality of service (see page 68) and investment behaviour (see page 75). There is, therefore, a natural tendency for the coverage and complexity of conduct regulation to increase and expand over time until it covers all the relevant aspects of the regulated utilities' behaviour that directly or indirectly affect the public interest.

A related problem is that, because of the informational disadvantage facing the regulator, conduct regulation must be primarily concerned with aspects of behaviour and service provision that are readily observable and measurable; and "these may be only loosely related to the issues of underlying concern ... The general weakness of regulating outcomes is that the process generating these outcomes may prove to be inefficient" (Kay and Vickers, 1988). As a result, there is also a tendency for regulators to get more and more involved in utility internal decision-making.

A collateral is that effective conduct regulation is "necessarily a complex business, and to pretend otherwise is likely to have damaging long-term consequences for the industries concerned. Undue simplification of the initial framework of regulation for privatized monopolies will ... very frequently lead to the emergence of much more serious difficulties in the longer term" (Vickers and Yarrow, 1988). These considerations go some way in explaining why, at least in the water supply and sewerage industry, approaches based on the philosophy of regulation with a light hand or on the belief that regulators can

make do with the calculation of simple price indexes or limit themselves to regulating just one aspect of utilities' behaviour (e.g., prices), are likely to prove to be unsustainable in the long-term.

A. Regulation of prices

Price regulation is the cornerstone and the most visible form of conduct regulation. The principal objective of regulation is to protect consumers against monopoly. Since the two principal concerns are excessive profits and monopolistic prices, there are two broad classes of mechanisms of price regulation: (i) those based on costs and rates of return; and (ii) those based on prices (Kay, 1993).

The power of incentives schemes in terms of incentives for cost reduction depends on the link between the regulated utility's allowable prices and its costs or profit performance (Laffont and Tirole, 1993). The mechanisms of price regulation based on costs and rates of return are referred to as "low-powered", and those based on prices as "high-powered". In between these extremes lies incentive regulation (cost or profit sharing).

At one extreme are cost-plus contracts in which the contractor is paid its observed costs and a fee (rate of return). Since this approach ensures that price accurately reflects actual observed costs and hence there are no excessive profits, it provides good incentives for allocative efficiency but weak incentives for productive efficiency. This is a simplistic form of rate-of-return regulation which is the traditional method of price regulation in the United States. It evolved through a series of court cases in the United States to provide procedural fairness in the allocation of rent accruing to public utilities (Newbery, 1998). The objective was to attract private capital to public utilities, while avoiding excessive exercise of monopoly power (Laffont, 1994). The emphasis is clearly on fairness, and this approach is often criticised by economists because it is believed to provide weak incentives for cost reduction and innovation.

At the opposite end of the spectrum are fixed-price contracts in which the contractor is paid a fixed fee. Since the contractor can keep the benefit of any increase in profits derived from a reduction in costs, these benefits and problems are reversed: this approach provides good incentives for productive efficiency but weak incentives for allocative efficiency because price and costs may turn out to be far apart. This is an extreme form of price-cap regulation which is the most distinctive feature of price regulation in the United Kingdom. It was designed in the United Kingdom specifically to provide strong incentives for cost reduction and facilitate the transition from monopoly to competitive markets (e.g., in telecommunications and energy). The emphasis is clearly on productive efficiency, and this approach is often criticised "for its lack of fairness in the distribution of rents between consumers, shareholders and managers" (Newbery, 1998). Thus, in price regulation there is an inescapable trade-off between the objective of restraining monopoly power (allocative efficiency) and that of providing maximum incentives for cost reduction (productive efficiency).

Although there appear to be important differences between the two approaches to prices regulation, in public utility industries each one inevitably incorporates some of the features of another, so neither one is a pure cost-plus or pure fixed-price contract. In practice, there are important forces encouraging their convergence: "In the industry in which the price cap approach has been most explicitly adopted — U.K. water — the regulatory regime appears in practice to be converging quite rapidly on rate-of-return regulation" (Kay, 1993). In the United States, the perceived weak incentive properties of rate-of-return regulation have led to a move away from its traditional forms to price-cap and other forms of incentive regulation, particularly in the telecommunications and energy industries.

The principal reasons for convergence of rate-of-return and price-cap regulation are that in both price regimes: (i) investments will only be forthcoming if shareholders expect to earn a rate of return that at least equals the cost of capital; (ii) since allocative efficiency requires (and public acceptance depends on) that the rate of return equals, or at least not exceeds for a long period of time, the cost of capital, the regulator is inevitably forced to consider such factors at review time; (iii) since both costs and demands change over time, prices are set for some length of time and must periodically be reset in order to prevent prices deviating from costs and profits from normal levels for long periods of time; (iv) under both approaches, price is set on the basis of the same key components (i.e., the operating expenditure, the capital expenditure, the asset valuation and the cost of capital), so both require similar information; and (v) because of the problem of asymmetric information, the regulator only has a limited ability to decouple a utility's price structure from its own reported costs and profits. As a result, most mechanisms of price regulation can be regarded as hybrids between rate-of-return and price-cap regulation, depending upon the length and nature of the period between price reviews, the expectations of how prices will be adjusted at the end of that period, and the degree of discretion over pricing policy that is given to regulated utilities.

This is not to say that there are no differences between them, but that these differences are much less obvious and much more complex than the advocates of each approach appear to believe. Which one should be preferred? It is essential to realise that the choice is not between either rate-of-return or price-cap regulation, rather these two approaches to price regulation "provide useful benchmarks for thinking about the development of practical regulatory mechanisms, given a country's regulatory and legal capabilities and the initial conditions of the infrastructure sector" (Joskow, 1998). Much will depend on:

- specific regulatory goals that the regulator pursues in the industry in question (e.g., encouraging efficiency and innovation, facilitating the transition to competitive markets, providing investment incentives, or establishing a regulatory regime that is perceived to be fair and is widely accepted by the public);
- the initial economic conditions of the industry and its economic characteristics, including the scope for new entry and competition afforded by the underlying technical and market conditions as well as for cost reduction and productivity increases; and

- the extent of the information asymmetry between regulator and regulated utilities, particularly the capability of the former both to acquire adequate information and to estimate realistic cost levels (and hence set reasonable prices).

1. Rate-of-return regulation

Rate-of-return regulation, also known as cost-of-service regulation, is the traditional method of regulation of public utilities in many countries and the most distinctive feature of public utility regulation in the United States. The general principle underlying this approach is that price levels should be set so as to provide a well-managed public utility the opportunity to recover all of its prudently incurred costs, including a fair and reasonable return on the capital employed. How is rate-of-return regulation applied in practice? Let us consider the case of the United States (this discussion is based on Phillips, 1993; Morin, 1994; Schneider, 1997).

Under rate-of-return regulation, the establishment of a price for a public utility involves two steps. The first is the determination of a public utility's total revenue requirement, also referred to as the total cost of service. The second is the determination of a public utility's rate structure, also referred to as rate design. Its objective is to set prices so as to recover, during the foreseeable future until another proceeding, the amount of the revenue requirement.

A public utility's total revenue requirement is defined as the sum of operating costs and a fair return on the fair value of the capital invested in the business. An estimate of total revenue requirement is derived from a thorough audit of the public utility's books during a test year, which can be a historical, future or hybrid accounting period, adjusted for known changes in revenues, expenses and investments between the test year and the period for which the new rates will be in effect.

Operating costs include operation and maintenance expenses, depreciation and taxes. Generally, prudently incurred and reasonable operating costs can be recovered in rates. Regulators are entitled to exercise supervision over operating costs and can disallow them if they are unnecessary or unreasonable. Operating costs that are not directly determined by competitive forces (e.g., executive salaries, payments to affiliated companies, expenses for advertising, litigation, public relations) or by regulatory authorities (e.g., taxes) usually receive special attention by regulators. When an expenditure is found to be extravagant, to represent an abuse of discretion or to be unreasonable, it is disallowed and the public utility's shareholders must bear the cost. As for annual depreciation rates, regulators typically look at the useful economic life of the assets and derive a depreciation rate from that useful life. These rates are then applied to the original cost of the facilities to determine how much depreciation can be taken as an expense in each year.

The fair return component of the public utility's total revenue requirement is obtained by multiplying the rate base by the allowed rate of return set by the regulator. The rate base is the net or depreciated value of the public utility's plant and equipment that are considered used and useful in providing services to the public, plus some

reasonable allowance for working capital requirements and, depending on the circumstances, the cost of acquiring water rights. The rate base may also include any investment to be undertaken by the public utility. Certain items may be disallowed: excluded from the rate base (e.g., imprudent investments) or shared between the ratepayers and the stockholders (e.g., excess capacity). Methods of estimating the value of public utility's property differ. In recent years, regulators generally have favoured original cost valuation or the amount actually paid for installing the original plant and equipment, while public utilities have argued in favour of reproduction cost valuation or the cost of the plant and equipment estimated at price levels prevailing at the date of valuation.

The cornerstone of rate-of-return regulation is the setting of a fair and reasonable rate of return. Decisions of the United States Supreme Court (see Box 5) have established the following standards of fairness and reasonableness of the allowed rate of return for a public utility: (i) a standard of financial integrity (i.e., the allowed rate of return should be sufficient to assure confidence in the financial health of a public utility); (ii) a standard of capital attraction (i.e., a public utility is entitled to a rate of return that will allow it to maintain its creditworthiness and attract additional capital on reasonable terms); and (iii) a standard of comparable earnings (i.e., the allowed rate of return should equal the expected rate of return of other comparable risk companies). Whatever rate of return is allowed, confiscation of the property of a public utility must be avoided as must be avoided exploitation of customers, and regulation does not guarantee a fair rate of return: "while being protected against arbitrary acts by regulators, they are not protected from the operation of economic forces" (Crew and Kleindorfer, 1990).

Regulators have typically used the following four main approaches to derive the allowed rate of return: (i) the comparable earnings standard, which uses the rate of return earned by companies comparable in risk to the public utility in question as the measure of a fair rate of return; (ii) the discounted cash flow model, which uses as the measure of a fair rate of return the present value of investors' expected dividends and growth in stock prices of companies having comparable risks; (iii) the risk premium approach, which estimates a fair rate of return on the basis of information on the relative risk premium between stocks and bonds; and (iv) the capital asset pricing model, which holds that a fair rate of return is equivalent to the risk-free rate plus a risk premium related to the risk inherent in the stock of the public utility in question. It is important to note that a regulator is not bound to use any single approach in determining rates. It is the end result, not the method employed, that matters: the allowed rate of return must be fair and reasonable. This practice is in sharp contrast to that prevailing in some Latin American countries where not only the specific approach but also the definitions of the variables to be used in determining the allowed rate of return are spelled out in great detail in the legislation.

As Holtram and Kay (1994) note: "But what is a reasonable return on capital? This is inherently a matter of judgement — it would be difficult to argue that 6.5 per cent was a reasonable return on capital but 6 per cent and 7 per cent were not — and, moreover, a matter on which judgements will quite properly vary over time. The law could prescribe a formula for determining the appropriate return — choosing, for example, between the capital asset pricing model and the dividend growth model and specifying how coefficients were to be calculated. But any such law would be rapidly overtaken by events". Yet, this is exactly what are doing some Latin American and Caribbean countries.

Box 5

Landmark United States Supreme Court cases which provide the foundations for the notion of a fair and reasonable rate of return

Willcox v. Consolidated Gas Co. of New York (1909)

"There is no particular rate of compensation which must, in all cases and in all parts of the country, be regarded as sufficient for capital invested in business enterprises. Such compensation must depend greatly upon circumstances and locality; among other things, the amount of risk in the business is a most important factor, as well as the locality where the business is conducted, and the rate expected and usually realized there upon investments of a somewhat similar nature with regard to the risk attending them. There may be other matters which, in some cases, might also be properly taken into account in determining the rate which an investor might properly expect ... or hope to receive and which he would be entitled to without legislative interference. The less risk, the less right to any unusual returns upon the investments. One who invests his money in a business of a somewhat hazardous character is very properly held to have the right to a larger return, without legislative interference, than can be obtained from an investment in government bonds or other perfectly safe security."

Bluefield Waterworks and Improvement Co. v. Public Service Commission of West Virginia (1923)

"A public utility is entitled to such rates as will permit it to earn a return on the value of the property which it employs for the convenience of the public equal to that generally being made at the same time and in the same general part of the country on investments in other business undertakings which are attended by corresponding risks and uncertainties; but it has no constitutional right to profits such as are realized or anticipated in ... highly profitable enterprises or speculative ventures. The return should be reasonably sufficient to assure confidence in the financial soundness of the utility and should be adequate, under efficient and economical management, to maintain and support its credit and enable it to raise the money necessary for the proper discharge of its public duties. A rate of return may be reasonable at one time and become too high or too low by changes affecting opportunities for investment, the money market and business conditions generally."

Federal Power Commission v. Hope Natural Gas Co. (1944)

"From the investor or company point of view it is important that there be enough revenue not only for operating expenses but also for the capital costs of the business. These include service on the debt and dividends on the stock ... By that standard the return to the equity owner should be commensurate with returns on investments in other enterprises having corresponding risks. That return, moreover, should be sufficient to assure confidence in the financial integrity of the enterprise, so as to maintain its credit and to attract capital."

Source: United States Supreme Court (1909), (1923) and (1944).

The next step is tariff calculation. Regulators set tariffs so as to recover the total revenue requirement, so the average tariff can be obtained by dividing the total revenue requirement by the quantity of output demanded. In practice, the problem is much more complex, because there is typically an attempt to apportion the total revenue requirement among different customer classes (e.g., residential, commercial and industrial) and categories of service on the basis of cost causation principles. The determination of individual rate levels is a two-step process: first, the costs that can be directly and unambiguously attributed to a particular service are assigned to that service; second, the remaining costs are assigned to individual services using some allocation formula, for example, on the basis of direct costs, revenues, output, etc. (Braeutigam, 1992). The problems is that cost allocation procedures tend to become somewhat arbitrary in the presence of large common costs, as is often the case in public utility industries (Brock, 1998). This procedure gives rise to separate revenue requirements and hence different rates for each customer class and category of service designed to recover the apportioned costs for that class and category. Finally, rates are computed using established rate design methods. In the United States, rate design for water utilities is becoming more sophisticated (e.g., seasonal, increasing-block and lifeline rates) and rates that encourage efficient water use and conservation are getting increasing attention (Beecher, 1997).

Regarding setting rate structures, rates must be just and reasonable, and undue or unjust discrimination among customers is prohibited.

Once new tariffs are set, they usually remain unchanged, for a period of time known as the regulatory lag, until the next regulatory review, which, under rate-of-return regulation, is usually initiated by the public utility, but can also be initiated by the regulator or triggered by customer complains. Tariffs are usually set in nominal prices, but may also be indexed to inflation or the price of inputs (e.g., fuel costs). During the regulatory lag, a public utility can appropriate the benefits of improved cost efficiency, but must also bear all of any increased costs. This means that the regulatory lag is advantageous to a public utility when costs are falling and revenues are rising, and disadvantageous when costs increase and revenues decrease.

Under rate-of-return regulation, the regulatory lag is relatively short and endogenous (i.e., its timing depends upon how the utility behaves in the meantime), and regulatory reviews are sensitive to current cost conditions (i.e., the last period's costs serve as the basis for the future period's prices). As a result, prices track costs closely, there are no excessive profits, consumers benefit soon from any cost reduction or innovation, and a good insurance against cost movements is provided to public utilities, but they have only weak incentives to act to reduce costs. As a practical matter, however, there are usually some deviations between the approved rate of return and the realised rate of return, principally because filing a rate case and obtaining regulatory approval to change prices tends to be time-consuming and expensive. In fact, prices are sometimes fixed for log periods of time (Schmalensee, 1995) and the regulatory lag often lasts several years (Joskow, 1998). In California, for example, each water utility is allocated a time for filing its general rate case application once every three years and processing a filing takes about 240 days (CPUC, 1997).

To make possible a longer regulatory lag and to reduce regulatory burden, many states in the United States use automatic rate adjustment mechanisms, whereby public utilities are allowed to adjust their output prices in response to changes in their input prices that are beyond their control (electric power for pumping, property tax increases, employee wage increases, and water price increases), without going through the lengthy proceedings associated with formal rate cases (NARUC Staff Committee on Water, 1998). Since automatic adjustment clauses may reduce incentives to switch production process to lower-cost inputs and to search and bargain to obtain inputs at the lowest prices, a number of states use lags, partial adjustments or input price indices (rather than actual prices paid) to avoid these problems and to preserve incentives for cost reduction (Berg and Tschirhart, 1988).

In recent years rate-of-return regulation has been criticised because: (i) it provides poor incentives to reduce costs and innovate; (ii) it encourages public utilities to use an inefficiently high capital/labour ratio for its level of output or the so-called Averch-Johnson effect; and (iii) it is unduly burdensome and costly to operate. It is worth noting, however, that one of the remarkable features about the literature criticising rate-of-return regulation, "is the relative dearth of empirical work providing evidence that the theoretical deficiencies actually occur in practice. Still less attention has been paid to the question as to whether the alleged defects are inherent products of the form of regulation employed or result from

the political context in which all regulatory systems have to operate" (Rees, undated); this literature also provides "no clue whatsoever on whether those defects are the outcomes of optimal trade-offs" (Laffont, 1994).

The lack of incentives to reduce costs and innovate. It is often argued that the fact that rate-of-return regulation is based on capping profits rather than prices means that poor incentives are provided for cost reduction, except in a limited way through the regulatory lag. On the one hand, at least in theory, the regulator examines the public utility's profits from time to time and can initiate a rate review if its profits diverge much from normal levels. In practice, however, in the United States, public utility commissions have tended not to intervene when profits are increasing, provided that prices are not increased (Beesley and Littlechild, 1989). On the other hand, should its costs rise sufficiently to justify the expense of a rate case, a public utility can always seek a corresponding rate increase which would typically be granted within a year or so. Since prices track costs closely, public utilities have no profit incentive to reduce costs and innovate, and since, because of the asymmetry of information, regulators are unlikely to know what the efficient cost level should be, they are not in a good position to argue that utilities are run inefficiently (Shleifer, 1985).

The fact that the regulatory lag is relatively short means that incentives for cost reduction and innovation are low because the public utility can keep its cost savings only for a short time. As the time of the new regulatory review approaches, a public utility will have less and less incentives to reduce costs, and, since this review is sensitive to its current cost level, it could even come to favour higher costs than it really has (the so-called "ratchet effect").The reason for this effect is that, since a regulated utility knows that its recently achieved cost level will be used by a regulator at the next regulatory review as the basis for setting revised prices in a subsequent period, it has an incentive to misrepresent its costs in order to obtain more advantageous terms in that period: this "is the depressing phenomenon of good performance today resulting in a higher target being set tomorrow" (Vickers, 1995). The utility also has an incentive to avoid making cost reductions later in the regulatory cycle and to delay them until after a regulatory review.

A closely related problem is that incentives to innovate may be dampened due to the asymmetric treatment of extraordinary losses and gains by regulators (Morin, 1994). For example, if a public utility makes a successful innovation that results in much greater profits than expected, there is a tendency for the cost savings to be passed on to customers (Train, 1991). On the other hand, if a public utility makes a decision that later proves to have been wrong, then there is a tendency to force it to absorb a large part of the costs of this decision rather than pass on the entire cost to its customers. According to Rathnam and Khaitan (1995), investors "in the United States ... have, in recent decades, become used to a 'heads you win, tails I lose' relationship between utility companies and regulators, where the cost savings from advances in efficiency are passed on to consumers in the form of lower rates while increased costs are borne by investors in the form of reduced profits and dividends". A net result is that a public utility may be unable to capture the cost savings of its efforts and innovations, and hence may be induced to undertake projects that are too conservative.

It is for these reasons that many experts believe that "rate-of-return regulation is potentially a recipe for misdirecting management's energies towards negotiating a higher regulatory asset base or a higher permitted rate of return, rather than towards achieving a higher rate of return by greater productive efficiency or innovation in products and services to meet consumer needs" (Whittington, 1994). Furthermore, a series of empirical studies of the water supply and sewerage industry in the United States has failed to find statistically significant differences in the relative efficiency of privately-owned water utilities subject to rate-of-return regulation and their publicly-owned counterparts which would seem to confirm the low incentive properties of rate-of-return regulation (see Box 1).

In reality, the problem of weak incentives to reduce costs and innovate is mitigated by several factors. The most important one is that regulators have oversight control over public utilities and always review management actions after the fact to ensure that only prudent costs and expenses are allowed in customer rates. For example, costs are subject to elaborate accounting and auditing requirements, and proven imprudent or excessive expenses and costs may be disallowed. In determining the utility's revenue requirement, regulators typically consider whether its management has followed norms of prudent business behaviour and whether there was an economic need for the capacity that was built (Gilbert and Newbery, 1994). "Therefore, in an attempt to prevent cost exaggeration, for example, the regulator might in practice scrutinize certain expenditures carefully and disallow them from the rate base if there is any evidence that they were not necessary. Similarly, in an attempt to prevent demand exaggeration, excess capacity could be disallowed from the rate base (as it often is). Also, in an attempt to limit underestimates of demand, the firm could be penalized when rationing is observed" (Lewis and Sappington, 1988). The ability of regulators to disallow imprudent or excessive costs provides a strong incentive to utilities to be efficient: "This review process has to a large degree been successful in preventing grossly excessive spending by regulated companies" (Ben Johnson Associates, 1998). The rate of return is never guaranteed, rather it must be earned through effective management, and the increases is prices due to increased costs are not automatic.

Regulatory lag, which often lasts several years, reinforces the public utility's incentives to reduce costs and innovate. In the United States, rate-of-return regulation worked best when the lags between rate reviews were relatively long because nominal input costs were falling due to productivity growth and low input price inflation (Joskow, 1998). Conversely, it did not work so well when the lag became very shot because of rising inflation.

In addition, rate-of-return regulation, as implemented in the United States, incorporates a number of other institutional features which discourage inefficient behaviour, such as "disallowance of imprudently incurred expenses, prudence reviews and application of the used-and-useful test, yardstick performance comparisons ..., commission-ordered management audits of both the reconnaissance and focused type, judicious employment of regulatory lag, altering the allowed rate of return to induce appropriate utility behaviour, occasional and selective jawboning by regulators" (Jones, 1992). In summary, one can say that the truth of this criticism largely depends upon the extent to which regulators can effectively exercise their oversight function.

In the United States, the perceived weak incentives under rate-of-return regulation have led to a move away from its traditional forms and toward versions incorporating stronger incentives for cost reduction, particularly in the telecommunications and energy industries which are becoming more competitive (Giulietti and Waddams, 2000). Common approaches include: price-cap regulation (Beecher, 1997), sliding scale regulation (Braeutigam and Panzar, 1993),[1] flexible regulation (e.g., allowing utilities to charge rates within an acceptable range and authorising them to negotiate rates with specific customer classes, subject to regulatory approval) (Bull, 1995), targeted incentive plans (these seek to improve the effectiveness of regulation by providing performance incentives for specific, well-defined areas of utility activity such as efficient input purchases, increased capacity or investment in infrastructure, and demand-side management or conservation), and external performance indexing plans (these use external benchmarks, such as the performance of other similarly situated utilities, to measure a utility's performance), among others.

The move from rate-of-return regulation is largely limited to the energy and telecommunications industries, which are becoming more competitive and where, in contrast to the water supply and sewerage industry, the objective of price regulation is basically to fill a gap during the period before competition arrives (see page 110). The basic rationale, not always justified, for abandoning rate-of-return regulation in these industries is that price-cap regulation is viewed as a regulatory instrument facilitating the transition from monopoly to competitive markets, while rate-of-return regulation is believed to perform relatively poorly in dealing with mixtures of competition and monopoly (Brock, 1998; Berg and Foreman, 1995; Levy and Spiller, 1993). Obviously, this development is of little relevance to the water supply and sewerage industry which displays almost no scope for direct market competition (see page 99) and where the need for conduct regulation is, therefore, permanent. In this and other utility industries, where the scope for competition is extremely limited and the rate of change in technology is low, price-cap regulation, even if adopted, may gradually become indistinguishable from rate-of-return regulation (Beesley and Littlechild, 1989).

The Averch-Johnson effect. Averch and Johnson (1962) developed a model which suggests that rate-of-return regulation encourages public utilities: (i) to use an inefficiently high capital/labour ratio for their level of output; and (ii) to expand into other regulated markers, even if they operate at a loss in these markets. This is called the Averch-Johnson effect or gold-plating. It is argued that this alleged source of inefficiency operates as follows: although there are restrictions on the return that a public utility may make per dollar of capital, there are no direct limits on its absolute profits, providing an incentive to expand its capital stock to increase the total return arising from a given rate of return (Boadway and Wildasin, 1984). The end result is that a public utility is induced to use

[1] Under sliding scale regulation, a public utility keeps all profits if its realised rate of return is less than some specified level. The public utility is than allowed a portion of any further earnings above that level with the rest being returned to customers (e.g., through a tariff reduction). Two broad approaches are possible: progressive sharing, where the share going to customers is positively correlated (increases) with the size of excess profit, and regressive sharing, where the share going to customers in negatively correlated (decreases) with the size of excess profit (Viehoff, 1995). The former approach is believed to provide stronger incentives for smaller cost reductions and the latter for larger ones. Navarro (1996) argues that regressive sharing is preferable because it provides a progressively rising incentive for the utility to continue to reduce costs; otherwise "it may only skim the cream: pursue the easiest cost savings and then stop once it has achieved them".

more capital, less labour and more capital-intensive techniques of production than is needed for its level of output, which is produced at too high a cost. To the extent that the Averch-Johnson effect operates, it does so subtly (Johnson, 1973). For example, the utility may prefer to buy rather than to lease equipment on grounds that to do so gives it greater control over the reliability, availability and use of the equipment, but the fact that the former approach allows it to expand its rate base will also play a role in biasing the decision.

In the seventies, the Averch-Johnson effect received considerable attention in the literature on the economic theory of regulation. Although earlier studies generally supported the Averch-Johnson thesis, they were later criticised for abstracting from many important aspects of real-world regulation, and more recent studies concluded that the existence of the Averch-Johnson effect was dubious or even found under-capitalisation (Geddes, 1998). For example, Gilbert and Newbery (1988) show that rate-of-return regulation, as implemented in the United States where it requires the regulator to allow a fair return only on capital that is considered to be used and useful, can overcome the Averch-Johnson bias. Empirical tests were also inconclusive as to whether public utilities actually engaged in such behaviour. According to Train (1991), the Averch-Johnson effect can be viewed as a worst-case situation, in which the regulator is unable to distinguish between efficient and inefficient behaviour.

Whether one agrees with Averch and Johnson (1962) or not, in contrast with their early concern about over-capitalisation, in recent years concern has shifted to the danger of underinvestment (see page 72) as the crucial problem (Armstrong, Cowan and Vickers, 1994). This implies that to the extent that the Averch-Johnson effect operates, it may have a beneficial aspect in that the incentive to over-capitalisation may offset the bias to underinvestment.

Regulatory burden. It is frequently argued, principally on the basis of analysis of the United States regulatory practice (see page 33), that rate-of-return regulation is unduly burdensome and costly to operate and fails to reach decisions expeditiously, especially in the case of public utilities serving both non-competitive (regulated) and competitive (unregulated) markets: “The quasi-judicial regulatory process is increasingly being regarded as being too cumbersome, too slow, unduly complex, subject to never-ending reconsideration, and incapable of reacting with the necessary sweeping policy changes in a rapidly evolving utility environment” (Wirick, 1999).

Determination of the rate base, the rate of return and the costs of operation, and the allocation of common costs demand accurate and detailed information, involve extensive research into the accounts of public utilities, and require judgement on complex technical issues. These difficulties are especially large when the regulated utility serves multiple markets, some of which are competitive and others are not (this is admittedly a minor concern in the water supply and sewerage sector). All this involves considerable costs and the adversarial, rigid and quasi-juridical nature of the regulatory process exacerbates these costs. The complexity of the system is believed to encourage lobbying, misrepresentation and misreporting of information, regulatory capture, and wasteful and costly gaming between public utilities and regulatory authorities.

Rate-of-return regulation, as any form of regulation, imposes costs on public utilities in terms of the opportunity costs of the resources devoted to complying with the regulatory framework. Since there are many fixed costs associated with rate cases (i.e., they do not vary much with the amount of the filing), small utilities face proportionally much higher costs than large utilities (Crew and Kleindorfer, 1990). One of the most striking features of the water supply and sewerage industry in the United States is that it is made up of primarily small utilities: 94% of the 59 266 water utilities in the United States serve populations of less than 10 000 (Jordan, 1998).[1] Many small water utilities lack the financial and managerial resources to comply with procedures developed for the much larger utilities typical of other regulated industries (Beecher, 1997).

Crew and Kleindorfer (1985) found that the administrative costs associated with the regulatory process averaged 0.87% of total revenue for large water utilities and 5.25% for small utilities. Small utilities file less frequently, presumably because of the relatively high costs involved in a rate case, and have little if any familiarity and expertise in the regulatory process. The problems of small utilities in obtaining timely rate relief undermine their ability to provide adequate service. In the United States, these problems have led many public utility commissions to adopt measures to lessen the regulatory burden on small water utilities. For example, many public utility commissions have developed some form of simplified filing requirements that are less intimidating to small water utilities and can be completed with minimal effort by them (NARUC Staff Committee on Water, 1998).

Although there is a clear need for a more flexible, less costly, more expedient and less administratively burdensome system, "it isn't clear that significant cost savings can be realised. While many jurisdictions have experimented with price caps and other substitutes for traditional regulation, it isn't clear whether this has resulted in any net reduction in the costs of regulation" (Ben Johnson Associates, 1998). The experience with the application of price-cap regulation also suggests "major administrative ... burdens" (Jones, 1992), and that it is "doubtful that substantial administrative savings have been realized" (Berg and Foreman, 1995). Other experts consider that there is "little evidence that the regulatory burden need be excessive under rate of return" regulation (Rees, undated), and that this form of regulation "is easy to administer and enforce and provides transparency" (Pollitt, 1999).

Finally, it is important to remember that effective regulation is necessarily a complex business, and that there are reasons to believe that the gains obtained from transparent and open decision-making outweigh the costs involved: "The argument against the open process is the charge every dictator ... levels against democracy: it is messy, time-consuming, complex, disappointing, chaotic and influenced by money and crowd sentiment. It is undoubtedly true that the US system offers no miraculous check on utilities

[1] These problems help explain why the water supply and sewerage industry in the United States is under increasing economic and political pressure to consolidate: small, contiguous water utilities are merging, and larger utilities are acquiring smaller ones around the country (Graham, 1995a). In some states, utility regulators provide financial incentives for consolidation (e.g., by granting a utility a slightly higher rate of return if it takes over a troubled water supply and sewerage system or allowing it to include in the rate base the excess of the purchase price over the depreciated original cost of the assets) (Little Hoover Commission, 1996). In addition, some states have enacted legislation that gives their regulatory agencies the authority to require a take-over of a troubled water utility under certain circumstances (Phillips, 1993).

that can outspend the public on attorneys and experts. However, the fact remains that US prices are lower due to this democratic system of regulation" (Palast, 1996).

Notwithstanding the criticisms that have been made of its incentive properties, rate-of-return regulation does possess some basic advantages which make it possibly attractive for Latin American and Caribbean countries:

- By providing a solid guarantee of a fair rate of return, rate-of-return regulation offers a type of long-run commitment which is crucial for investments with a high sunk cost component which are very important in the water supply and sewerage industry (Laffont, 1994). Public utilities subject to this form of price regulation tend to have a lower cost of capital than utilities subject to price-cap regulation (Alexander and Irwin, 1996; Grout, 1995). Public utility industries in the United States and other developed countries evolved under some variant of rate-of-return regulation and, "whatever the faults of this system, inadequate investment and shortages of capacity to meet demand are rare among them" (Joskow, 1998). Accordingly, this approach is potentially attractive in situations where quickly attracting a large amount of capital investment on reasonable terms is considered important. Since it protects investors in risky environments, it may end up encouraging some of them to participate in projects they would have not otherwise considered given the level of risks involved (Burns and Estache, 1998). Furthermore, there are reasons to believe that rate-of-return regulation provides better incentives for the provision of service quality (see page 68).

- At high levels of cost uncertainty and asymmetric information about the capabilities of public utilities, rate-of-return regulation generally performs better than price-cap regulation, particularly in terms of consumers' surplus (Schmalensee, 1989). Rate-of-return regulation is also likely to reduce the ability of public utilities to profit from regulatory ignorance and favourable cost shocks. The incentive for the regulated industry to exercise pressure in order to affect the regulatory outcomes is also likely to be weaker under rate-of-return regulation then under price-cap regulation and other high-powered incentive schemes, because the latter "are bound to leave high potential rents to the industry and thus create high payoffs to collusion" and capture (Laffont and Tirole, 1991). On the whole, a "thorough reading of the literature leaves one with the feeling that in spite of its failings, rate of return regulation remains the best overall regulatory framework" (Morin, 1994).

2. Price-cap regulation

Price-cap regulation, also known as RPI—X regulation, was developed in the United Kingdom in the eighties (see Box 6). It attempts to avoid some of the perceived problems associated with rate-of-return regulation. When this approach was originally proposed, it was claimed to be superior to rate-of-return regulation, particularly in settings in which the role of competition was increasing (e.g., energy and telecommunications), on the following grounds: (i) rather than covering the whole business of a public utility, or a large part of it, it would focus regulation explicitly on the particular services where monopoly power and

Box 6

Water supply and sewerage industry regulation in England and Wales

Before the Water Act of 1989 which brought about privatisation in England and Wales, there were ten publicly-owned water authorities supplying water and sewerage services and 29 privately-owned companies supplying water only. The former were privatised in November 1989 and the latter were brought under the same regulatory regime as the rest of the industry (until 1989 they had been subject to the regulatory controls, which were effectively a form of rate-of-return regulation). The Government wrote off the industry's debt of £ 4.95 billion (about US$ 7.9 billion) before privatisation and gave the companies a further £ 1.25 billion (US$ 2.0 billion) cash injection, known as the "green dowry", towards the cost of the investment programme. The companies were sold for £ 5.25 billion (US$ 8.3 billion). The cost of the privatisation was £ 0.13 billion (US$ 0.2 billion). In Scotland and Northern Ireland water supply and sewerage services remain in public ownership.

OFWAT, headed by the Director General (DGWS), is the economic regulator of the water supply and sewerage industry in England and Wales. The primary duties of the DGWS are to act in the manner best calculated to secure that: (i) the functions of the companies are properly carried out; and (ii) the companies are able to finance their functions, in particular by securing a reasonable rate of return on their capital. This means that investors should be in a position where they can expect to receive a return sufficient, but no more than sufficient, to induce them to make loans and hold shares, if the company operates efficiently. Subject to these primary duties, the DGWS has a duty to customers to ensure that: (i) no undue preference is shown and that there is no undue discrimination in the way companies fix and recover charges, and that rural customers are protected (this means that a customer's bill should, in general terms, reflect the costs which that customer imposes on the water supply and sewerage system); and (ii) other aspects of customers' interests are protected, including quality of service and benefits from the sale of land transferred to the companies at privatisation, or acquired since then. Other responsibilities of the DGWS include: promoting economy and efficiency on the part of the companies; enforcing the duty of the companies to promote the efficient use of water by customers; facilitating effective competition and ensuring that a framework exists in which competition can develop; enforcing company licences; and limiting charges.

Each company operates under a licence (Instrument of Appointment). The licence imposes conditions on the companies which the DGWS is required to enforce. Changes to a licence can be made by the DGWS with the company's agreement, or following reference by him/her to the Competition Commission on public interest grounds. The principal Conditions of Appointment are common to all companies:

- Condition A: explains terms and expressions used in the licence.
- Condition B: sets out the formula for calculating price limits, or K factors.
- Condition C: regulates charges for the first-time provision to any premises of a water supply or sewerage service for domestic purposes.
- Condition D: requires companies to fix and publicise their charges for water supply and sewerage services and infrastructure charges.
- Condition E: prohibits undue preference to, or undue discrimination against, any class of customer or potential customer for standard charges.
- Condition F: details the accounts and financial information which companies are required to produce to enable the DGWS to assess their affairs and compare their financial position and performance.
- Condition G: requires companies to obtain the DGWS's approval and publish Codes of Practice for customers, describing services provided, charges, billing arrangements, meter reading and complaint handling.
- Condition H: all companies must have a Code of Practice, including guidance to domestic customers who have difficulty paying bills and setting out the procedures a company must follow before it disconnects the supply.
- Condition I: deals with charges for metered domestic customers when there is an unidentified leak in a part of the pipe that is the customer's responsibility.
- Condition J: each company must provide the DGWS with an annual report setting out performance against various aspects of service.
- Condition K: requires the companies to ensure that they retain access to sufficient assets to be able to perform their duties.
- Condition L: allows the DGWS to check that each company is maintaining and developing the underground assets necessary to fulfil its legal obligations.
- Condition M: requires companies to provide the DGWS with information he/she may reasonably require to carry out his/her functions.
- Condition N: gives the DGWS power to levy annual Licence Fees on the companies sufficient to cover the costs of running OFWAT.
- Condition O: licences were granted from 1 September 1989 for 25 years and may be terminated at any time on or after the expiry of that period, provided ten years' notice is given.

Source: DGWS (2000); House of Commons Library (1998); OFWAT (1995b), (1996b) and (1997c).

Note: In a new development, some water companies are looking at innovative restructuring ideas. In its most radical form this involves the creation of a licensed entity entirely financed by debt that owns the assets of the utility. This then contracts out its operations to service providers. In some versions this asset-owning body would in turn be owned not by shareholders, but by its customers or members in the form of a mutual.

public concern were greatest; (ii) the fact that it was based on capping prices rather than profits would give public utilities stronger incentives for cost reduction and innovation; (iii) for the same reason, it would neither distort the pattern of investment nor encourage inefficient diversification (i.e., it would be less vulnerable to the Averch-Johnson effect (see page 44)); and (iv) because there would be no need to measure the rate base and rate of return or to allocate common costs, it would be simpler to operate and there would be less danger of regulatory capture.

The basic principle behind price-cap regulation is that prices are set on the basis of the costs of an efficient company and remain unchanged for a relatively long period of time. The objective is to provide strong incentives for cost reduction and innovation. If during this period the utility succeeds in increasing its efficiency beyond predicted levels, it will be able to retain that extra profits for a period. At the next regulatory review, these unanticipated cost reductions will be taken into account by the regulator, and the prices that the utility will be allowed to charge in the next period will be set at lower levels than they could have been if the utility had not made those extra efficiency savings. This is the distinctive feature of price-cap regulation which goes some way in explaining why this mechanism of price regulation is both: (i) often regarded as replicating more accurately the competitive process and offering superior incentives for cost reduction and innovation than rate-of-return regulation; and (ii) equally often perceived as conferring unwarranted profits on the utilities at the expense of customers and imposing unsustainable demands on regulators.

Acton and Vogelsang (1989) specify the following four characteristics of price-cap regulation: (i) the regulator set a maximum tariff, called the price cap, to be charged by the regulated public utility; (ii) if the regulated utility provides more than one service, price caps are defined not for individual services, but for baskets of related services; (iii) these price caps are adjusted periodically by a preannounced adjustment factor, such as general inflation or productivity growth, that is exogenous to the regulated utility; and (iv) at longer periods, the adjustment factors and other parameters are reviewed by the regulator and possibly changed.

How are these general principles applied in practice? In the United Kingdom, a public utility subject to price-cap regulation, must ensure that the rate of growth of the price of a basket of its services in one year does not exceed the percentage increase in the retail price index (RPI) adjusted by a factor, known as the “K” factor in the water supply and sewerage sector and as the “X” factor in other industries, which may be positive or negative. The factor is designed to allow the regulated utility to finance the proper carrying out of its functions, while encouraging it to be efficient, and is typically fixed for a period from 4 to 5 years. The factors vary across utilities and across time.

When price-cap regulation was first introduced in the early eighties in the United Kingdom, many commentators thought that it was fundamentally different from rate-of-return regulation. Most now agree that the two approaches “belong to the same family of instruments, with both requiring a similar process and similar calculations” (Green, 1997b). Three principal aspects of the comparison between price-cap and rate-of-return regulation are: (i) the length and nature of the regulatory lag; (ii) the

expectations of how prices will be adjusted at the end of the regulatory lag; and (iii) the degree of discretion over pricing policy that is given to public utilities.

The length and nature of the regulatory lag. Perhaps the key feature that distinguishes price-cap regulation from rate-of-return regulation is that the regulatory lag is relatively long (this explains why, under price-cap regulation, the price cap is adjusted over time by a predetermined adjustment factor, such as an index of retail prices or industry-wide input prices) and exogenously determined (i.e., the date of the next regulatory review is fixed in advance). This means that incentives for cost reduction and innovation are potentially greater, especially in the short-run, than under rate-of-return regulation because the utility can keep the benefit of any increase in profits derived from a reduction in costs for a longer time.

On the other hand, a long and exogenously determined regulatory lag delays the time at which customers benefit from greater efficiency, provides poor insurance to regulated utilities against cost movements, means that the regulated utilities' profits can diverge significantly from normal levels, and reduces but not eliminates the ratchet effect (as time passes the public utility's behaviour will be increasingly affected by the benefits to be gained from influencing the outcome of the next regulatory review). It also subjects regulated utilities to more risk than rate-of-return regulation and the increased risk they bear tends to raise the cost of capital. Empirical studies suggest that public utilities subject to price-cap regulation have to pay about an extra percentage point for their capital (Alexander and Irwin, 1996).

Since under price-cap regulation the regulatory lag is relatively long and exogenously determined, industry conditions are likely to change significantly during this period in ways that cannot be foreseen. As a result, although under price-cap regulation the formal or nominal regulatory lag tends to be long, there is usually scope, both for the regulator and the regulated utilities, to intervene through "cost passthrough provisions" within this period, thus shortening the effective regulatory lag. This mechanism seeks to ensure that a public utility neither loses nor gains from significant cost changes that are exogenous and beyond the control of its management.

In principle, since full cost passthrough does not provide any cost reduction incentives, it should be limited only to factors that are genuinely exogenous. The problem is that although many costs are greatly influenced by exogenous factors (e.g., input prices), public utilities usually have some degree of control over these costs (e.g., by seeking lower cost or less uncertain sources of supply, by signing fixed-price contracts with suppliers, or by adopting the least-cost technology for production) and automatic cost passthrough provisions reduce incentives to minimise these costs. There is, therefore, the danger that cost passthrough provisions could reduce the incentive benefits of a relatively long regulatory lag. This danger can, however, be reduced if the criteria for cost passthrough is clearly specified and the passthrough is limited to factors that are entirely exogenous to the public utility (Armstrong, Cowan and Vickers, 1994). In the water supply and sewerage industry, the principal exogenous sources of additional costs are usually unanticipated changes in expansion plans or in environmental and quality standards. Since many of these costs are capital costs, the passthrough provisions for the water supply and

sewerage industry are often more complex that for other utilities, where the costs that can be passed through are mainly or exclusively operating costs.

The main argument in favour of price-cap regulation is that it gives regulated utilities strong incentives for cost reduction and innovation because they can keep any efficiency savings for a long time until the next regulatory review. An important point to note is that these incentive qualities of price-cap regulation mean that profits and losses can diverse significantly from normal levels: "This is basically the hidden side of the famous price cap proposals which for a while were presented as a free lunch guaranteeing efficiency of utilities. More efficiency can only be induced at the cost of higher rents" (Laffont, 1994).

There are also other potential problems with this argument. On the one hand, if a public utility begins to earn profits much below the cost of capital, it is likely to seek a higher price cap on the grounds that a higher price is needed for it to continue to have assess to the capital markets to raise the funds required for investment. Given the high political visibility, and economic and social importance of the water supply and sewerage services, which are usually viewed as vital to the well-being of a country, and the costs and inconveniences associated with contract termination, such pressures are likely to be successful. On the other hand, there are many indications that, for political and other reasons, regulated utilities will never be allowed to earn excessive profits even though, at least in theory, these profits may lead to future reductions in prices. As a result, if the utility believes that the price cap can be influenced in the period between regulatory reviews, "then the cap will no longer be viewed as exogenous ..., and it is not clear whether any of the efficiency properties ... ascribed to price-cap regulation will be realized" (Braeutigam and Panzar, 1989). These potential problems suggest that price-cap regulation is best suited to reasonably stable technologies with predictable opportunities for productivity improvements (Brock, 1998). Conversely, it is likely to be much less suited where very poor knowledge of system and asset conditions gives rise to too much uncertainty on rehabilitation and investment needs.

In the water supply and sewerage industry in England and Wales, the regulatory lag was originally set at ten years, but the water companies' licences allowed for reviews to take place after five years at the request of the companies or the Director General of Water Services (DGWS), head of OFWAT. The ten year period has never been used. The initial price caps were set in 1989 for ten years. These price controls, apparently based on underestimates of the companies' scope for cost reduction (one possible explanation is that other objectives of privatisation, such as the political desire to privatise without delays, conflicted with effective regulation), turned out to be overgenerous, allowing them high profits (Green, 1997a; Aylott, 1996). For example, the share price index for the ten water supply and sewerage companies increased in value by 93% over and above the market as a whole in the first four years after privatisation (Chennells, 1997). These high profits accompanied by massive increases in compensation among the top executives of the water companies, and the general belief that the profits arose because the companies had been privatised too cheaply and regulated too lightly, had led to the imposition in 1997 of the windfall tax on the privatised utilities,[1] including the ten water supply and sewerage

[1] This tax was a special, one-off tax called the windfall tax, levied on the privatised utilities, including the ten water supply and sewerage companies. It was charged at a rate of 23% on the difference between

companies. Following these events, some commentators suggested that price-cap regulation should be replaced by profit-sharing regulation, which permits the sharing of risks and rewards between investors and consumers.[1]

OFWAT came to the conclusion that the price caps set in 1989 had to be revised. The first periodic review took place in 1994 and the new price limits were set again for ten years. Finally, it was recognised that a regulatory gap of ten years was too long, even given the long term nature of the water supply and sewerage industry, and the period between regulatory reviews was formally reduced to five years (the modification took effect on 1 April 2000) (Byatt, 1998). The second periodic review took place in 1999 and the new price limits came into effect on 1 April 2000 for five years. However, some experts consider that even the lag of five years is perhaps too long, referring to the fact that the system is seen as slow to respond to larger-than-expected profits (Boulton, 1996), and the DGWS believes that an interval of four years would still be consistent with the preservation of adequate incentives while allowing swifter transfer of benefits to consumers (Byatt, 1997). Of course, the shorter the period between price reviews, the closer is price-cap regulation to rate-of-return regulation.

As for cost passthrough provisions, the licenses allow the DGWS to adjust price limits between regulatory reviews in certain pre-specified cases where circumstances change significantly ("Relevant Changes in Circumstances"). The arrangements are symmetrical, either the DGWS or utilities can use them. Key factors are: changes in legal

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company value, calculated by reference to profits over a period of up to four years following privatisation, and the value placed on the company at the time of flotation (Inland Revenue, 1997). The yield was about £ 5.2 billion (some US$ 8.3 billion), including about £ 1.6 billion (some US$ 2.6 billion) from the water supply and sewerage companies. The proceeds were used to finance the "Welfare-to-Work" programme. The tax was based on the idea that a windfall gain had accrued to the owners of the utility companies in the first years after the companies were privatised. This windfall gain was said to have resulted from a combination of underpricing of shares in the companies when they were privatised and the lax regulation of the companies in their initial years in the private sector. Chennells (1997) concluded that: (i) the tax should have only a limited effect on prices and investment in the utility sectors, provided that the statement that the tax is one-off is credible; and (ii) because the tax is imposed at the level of the company rather than the individual shareholders that benefited from the windfall gains, it can only capture some of these gains (those who sold their shares before the tax was suggested will avoid it). The assessment that the tax is unlikely to have a serious effect on the economic behaviour of the companies is based on the assumption that the statement that the tax is one-off is credible. If there is a suspicion that such a tax might be imposed again, the cost of capital would increase, which might lead to higher prices and lower investments in the future. Some experts disagree. According to Plummer and Powell (1995), such "a tax would have damaging implications for efficiency incentives, for the utilities' cost of capital, for investment, customer service and employment, and for the perceptions of potential investors both within and outside the industries concerned". The government of Argentina is reportedly looking at the possibility of imposing a similar tax on the country's privatised utilities (Privatisation International, 2000).

[1] Although price-cap regulation has been sometimes implemented without an explicit limit on the rate of return being earned, as for example in the United Kingdom, a more common approach involves implicit or explicit limits on the rate of return which the public utility may keep. These limits are often imposed through sliding scale regulation (see footnote 1 on page 44). The profit-sharing approach is attractive because: (i) it makes an explicit connection between unanticipated efficiency gains and benefits to customers; and (ii) provides a mechanism to correct the inevitable mistakes made during price reviews and hence reduces the need for regulatory intervention between them. Its important disadvantage is that it reduces incentives for cost reduction and innovation, and might increase regulatory uncertainty. In addition, there is some doubt as to whether, in a highly capital intensive industry like water supply and sewerage, profit can be measured well enough on a continuous basis to be incorporated explicitly into price controls: "profit measures are subjective, open to manipulation and prone to an inherent problem of circularity" (Mayer and Vickers, 1996).

obligations placed on utilities (e.g., new water quality and environmental standards), failure to achieve legal requirements allowed for when price limits were set, and to allow for differences between the actual proceeds of surplus land and the proceeds assumed when price limits were last set. The procedure operates as follows: a company makes an application for cost passthrough, the DGWS assesses the appropriate net additional costs or revenue loss, tests against the specified materiality threshold, and adjusts future price limits only if the approved changes exceed the threshold; otherwise, the process is delayed until the next year (if a new application for cost passthrough is made) or until the next periodic review. Cost passthrough provisions have been used both by the water companies (e.g., to deal with the increased costs resulting from the tightening of environmental controls) and the DGWS (e.g., in the early nineties most utilities had their price caps reduced, through both "voluntary" agreements and formal process, on the basis that the recession of the early nineties had reduced construction costs below the levels assumed in 1989).

The experience of England and Wales suggests that the long and fixed regulatory lag typical of price-cap regulation, while possibly attractive in other utility industries, could be less appropriate for a very capital-intensive industry like water supply and sewerage (Helm and Rajah, 1994). The principal reason for this is that long-term investment planning in the water industry is subject to a considerable degree of uncertainty, relative to that in the other utility industries. This problem is further aggravated by: (i) the fact that the condition of fixed assets is generally more difficult to determine in the water supply and sewerage than in other utility industries because many of these assets are located underground and because the information available in many countries on the conditions of the existing asset base is very deficient; and (ii) the inherent instability arising from the separate institutional structures of economic and environmental regulation and their conflicting objectives (see page 91). Nevertheless, the experience of England and Wales also suggests that "the longer lag than typical in rate-of-return regulation appears to have beneficial incentive properties" (Armstrong, Cowan and Vickers, 1994).

The expectations of how prices will be adjusted at the end of the regulatory lag. The correct selection of a price cap is critical for the incentive benefits of price cap regulation to materialise. Large inefficiencies may result if price caps are chosen incorrectly (Braeutigam and Panzar, 1993); and improper indexing can also lead to undesirable outcomes (Braeutigam, 1992). For example, if the price cap is too high, the regulated public utility will earn excessive profits at the expense of consumers, and if it is too low, underinvestment will result and the utility's financial integrity and capacity to attract capital will be threatened. Unfortunately, although the regulatory literature provides useful discussions of the strengths and weaknesses of price-cap regulation, it "provides surprisingly little guidance" on how to determine and reset the price cap (Bernstein and Sappington, 1998a).

There is a simple theoretical guideline that can inform the selection of an appropriate price cap. The guideline states that the price cap should reflect the extent to which: (i) the regulated utility is capable of increasing its productivity more rapidly than other industries in the economy; and (ii) the prices of inputs employed by the utility grow less rapidly than do the input prices faced by the rest of the economy (Bernstein and Sappington, 1998a and 1998b). One might question whether such a simple theoretical

guideline can adequately take into account the cost of capital, the value of existing assets, expected rates of growth of productivity and demand, variations in input prices, technology, and other factors which must necessarily be considered in public utility industries.

One of the reasons for the adoption of price-cap regulation was that it was believed that it would be simple to operate because it would allow regulators to make do with relatively simple cost and demand information, there would be no need to measure the rate base and rate of return, and the allocation of common costs would be unnecessary. The fact that this approach appears to side-step the problem of determining a fair rate of return is potentially appealing to investors in developing countries where they "prefer not to reveal what rate of return they require, lest this be thought excessive" (Newbery, 1998). In practice, this "original idea that regulation would be a simple matter of capping prices, avoiding all the problems of profit control, has proven illusory" and, as a result, the regulator "has found himself dragged into a complex mass of detail — covering the intricacies of business plans and fixing the cost of capital and the value of shareholders' assets" (Helm, 1994a). It "was quickly realized that in a capital-intensive monopoly industry such as the water industry, simple price controls would not be enough. There must also be an assessment of capital expenditure requirements, coupled with recognition of the financing implications of this capital expenditure on price increases" (Jeffery, 1994).

In fact, although nominally a price-cap, price regulation, as practised in the water supply and sewerage industry in England and Wales, has much in common with rate-of-return regulation. The primary duty of the DGWS is to ensure that the companies are able to finance their functions and to earn reasonable returns on their capital, which implies that the rate of return is a major consideration in regulatory practice. In essence, prices are set so as to generate expected profits that are sufficient to yield a normal rate of return on assets employed, to remunerate efficient levels of operating expenditure, and to finance efficient levels of capital expenditure (Helm, 1994b). As a result, the procedures used to set a price cap under price-cap regulation are essentially the same as those used in rate-of-return regulation (see Box 7).

The implications are threefold. The first is that to set and reset price caps, the regulator needs reliable and detailed information about the regulated utility's cost and demand conditions. It may be said, that a well-functioning price-cap regulation requires as much information as rate-of-return regulation (Liston, 1993). This explains why the burden of information provision and processing has tended to increase. The second is that, in practice, the differences between price-cap and rate-of-return regulation are basically ones of degree rather than of a fundamental nature, and the incentive properties of the former are unlikely to differ much from those of the latter. The third is that price-cap regulation shares many of the shortcomings of rate-of-return regulation, including the Averch-Johnson effect (Helm and Rajah, 1994; Gonenc, Maher and Nicoletti, 2000). As for the original expectation that there would be less danger of regulatory capture, although "there has not been complaints of capture of the regulators by regulated firms" (Powell, 1996), the system is considered to be more, rather than less, vulnerable to capture both because of the high degree of discretion that regulators have under price-cap regulation (Helm, 1994b), and because it is somewhat closer to high-powered incentive schemes (Laffont and Tirole, 1991).

Box 7

How is a price determined under price-cap regulation?

In the United Kingdom, where price-cap regulation is the common means of price regulation for the privatised utilities, regulators take into account many factors in setting the level of a price cap, including: (i) the cost of capital; (ii) the value of the existing assets; (iii) the future investment programme; (iv) expected future changes in productivity; (v) estimates of demand growth; and perhaps, in some cases, (vi) the effect of price setting on actual and potential competitors. Making projections requires that regulators make general assumptions about macro-economic factors such as future inflation, interest rates and wage growth.

The process begins with using financial models, such as the capital asset pricing model, to estimate the cost of capital of the company's regulated business (i.e., the minimum return that investors require to induce them to invest in it). This rate of return is then applied to the value of capital assets employed in the company. The product of the rate of return and the asset base is the minimum profits that the company needs to reward its shareholders adequately. This minimum profit is then adjusted by an estimate of operating costs to arrive at the required revenue of the company. Finally, the revenue stream is converted to a price cap on the basis of a projection of demand. The problem is that each stage of this process is in practice fraught with considerable difficulties.

First, conflicts arise over the appropriate measure of the cost of capital. Even though there are standard approaches to its determination, they often provide different estimates for what is supposedly the same value. There has also been considerable controversy over the value of the parameters that should be used in the models. As a result, the companies and the regulators have referred to estimates that differ by as much as 6%. The estimate of the cost of capital is of enormous importance because both prices and profits are directly dependent on this estimate. For example, each extra 1% return earned on equity is equivalent to some £ 82 million (about US$ 130 million) of additional profits for the water companies.

Secondly, considerable complications have arisen with the valuation of pre-privatisation assets. The principal reasons for these complications are that: (i) most of the assets of the utilities that are in the public sector usually have no observable market value before privatisation; (ii) these assets are sunk in the sense that they are not transferable to other activities, and extremely long-lived; and (iii) the accounting valuations shown in utilities' books typically bear little relation to the underlying economic valuation of the assets (e.g., the valuation of the water companies' assets at replacement cost exceeds their market value, as recorded by their stock-market valuations, by a factor of ten).

Were valuation at replacement cost to be used as the basis for determining reasonable levels of profits, this would imply large price increases and windfall gains for shareholders at the expense of consumers. As a result, it has been necessary to develop alternative methods of asset valuation based on the market valuations at the time of privatisation.

The valuation of pre-privatisation assets is a common sources of controversy in many developing countries privatising their utilities. In many of them, for essentially the same reasons as in the United Kingdom, regulators, where possible, have avoided using current or replacement cost values as a basis for regulation and instead have derived a regulatory value based on the sale or floatation value of the assets, rolled forward by net investment.

Since the pre-privatisation assets are gradually replaced by new assets, this problem will disappear in the future as at some future date all assets will have been created since privatisation. As the problem of asset valuation withers away, another one can be expected to attract increasing attention. The replacement of pre-privatisation assets by new assets earning at least the cost of capital will entail rising prices over time, unless the costs of replacing, operating and maintaining the assets can be reduced, or the cost of capital falls.

Thirdly, the determination of minimum operating costs and of the precise extent of possible efficiency gains has also been fraught with considerable difficulties, in part because implementing yardstick competition (see page 26) has proved much harder that was originally envisaged. An unduly optimistic prediction of potential efficiency gains could undermine the financial condition of companies, while an unduly conservative view of potential efficiency savings would generate excessively large gains for shareholders at the expense of consumers.

Finally, regulators may also need to ensure that the levels and trends of accounting ratios (e.g., debt-equity ratios, interest cover, dividend cover, earnings per share, dividends per share, net cash flow) are appropriate. For example, prospective lenders are concerned about interest cover and debt-equity ratio, so regulators must ensure that the projected ratios are such that they do not jeopardise potential lending.

These considerations help explain why: (i) the original expectations of a light regulatory burden have not materialised, rather the scope, toughness, and detail of price-cap regulation have all tended to increase; and (ii) setting prices for several years is difficult, especially where there are large investment programmes and where the degree of uncertainty surrounding these programmes is substantial.

Source: Bishop, Kay and Mayer (1995); Armstrong, Cowan and Vickers (1994); Grout (1995); Burns and Estache (1998) and (1999).

The degree of discretion over pricing policy that is given to public utilities. Since public utilities almost always provide a number of different services, regulators need to decide how much discretion the utilities can have over relative prices. Three broad approaches are possible: (i) to have a separate price constraint for each of the utility's products; (ii) average revenue regulation (i.e., to have an overall constraint on the average of the prices charged by the utility), which is only possible when, as in the electric industry, products are commensurable; and (iii) tariff basket regulation (i.e., to have a constraint on the average of a subset of the utility's prices).

A notable feature of price-cap regulation is that regulated utilities are usually allowed more discretion, albeit with some constraints such as floors and ceilings on annual price movements, over relative prices than under rate-of-return regulation. Under price-cap regulation, utilities can typically rebalance their relative prices to some extent, without drawing the regulator into a full regulatory review. This is especially important in the industries, such as telecommunications, which are gradually deregulated and where companies need a certain degree of discretion over relative prices to meet competition. It is in part for this reason that price-cap regulation is often considered to be more suited to mixtures of competition and monopoly (Brock, 1998). The opposite applies to rate-of-return regulation, where each price is individually approved and changing a price requires regulatory approval. However, it is important not to exaggerate this difference: the freedom to rebalance prices under price-cap regulation is not complete, while in principle rate-of-return regulation could be based on a basket of services.

The main arguments for allowing regulated utilities discretion over relative prices are that it: (i) gives them more freedom to respond to cost changes and permits more efficient capacity utilisation, and thus makes possible a longer regulatory lag; (ii) allows to bring prices more closely into line with the costs of providing the different services and to unwind historical cross-subsidies; and (iii) allows them to introduce new types of tariffs. On the other hand, granting a utility complete freedom to change relative prices may: (i) have anticompetitive consequences (e.g., by charging a higher price to customers in the captive market, it would be able to reduce prices and undercut its rivals in the competitive market); (ii) lead to politically and socially unacceptable price discrimination and unravelling of socially desirable cross-subsidies; (iii) lead to inefficient relative price structures; and (iv) encourage strategic manipulation of costs (Vickers and Yarrow, 1988; Vickers, 1991). It is for these reasons that public utilities that face price-cap regulation are usually allowed some price flexibility, but the freedom to rebalance is not complete.

In a recent review of how public utilities subject to price-cap regulation in the United Kingdom and the United States rebalance their prices, Giulietti and Waddams (2000) find that despite the short term profit incentive for them to do so, public utilities in general have not moved towards more efficient pricing structures. This suggests that public utilities "are responding more vigorously both to informal guidance within the review period, and to the eventual need to reset the cap. With this in mind they focus on the role of capital in determining price level, and persist in tariffs which encourage demand requiring capital investment. Furthermore widespread tariff rebalancing might reveal more about costs than the firms would choose; firms are notoriously secretive about cost information". Giulietti and Waddams (2000) conclude that public utilities "seem to view price caps merely as a form of regulatory lag within rate of return regulation, and so are

content to maintain their previous tariff structures, except when these come under competitive pressure".

In the water supply and sewerage industry in England and Wales, the DGWS sets a price limit for each water supply and sewerage company. The price limit applies to a basket of charges for the following five services (three services for the water-only companies): charges for metered and unmetered water supplies, charges for metered and unmetered sewerage services, and charges for the reception, treatment and disposal of trade effluent. Increases in charges for any individual service may be more or less than the price limit. However, the average increase in the basket of charges must not exceed the price limit.

Although the experience with allowing regulated utilities a certain degree of discretion over relative prices has been in general positive, some problems have emerged. One of them is that many water utilities have begun to offer lower tariffs to customers who use large volumes of water, and to increase charges to other customers (OFWAT, 1999b). This rebalancing is usually justified by reference to the lower costs involved in supplying large users, but might also be anticompetitive since it is the market for larger users that is subject to some competition (see page 101). To prevent the utilities from recouping any money they lose through this rebalancing by increasing charges to other customers, the DGWS removed from 1 April 2000 large users from the basket of charges on which price limits apply.

There are also other constraints on tariff rebalancing. The Water Industry Act of 1999 gives the DGWS powers to approve company charges schemes. The main criteria for the approval of these schemes are the impact on customers' bills of proposed tariff rebalancing as well as other objectives such as encouraging economy in the use of water through tariffs (OFWAT, 1999e). In addition, the DGWS reviews all regulated tariffs each year to ensure they are not unduly discriminatory or unduly preferencial, and some forms of tariff rebalancing could be forbidden by this. The guiding principle is that charges to particular classes of customers should be broadly related to the costs they impose on the system.

The conclusion to draw from this discussion is that the differences between price-cap regulation as practised in the United Kingdom and rate-of-return regulation as practised in the United States are largely ones of degree rather than of a fundamental nature: (i) the former uses a longer and exogenously determined regulatory lag to provide additional incentives for cost reduction, and relies heavily on yardstick competition as a source of information, features that can also be incorporate in rate-of-return regulation; and (ii) the latter is based on actual costs, with adjustments for the future largely limited to an adjustment for inflation or the extrapolation of historic trends, while in principle the former is based on projected efficient costs (Newbery, 1998; Beesley and Littlechild, 1989). The contrast between them "is mostly one of emphasis" (Laffont and Tirole, 1993).

How does the performance of price-cap regulation and rate-of-return regulation compare in practice? Up to now, it has not been convincingly established that, in real world conditions, price-cap regulation offers a qualitatively superior alternative to rate-of-return regulation: it "seems likely that the overall incentive effects of price cap and rate-of-return approaches do not differ dramatically in principle and need not differ dramatically in practice, but the matter is by no means settled" (Schmalensee, 1995). A recent overview concludes that while it is clear that price-cap regulation is superior for

telecommunications where it may only be needed in the transition to competition, it is less clear that it is superior for core network monopolies like water supply and sewerage, balancing the better incentives of price-cap regulation against the lower perceived investor risk and cost of capital of rate-of-return regulation (Newbery, 1998).

It is now generally agreed that price-cap regulation as implemented in the United Kingdom "has turned out to be a more incentive-compatible form of rate-of-return regulation rather than a radical departure from more traditional regulatory techniques" (Grout, 1995). It may be said that, on the whole, "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" (Schmalensee, 1989).

B. Regulation of service quality

There are three principal aspects of service quality: (i) drinking water quality; (ii) the level of service that a public utility provides (e.g., water pressure, response to complaints); and (iii) environmental quality (i.e., water pollution control). In this chapter the focus will be on the second aspect. The first and the third aspects of service quality will not be discussed here since they do not directly concern economic regulation.

As for the first aspect, any water utility has the obligation to provide the public with an adequate supply of clean, safe drinking water (see Box 8). There are four points here:

- The World Health Organization's "Guidelines for drinking water quality" are intended to be used as a basis for the development of national standards that will ensure the safety of drinking water supplies through the elimination, or reduction to a minimum concentration, of constituents of water that are known to be hazardous to health.

- To ensure the quality and safety of drinking water, it is important to adopt a multiple-barrier approach to protecting water supplies that includes source water protection, treatment as appropriate, distribution system maintenance, and monitoring. It is also important to pay attention to the technical, managerial and financial capacity of water utilities to comply with applicable drinking water standards.[1]

[1] The United States Environmental Protection Agency (EPA) (1998a) defines capacity as a water system's ability to consistently provide safe drinking water for its customers. To do that, a water system must have the technical abilities, managerial skills, and financial resources to meet applicable drinking water regulations. Technical, managerial, and financial capacity are individual yet highly interrelated dimensions of capacity. Each dimension of capacity is defined as follows. Technical capacity refers to the physical infrastructure of the water system, including but not limited to the source water adequacy, infrastructure adequacy, and the ability of system personnel to implement the requisite technical knowledge. Managerial capacity refers to the management structure of the water system, including but not limited to ownership accountability, staffing and organisation, and effective linkages. Financial capacity refers to the financial resources of the water system, including but not limited to the revenue sufficiency, credit worthiness, and fiscal controls. See also Wilhelm (1999).

- The fact that the responsibilities for economic regulation and for the establishment of drinking water quality standards are usually entrusted to different agencies means that there is the potential for the problem of common agency, where one agent (public utility) has several principals (regulators) (see page 91)

- The asymmetry of information between regulator and public utilities regarding the costs of drinking water quality control, and its implications for investment regulation (see page 82).

Box 8

Legal aspects of drinking water quality regulation

The service provider, who supplies drinking water to the customer, should have the legal responsibility to supply safe and wholesome water meeting the legally established water quality standards. It must be responsible for the provision of continuous and effective water quality control, including inspection, supervision, preventive maintenance and safe operation of the water supply system, routine testing of the water quality and remedial actions as required. The service provider should also have the legal responsibility to notify the public of any serious deterioration in water quality.

The service provider should be held responsible for the quality of the water supply up to a defined point in the distribution system, generally up to the house connection or public stand-post, or to the point of connection to the local supplier network. However, it should not be held responsible for deterioration of water quality within the household. It is advisable to consider making legal provisions enabling a water utility to initiate legal actions to protect its water sources and distribution networks from pollution and other interferences.

The burden of the primary level of water quality control testing should be placed on the service provider. Consideration should be given to the possibility of holding its management personnel liable for serious offences involving personal neglect and mismanagement. At the same time, an independent surveillance agency with strict enforcement authority should be established to enforce compliance with the drinking water quality standards and regulations by carrying out periodic audits of all aspects of water quality and safety. The public should have free and regular access to all this information.

Source: Shuval (1992).

As far as the third aspect of service quality is concerned, the important points to be taken into account include: (i) privatisation changes incentives toward profit maximisation, so water pollution control needs to be reinforced; (ii) the need to ensure that the methods used to control pollution are efficient and that public utilities comply with their environmental obligations in a cost-effective way; (iii) the existence in most countries of separate economic and environmental quality regulators means that there is the potential for the problem of common agency (see page 91); and (iv) the asymmetry of information between regulator and public utilities regarding the costs of water pollution control, and its implications for investment regulation (see page 82).

1. Service quality under monopoly provision

Consumers demand better service and product quality. It must be recognised, however, that more stringent service quality standards do have a price, so it is important to find a balance between the two: “The issue is not high or low quality *per se*, but that efficient price/quality combinations are offered to consumers” (Vickers, 1991).

A reduction in quality of service is tantamount to an increase in price. This means that without adequate quality of service regulation, price regulation may be rendered

ineffective: "One purpose of regulation is to protect buyers from monopolistic exploitation — but buyers can be exploited just as effectively by giving them poor or unsafe service as by charging them excessive prices ... Price really has no meaning except in terms of an assumed quality of service; price is a ratio, with money in the numerator and some physical unit of given or assumed quantity and quality in the denominator. Price regulation alone is economically meaningless. Moreover, the nature of our dependence on public utility services is typically such that customers may correctly be *more* interested in the denominator than in the numerator — in the reliability, continuity, and safety of the service than in the price they have to pay" (Kahn, 1988).

In a market in which there is full and effective competition, there should be no reason to regulate service quality. If a firm arbitrarily reduces the price/quality combination it offers to consumers, this will lead to a corresponding reduction in its market share. If consumers are not satisfied with the product or service offered, they can easily switch to other products or companies, and competition will ultimately weed out those firms which fail to provide the price/quality combination which consumers demand. In such a market, there is no justification for service quality regulation: "its only effect would be to restrict artificially the range of products offered for sale" (Shapiro, 1983).

The situation in very different in the water supply and sewerage, and most other utility industries, where customers, both now and in the foreseeable future, can choose neither their supplier nor the price and quality of the goods and services, and where substitutability in demand is extremely limited. If a utility chooses to reduce service quality in order to increase profits, there is very little its captive customers can do. Spence (1975) shows that an unregulated monopoly is likely to find it profitable to either oversupply or to undersupply service quality, the outcome depending on the relative valuations of service quality by the marginal and average consumers, but a monopoly subject to price regulation will always have incentives to set service quality below the level which is socially optimal, given the particular price ceiling. The magnitude of this bias is likely to be greater where the price elasticity of demand is low, as in the case of water supply and sewerage services.

The second argument for supplementing price control by service quality regulation is the asymmetry of information, in which the seller knows the quality of the service, but the buyer does not. It is difficult, for example, for customers to evaluate and verify the reliability and safety of water supply before a disruption occurs, while the costs of mistakes are high. In markets with informational asymmetries, "there is an incentive for sellers to reduce quality and take short-run gains" (Shapiro, 1983). In such markets, service quality deterioration "is a general phenomenon" and they "reach equilibrium at suboptimal quality levels" (Leland, 1979). In general, when there is asymmetric information between consumers and utilities "about quality there is a clear case for regulation" (Cowan, 1993).

It should also be noted that, logically, a public utility has little incentive to increase the quality of the service it provides unless the service is metered (Cowan, 1993). The reason for this is that an increase in service quality is likely to encourage additional consumption, and hence impose additional costs on the utility, but there is no direct means for it to obtain extra revenue as a result of the incremental demand. A lack of metering not

only encourages wasteful use of water but may even tempt a public utility to reduce the quality of the service it provides in order to reduce demand. One example in afforded by the water supply and sewerage concession in Buenos Aires, Argentina, where few customers have water meters and, as a result, the concessionaire, at least until now, does not have any non-regulatory incentive to maintain or improve service quality (Artana, Navajas and Urbiztondo, 1999b).

These considerations imply that under monopoly, the problem of service quality is potentially a serious one. They also go some way in explaining why, "One of the main complains about privatization ... focuses on a reduction of the quality of supply" (Bös and Peters, 1988). Unfortunately, service quality regulation is one of the most neglected aspects in the debate on private sector participation in the water supply and sewerage sector.

Given that the scope for direct market competition is extremely limited even for large consumers and that markets for water supply and sewerage services are characterised by informational asymmetries, regulation of prices must be supplemented by regulation of service quality. Otherwise, regulated utilities would be able to render price regulation ineffective by reducing their standards of service quality: "effective regulation will require that the privatized industry be subject to strict quality controls as well as price controls, and, in setting price and quality constraints, regulators will be compelled to take into account the trade-off between the two variables: higher quality standards will, by raising costs, lead to higher prices. Any notion that regulation need only concern itself with price controls is, therefore, fundamentally misguided, and should be abandoned at the outset" (Vickers and Yarrow, 1988).

In the water supply and sewerage industry, many aspects of service quality depend on adequate maintenance. In view of the long lives of the fixed assets employed in the industry, it may take many years of inadequate maintenance before they show serious deterioration. "When this does happen, however, it may be very expensive to restore adequate service" (Crew and Kleindorfer, 1990). Since many of these assets are located underground and it is difficult to know their condition, underinvestment and improper maintenance can go unnoticed for many years, so whatever form of service quality regulation is implemented, the information and enforcement burden on regulators will be large. They must ensure that public utilities devote sufficient resources to maintenance and monitor carefully their capital and maintenance spending to keep assets in good condition.

A useful measure which can help ensure that service providers do not compromise long-term asset management to meet short-term profit objectives at the expense of service quality is to require them to have asset management plans to support service standards (Water Reform Unit, 1999). Such plans should demonstrate: (i) effective systems for the operation and maintenance of assets; (ii) systematic renewal and replacement of assets; and (iii) the source and application of funds to support the asset management plan.

Finally, it is important to note that in the water supply and sewerage sector, the losses which result from service failure can be very large, in financial, social, health, environmental and political terms, relative to the basic cost of service provision. The implications are twofold. The first implication is that the public sector can never wholly

abdicate its responsibilities for the provision of these essential and indispensable services to the same extent as in other industries, without placing the public at risk. Given that the operator of last resort will always be the public sector, governments should probably consider either to regulate water utilities more comprehensively than is traditionally the case and/or to retain a force account capacity to provide a residual means of performing essential functions should the private operator fail to perform its functions. The second implication is that a water utility is usually required to serve all those who live within the area where it holds itself out to service, apply for service, and are willing and able to pay for it. Without such an obligation, a utility would serve only the portions of its service area which are profitable for it to serve, and would also suspend service when the costs of supply temporary increase.

2. Alternative mechanisms for service quality regulation

In considering mechanisms for service quality regulation, it is useful to distinguish between those aspects of service quality that are verifiable at a reasonable cost and those that are not (Laffont and Tirole, 1993). Many but not all aspects of the former kind chiefly depend on managerial efficiency and current expenditures (e.g., the speed of response to complaints and timely repairs) and those of the latter type tend to depend primarily on capital investment (e.g., drinking water quality and reliable water supply).

Verifiable aspects of service quality. When service quality is verifiable at a reasonable cost, regulators can use various mechanisms for directly regulating service quality, including publication of information on service quality performance, minimum standards of service quality, legal liability for damages arising from poor service quality, customer compensation schemes, and incorporation of a measure of service quality into the price control formula. Neither of these approaches is appropriate in all circumstances and for all aspects of service quality. Many of them are mutually complementary. Regulators should, therefore, rely on a mix of various regulatory mechanisms and this mix should be tailored to the particular characteristics of the service, sector and country in question. Yardstick competition (see page 26) is potentially very useful whatever method of service quality regulation is adopted.

Whatever regulatory approach is adopted, the regulator will have to set explicit or implicit service quality standards. For a water utility an appropriate set of service quality standards usually includes the following categories: (i) customer service (e.g., meeting commitments to customers to connect water services, response times to written complaints, providing accurate bill information, ease of telephone contact, and meter installation); (ii) reliability of water supply services (e.g., minimum and maximum water pressures, and interruptions to supply); and (iii) sewerage service (e.g., flooding from sewers) (Jamaica/OUR, 1999a).

Setting service quality standards is a complex and demanding task given: (i) the heterogeneity of consumers and the difficulty of estimating their preferences for marginal changes in service quality; and (ii) the asymmetry of information between regulator and public utilities regarding the costs of supplying incremental service quality. The guiding principles include: (i) standards should be set with reference to consumers' valuation of higher (or lower) levels of service quality and the corresponding costs of achieving them;

(ii) they should be set, as far as possible, in consultation with those who will have to pay for them (i.e., consumers), to abide by them (i.e., public utilities), and to monitor and enforce them (i.e., regulators); (iii) they should focus on those aspects of service quality for which consumers care most about;[1] (iv) major changes in service quality standards should be implemented to coincide with price reviews so that utilities can plan their investment programmes in a stable regulatory environment; and (iv) they must be realistic, attainable, well defined, technologically sound, enforceable, and above all, in line with social and economic reality of the sector and area in question.

Publication of information on service quality performance. This is a simple and inexpensive measure, and can be a useful complement to other regulatory mechanisms, but provides few incentives for compliance, except through public and media pressure associated with demonstrated poor performance (Rovizzi and Thompson, 1995). In addition, it might encourage public utilities to "indulge in conspicuous and wasteful expenditure in an attempt to signal quality" (Horton, 1998). To be more effective, it should be complemented with: (i) awareness campaigns intended to inform the public; and (ii) imposing an obligation on public utilities to define, document and publish appropriate service quality standards and codes of practice, including complaints and dispute resolution procedures, and to report periodically on their performance against those standards and codes. One example of this approach is afforded by the recent decision of the United States Environmental Protection Agency (EPA) to require that water utilities should provide consumers with annual reports ("Consumer Confidence Reports") on the state of their drinking water (United States EPA, 1998b).[2]

Minimum standards of service quality. Under this approach, the regulator specifies minimum standards of service quality and backs them by a system of legal sanctions, financial penalties (payable in the event of non-compliance either to government/regulator, or, preferably if it is feasible, directly to affected customers; for example, in the Buenos Aires water supply and sewerage concession, any revenues from fines do not become part of the regulator's budget, to avoid giving it an incentive to penalise the utility in order to collect the fine, but are returned to consumers through lower prices), and/or other measures designed to induce compliance. Minimum standards of service quality are appropriate in circumstances where there are informational asymmetries between

[1] It is important to strike an adequate balance between targeted and broad-based service quality standards. If there are few very specific components of service quality that matter to consumers, than the regulator can motivate the regulated utility to focus its energies on them by establishing performance or compensation schemes that target specifically these critical dimensions of service quality (Sappington, 1994). However, this approach is subject to the problem that the utility may focus only on these few narrow measures of service quality and ignore others which may be also important for customers (Pollitt, 1999).

[2] These reports must provide consumers with the following fundamental information about their drinking water: (i) the lake, river, aquifer, or other source of the drinking water; (ii) a brief summary of the susceptibility to contamination of the local drinking water source; (iii) how to get a copy of the water system's complete source water assessment; (iv) the level of any contaminant found in local drinking water, as well as EPA's health-based standard for comparison; (v) the likely source of that contaminant in the local drinking water supply; (vi) the potential health effects of any contaminant detected in violation of an EPA health standard, and an accounting of the system's actions to restore safe drinking water; (vii) the water system's compliance with other drinking water-related rules; (viii) an educational statement for vulnerable populations about avoiding Cryptosporidium; (ix) educational information on nitrate, arsenic or lead in areas where these contaminants are detected above 50% of EPA's standard; and (x) phone numbers of additional sources of information (United States EPA, 1998b).

producers and consumers, or where there are severe non-linearities in the consumer-benefit function (Rovizzi and Thompson, 1995). They may also be attractive as a public relations exercise. There are also disadvantages with minimum standards, including: (i) the difficulty of determining the correct level of service quality, the efficient level of penalty (penalties should be sufficiently high to provide adequate incentives for compliance and to reflect the damage caused, but not so high as to discourage their application),[1] and how to redistribute the fines to consumers (without redistribution, there will be no compensation); and (ii) a lack of flexibility as well as of incentives for the regulated utilities to improve service quality beyond the minimum (unless there is a system of financial rewards, payable to the utility for raising service quality above the minimum level).

Legal liability for damages arising from poor service quality. Under this approach, public utilities are liable for the nuisances and losses to customers caused by poor service. This approach potentially provides strong incentives for the provision of service quality, enforcement is decentralised, and customers receive compensation for poor service. Its principal disadvantages are: (i) high transaction costs, especially for smaller customers who are likely to find it costly to pursue their claims vigorously (a number of measures can be taken to reduce these costs such as awarding the full value of the fees and costs incurred in litigation to plaintiffs bringing effective or useful suits); and (ii) while public utilities cannot reasonably be expected to provide faultless service all the time, this approach would be tantamount to providing an insurance scheme to all customers (Vickers and Yarrow, 1988). Because of these considerations, this approach is more suited to large water users and much less to smaller consumers for whom compensation schemes are often more appropriate.

Customer compensation schemes or guaranteed standards of performance. This mechanism has much in common with the previous two approaches. The regulator specifies guaranteed standards of service quality which public utilities must provide to their customers, and any failure of a utility in achieving one of these standards renders it liable to make a predetermined payment in compensation to the customer affected by the failure (see Box 9 and Box 10). Customers may be required to claim compensation or utilities may be directed to automatically compensate customers in all cases where the affected customer can be readily identified. The latter approach is preferable, because the requirement for the customer to claim compensation may lessen the impact of the scheme as an incentives for the utilities to perform (Jamaica/OUR, 1999b). This is evidenced from the United Kingdom experience which suggests that only a minority of customers entitled to compensation actually make a claim as they seem to be unaware of or care about their entitlement.

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[1] In many countries, failure of public utilities to meet service quality standards, expansion requirements, provide information on time, etc. may result in fines. The fines should be sufficiently high to encourage compliance. However, fines high enough to deter undesirable behaviour could have negative effects on the utility's ability to finance its functions. Coffee (1981) has suggested an innovative solution to this problem: an equity fine. For example, with a 1% equity fine, for each 100 shares held in the utility, one new share would be issued to a victim compensation fund (Braithwaite, 1993). This would result in a discounting of the value of all existing shareholdings by 1%, but this would be accomplished without jeopardising the financial integrity of the utility. Furthermore, shareholders would be encouraged to insist that management complied with the law.

Box 9

The Guaranteed Standards Scheme in the water supply and sewerage industry in Jamaica

The Office of Utilities Regulation (OUR) plans to implement the Guaranteed Standards Scheme in April 2001. Most of the guaranteed standards will require the National Water Commission (NWC) to make automatic payments to customers when the standard is breached, but customers will be required to claim for compensation for particular standards, especially where NWC is unable to determine the affected customer(s). Payments will be credited to customers' accounts.

Three possible options for determining the level of compensation were originally considered. The first option was an amount equivalent to the monthly average water only bill. The second option proposed compensation in line with the service charge. The third option proposed was for the compensation to be fixed as a percentage of the consumer's next (or last) bill. It is currently envisaged that the compensation payment for domestic customers will be the same as the service charge to this group of customers, which is approximately J$ 100 (about US$ 2.40). The payment to commercial customers will be the same as the charge that is paid by this group of customers, which ranges from approximately J$ 200 (about US$ 4.80) to J$ 3 000 (about US$ 72).

The Guaranteed Standards Scheme will be suspended in circumstances where compliance is beyond the control of NWC. The burden of proof of exceptional circumstances will lie with NWC. Examples of possible exceptional events are: bad weather or natural disaster, system conditions such as major breakdown of treatment plants or pumping stations, drought, civil unrest, strikes, and malicious destruction of property.

Guaranteed standards

- *Connection to supply*. NWC is required to connect all new customers, where water supply is available at the property boundary, within 10 working days after signing the contract for connection.
- *Issue of first bill*. NWC must issue (print and mail) a bill to a new customer within 48 days after connection.
- *Keeping appointments*. NWC has a responsibility to satisfy a request for a representative to visit the customer's premises, to deal with an identifiable problem and should let the customer know whether the visit will be before or after 12 noon. NWC must guarantee to keep all appointments or to notify the customer prior to the appointed time, if an emergency prevents them from keeping the appointment.
- *Response to complaints not related to billing*. If a complaint is made in writing to NWC, it must acknowledge the complaint (have a letter prepared for dispatch to the customer) within 5 working days after receipt of complaint and a reply to the customer should be made in writing within 30 working days of receipt. NWC is required to take details of complaints made by telephone or in person, at the time of the call or visit. If the complaint has to be investigated, NWC will still be required to provide an answer within 30 working days of receipt.
- *Response to complaints about billing matters*. NWC is required to acknowledge complaint within 5 working days and reply to all complaints whether written or by phone regarding bills within 30 working days of receiving the inquiry.
- *Account status request*. If a customer is moving and requests an account status and/or service to cease, NWC is required to read the customer's meter on the day the customer is moving, if on a working day, as long as five working days notice of the move is given to NWC. If the customer is moving on a weekend, NWC should read the meter within two days of the move. NWC is also required to provide the relevant bill within 48 working days of the customer's moving.
- *Restoration after emergency lock-off*. If there is a burst water main or other emergency, NWC may not be able to warn customers that water will be off. NWC should, however, inform customers by making announcements on at least one radio station within 2 hours after interruption. NWC will be required to provide an alternative supply of water if necessary (trucking water to affected areas), and to restore supply within 24 or 48 hours (for urban or rural customers, respectively).
- *Meter installation*. NWC is required to fit a meter, where an unmetered customer requests one, within 30 working days of receiving the customer's order.
- *Repair or replacement of faulty meters*. If a customer's meter is verified as faulty, NWC will repair or replace it within 40 working days of being informed by the customer, after verification by NWC, or within 40 working days after detection by NWC if the fault was discovered by NWC.
- *Meter reading*. NWC has the responsibility to provide at least one bill every three months and will guarantee to read customers' meters at least once every three months as long as it can be accessed (NWC should make arrangements to relocate inaccessible meters).
- *Reconnection after payment of overdue amounts*. NWC is required to reconnect customers, whose supply has been locked off for debt and who have settled their accounts, within 24 or 48 hours (for urban or rural customers, respectively) after debt settlement.
- *Payment of compensation*. NWC is required to make payments that are due under the Guaranteed Standards Scheme within 60 days of: (i) the date the standard was breached, for automatic payments; or (ii) the date the claim was received, for claimed payments.

Source: Jamaica/OUR (1999b).

Box 10

The Guaranteed Standards Scheme in the water supply and sewerage industry in England and Wales

Under the Guaranteed Standards Scheme (GSS), all customers of water supply and sewerage companies, including potential customers, business customers, tenants and those in debt, are entitled to guaranteed standards of service, laid down by the Government. The companies must inform billed customers of their rights under the scheme every year. Any disputed claims for payment under this scheme can be referred to the DGWS by the customer or the company. The DGWS's decision is binding upon both parties. The DGWS monitors the scheme and recommends changes. OFWAT publishes details annually about company procedures and payments made under the scheme. Some companies operate compensation schemes which go further than the GSS.

If a company fails to meet any of the guaranteed standards, customers are entitled to a compensation payment, normally of £ 10 (about US$ 16) for each time the company fails to meet the standard, except for sewer flooding where a rebate of charges up to a limit of £ 1 000 (about US$ 1 600) is payable.

If the company fails to meet the standards for responding to appointments, account queries, written complaints and installing meters, the company must automatically pay to the customer (or credit to his/her account) £ 10, within 10 working days of the incident. If it does not do so and the customer claims this payment within three months, the company must pay an additional £ 10. To obtain a payment for the other standards, the customer must make a claim in writing within three months of the incident. If at the time of the incident the customer owes money to the company and has done so for more than six weeks, the company will make a credit to his/her account rather than a cash payment.

There are certain exceptions to the scheme. Different exceptions apply to different standards, but they include failure to comply because of particular circumstances beyond the company's control (such as unforeseen circumstances or severe weather conditions). The scheme does not affect any other legal rights to compensation that customers may have.

In addition to the GSS, the companies are required to pay compensation to customers where essential household water supplies are interrupted as a result of emergency restrictions authorised by drought orders. This includes water supplies for purposes such as cooking, washing, drinking, flushing the toilet, etc., but does not include uses such as garden watering, washing the car or filling a pool. This compensation measure is not part of the GSS, but it does mean that customers have access to compensation if essential supplies are not maintained.

Household customers can claim £ 10 for each day (or part of a day) that the supply of water is interrupted or cut off. The maximum compensation entitlement is equal to the water company's average household bill for the previous year. Business customers, in the same circumstances, can claim £ 50 (about US$ 80) a day (or part of a day). Here the maximum compensation payable is the amount of water charges paid by that customer in the previous year, or, if he/she is a new customer or a third party is responsible for the water charges, the maximum is £ 500 (about US$ 800).

There would be no entitlement to compensation if the circumstances were so exceptional that it would, in the DGWS's view, have been unreasonable for the water companies to have avoided the interruption or cut off.

Source: OFWAT (1998d).

The main advantages of customer compensation schemes are that they provide for consumer- and fault-specific compensation and their flexibility in the sense that the utility is allowed to trade-off changes in service quality against the incremental costs of achieving these (Rovizzi and Thompson, 1995). Although this approach might involve high transaction costs, both to the utilities and to the consumers, they can be substantially reduced by limiting compensation only to those aspects of service quality which are: (i) of greatest concern for customers; and (ii) easily verifiable and observable. Customer compensation schemes are particularly appropriate for supply interruptions, rationing and other similar problems which are directly observable by customers and typically affect a large number of them simultaneously, so there would be few disputes over whether the problem has occurred or not.

Although customers should receive compensation if the service for which they have paid is not suitable for the purpose or is of a poor quality which causes demonstrable damage, loss or inconvenience, the design of customer compensation schemes should take

into account the following factors: (i) exceptional costs: in some cases, because of the scale of known service problems, in terms of the number of customers affected and the cost implications of paying compensation, the application of customer compensation schemes could have a significant impact on the utility's ability to finance its functions, and thus to make improvements to services in the longer term; (ii) exceptional circumstances: the delivery of water supply and sewerage services is influenced by external events, in particular, exceptional weather conditions, and it is not cost effective to plan service delivery against every eventuality (the burden of proof of an exceptional circumstance, however, should, in general, lie with the regulated utilities); and (iii) customer responsibility: it would be inappropriate to compensate customers for poor service which has arisen from their own action or inaction (OFWAT, 1995a). As for the level of compensation, it should neither be so low, that the utility is not encouraged to improve its performance, and nor so high, as to become excessive in relation to the damage caused. The amount should be sufficiently high to be a real nuisance to the utility without being detrimental to its operations while not becoming a source of income to customers (Jamaica/OUR, 1999a).

Incorporation of a measure of service quality into the price control formula. Under this approach, the regulator sets targets for quality of service, and periodically readjusts, according to a pre-established formula, maximum allowable prices as a function of the level of service quality actually achieved. Incorporating a measure of service quality into the price control formula is theoretically very attractive: (i) this approach creates an automatic incentive mechanism which mimics the incentives existing in a competitive market; and (ii) it is flexible because the utility is free to select the price/quality combination which it finds appropriate given the price and service quality constraints. However, this approach is extremely difficult, if not impossible, to implement formally and explicitly in practice. A major difficulty is the heavy informational burden involved in establishing and operating the mechanism, particularly the difficulty of finding good summary indexes of service quality, which requires to identify service quality dimensions and weights, and to make a judgement on the appropriate relationship between price and service quality in the regulatory formula (Vickers and Yarrow, 1988). Besides this, it does not compensate those who have experienced poor service.

Whatever form of service quality regulation is implemented, regulatory agencies must monitor carefully service quality performance of the utilities they regulate, and compare their achievements with what is allowed for in price limits. If the utilities do not deliver the standards of service quality allowed for in the price limits, regulatory agencies should be prepared to reclaim appropriate allowances from them.

Unverifiable aspects of service quality. When the costs of verifying the actual level of service quality delivered are high, direct regulation tends to become less efficient given difficulties of service quality specification and costs of monitoring and enforcement, so regulators must increasing rely on indirect incentives to achieve desired goals. These indirect incentives can be created by basing the utility's compensation on observable performance measures that are correlated with improvements in unverifiable aspects of service quality (see page 11). In some cases, certain technical solutions (e.g., investments and operating procedures) may be prescribed to ensure compliance with minimum standards (Klein, 1996b, 1998a and 1998b). For example, when wastewater discharges

cannot be monitored effectively, the installation of wastewater treatment equipment may be prescribed to ensure that environmental standards are met. The idea is that once the investment is in place, the potential for enhancing profits by reducing service quality is substantially reduced.

The indirect incentives for the provision of unverifiable aspects of service quality can be provided in various ways, but it is doubtful that these pressures alone will be as reliable as those exerted by direct regulation. Still, motivations such as those discussed below can play a useful role in inducing regulated utilities to have a favourable attitude towards providing good service quality to their customers.

The mechanism of price regulation. There are reasons to believe that rate-of-return regulation could provide better incentives for service quality provision that price-cap regulation, especially if service quality is a capital-intensive attribute. The experience with rate-of-return regulation in the United States suggests that utilities subject to this form of regulation "will typically have a strong interest in providing good, ample, and expanding service, as long as they can recoup its costs in the prices they charge" (Kahn, 1988). The reasons for this are twofold.

First, to the extent that the Averch-Johnson effect operates (see page 44), rate-of-return regulation encourages higher capital expenditures and if such expenditures are associated with improvements in service quality, this form of regulation would tend to offset the incentives to reduce service quality when the allowable price is fixed (Vickers and Yarrow, 1988). However, if service quality is labour-intensive, rate-of-return regulation is likely to exacerbate the quality problem (Spence, 1975). In contrast, price-cap regulation does not give any incentive to maintain service quality; on the contrary, the utility has an incentive to under-provide service quality for the given price level.

Second, price-cap regulation is believed to provide strong incentives for cost reduction, hence it is feared that public utilities subject to this form of regulation would concentrate their efforts on aggressive cost cutting and would sacrifice service quality, especially its unverifiable and non-contractible aspects. In procurement, for example, a high concern for quality often leads to cost-plus contracts and other low-powered incentive schemes (Laffont and Tirole, 1993; Bajari and Tadelis, 1999). On the other hand, the fact that under price-cap regulation profits can diverge significantly from normal levels may encourage public utilities to assume more responsibility for giving a good level of service. The reason for this is that customers may be less inclined to pressure the regulator to change the price cap if they think that the utility is performing well (Sappington, 1993).

In the water supply and sewerage industry in England and Wales, the perceived problem of inadequate incentives for service quality provision under price-cap regulation was addressed by imposing the requirement on OFWAT to ensure that water utilities are able, in particular by securing reasonable returns on their capital, to finance the proper carrying out of their functions. In addition, OFWAT looks closely at whether utilities achieve the standards which are allowed for in price limits. It seeks to ensure that customers do not pay for services that utilities have not delivered. OFWAT considers that it is not sufficient for utilities to assert that they will meet compliance by the due dates. Rather, it wants to see solid evidence of moves towards compliance.

Reputational effects. Most public utilities are concerned with protecting their reputation and that of their shareholders' in the market. It has long been recognised that a public utility "which has a good reputation owns a valuable asset" (Shapiro, 1983). It is possible to reinforce the reputational incentive that public utilities have to provide service quality by making them more concerned about the future. For example, if the possibility of non-renewal of a concession contract or of winning contracts elsewhere depends in part on its current performance, the regulated utility is likely to be concerned about its reputation as a supplier of service quality (Laffont and Tirole, 1993; Klein, 1998c). Such reputational effects will work best where there is a real threat of displacement, which is most unlikely in the water supply and sewerage sector, and where consistent information on service quality performance is widely available. Unfortunately, "reputation can operate only imperfectly as a mechanism for assuring quality" (Shapiro, 1983), even in a competitive environment, so it is risky to rely on these incentives (Cowan, 1993).

Implicit regulation. Under implicit regulation, also known as potential regulation or regulation by threat, public utilities operate without specific service quality controls, but regulators monitor and evaluate their performance and there is a credible threat of regulatory intervention if service quality becomes compromised or if customers are not reasonably satisfied. The argument holds that the threat of regulatory intervention will create sufficiently strong incentives for the provision of service quality. The threat can take various forms, such as warning the public utility that the regulator will initiate a regulatory review if service quality falls below a certain level, that the allowed rate of return will be reduced until specified improvements are made, that low service quality now will be reflected in lower prices at the next price review, or that the regulator will impose enforceable quality of service standards if service quality deteriorates. In the United States, for example, rate-of-return regulation offers regulators effective control of service quality by virtue of the fact that if a utility does not provide adequate and timely service, the commission can reduce its allowed rate of return until specified improvements are made (Zearfoss, 1998).

Implicit regulation is a simple regulatory measure, and provides a means to institute regulation of service quality gradually. Under the right conditions, this approach may be a useful complement to or substitute for other forms of service quality regulation, particularly where the cost of errors is low and as a temporary measure until more effective forms of regulation are implemented. It can be strengthened by encouraging consumer participation in the regulatory process and by requiring public disclosure of relevant information, including periodic publication of key indicators of utility performance. In the United States, for example, "public utility commissions have been willing, and to some extent justified, to leave the quality of service, far more than price, to the companies themselves — the latter will typically have a strong interest in providing good, ample, and expanding service", in part because a "public utility company is peculiarly exposed to public criticism if its service is inadequate. This exposure is increased by the possibility of customers complaining to regulatory commissions" (Kahn, 1988).

C. Regulation of investment

Although the direct object of conduct regulation is usually pricing policy, "the effects of regulatory policy upon social welfare depend critically upon the investment behavior that it induces" (Vickers and Yarrow, 1988). Investment is important both to ensure continuity of supply in the long term and that standards of performance and quality are maintained and can be maintained in the future at an appropriate level. The need for investment in the water supply and sewerage industry is great, because of:

- The need to expand service coverage: in Latin America and the Caribbean, some 92 million people do not have access to drinking water supply and about 128 million do not have access to sanitation services (UN, 2000).

- Deteriorating infrastructure: in the majority of drinking water supply systems in the region, unaccounted-for-water is estimated in the 40 to 50% range compared with 10 to 20% in well-managed systems (Beato, 1997).

- More demanding environmental standards: in the region as a whole, only about 13% of collected sewage receives treatment (PAHO, 1998).

One of the major factors driving private sector participation in the water supply and sewerage industry is the need to attract private capital to it and reduce the impact of infrastructure spending on government budgets and thereby free up financial resources that could then be used to address urgent social problems and investments in areas that are not attractive for private sector participation. Regional experience suggests that the financing of investments in water supply and sewerage is, unfortunately, one of the most vulnerable to cuts in government budgets during periods of adjustment and fiscal austerity (ECLAC, 1995). As a result, private sector financing is also seen as a way of protecting economically, socially and environmentally necessary but politically vulnerable and dispensable infrastructure expenditure from general budgetary pressures (Kay, 1993).

The water supply and sewerage industry is very capital intensive: it is estimated to be three to four times more capital intensive than the electric industry and five to six times than railroads (Jordan, 1998). Capital costs are large relative to operating and maintenance costs. Most of the fixed assets, such as the networks of water mains and sewers, are too expensive to duplicate to any significant degree, making direct market competition impractical, if not impossible.

Since technology changes have been slow and limited, many of the water supply and sewerage industry's fixed assets have a longer productive life than in most other industries. For example, they often last from 30 to 50 years (Haarmeyer and Mody, 1998), and many of them have a design life of about 60 to 100 years (Schofield and Shaoul, 1996). Long-term financing is, therefore, needed to finance investments.

Because of the need to take advantage of economies of scale and because ageing facilities must be replaced from time to time, investments are often lumpy rather than spread uniformly over a number of years. Capacity is usually added in large increments.

This results in temporary excess capacity and hence intermittent periods of capacity under-utilisation. Economic theory suggests that it is better to finance these temporary increases in spending by borrowing (after funds have been exhausted from retained earnings), and to recover the costs involved thought charges over time (Swaroop, 1994).

Many of the fixed assets are underground and their actual state is often unknown and difficult and costly to evaluate. In most Latin American and Caribbean countries the information available on the conditions of the existing asset base is so deficient as to create a very high degree of uncertainty on rehabilitation, maintenance and investment needs. Triche, Mejia and Idelovitch (1993) describe in the following way the situation in Buenos Aires, Argentina and Caracas, Venezuela: "The quality of existing operational and commercial information was very poor. Revenues could not be audited; financial projections and estimates of water consumption and demand were based on rough calculations. Maintenance had been inadequate and little was known about the actual condition of the assets and requirements for rehabilitation and new investment".

Most of the fixed assets, including reservoirs and the networks of water mains and sewers, are both site-specific (i.e., their physical features make it impossible or extremely costly to remove or relocate them) and industry-specific (i.e., their physical features make it impossible or extremely costly to retrofit or transfer them to other industries). This means that they are largely sunk costs in the sense that they have no or few alternative uses, and their resale value is well below the cost of replacing them. Since sunk costs are high, so are the costs of entry and exit, and the potential for direct market competition is correspondingly minimal.

Since all revenues are in local currency, these investments are usually more suited for local rather than foreign capital because reliance on long-term international lending creates a foreign exchange risk. However, in many countries of the region national financial markets are not developed sufficiently to provide long-term lending and this represents an important obstacle to private investment: "long-term markets in Latin America are typically only three, five or seven years. In order to finance a project ... you need long-term money ... In the U.S., you can get 15-, 20-, 25-year money, which is very difficult, if not impossible, to get in Latin America" (Simon, 1994).

The introduction of private capital into water supply and sewerage infrastructure financing implies that private sector rates of return must be earned. The implications are twofold. One effect of the use of different rates of return in the public and private sectors is that there is a tendency for the public sector to favour long-life, capital-intensive projects, but the funds available are typically rationed and some projects do not materialise while others come to only a slow conclusion (Kay, 1993). The private sector, while it tends to favour shorter-life, lower-capital cost options, ensures that capital is available for any project the meets the rate-of-return criteria.

Second, much more important is the fact that since private sector rates of returns usually greatly exceed those of the public sector (largely because governments can spread risk over the entire population), prices under private provision might be much higher than if the investment had been carried out with public sector financing. Prices are likely to increase in both the short-term (in part because traditionally in the region water tariffs have

not reflected the full cost of service provision) and in the long-term because new (privately financed) investments will earn a higher rate of return than existing (publicly financed) assets and the former will gradually replace the latter.

Only if there is either rapid cost reducing technological progress or significant inefficiencies to be eliminated will this upward pressure on prices be alleviated. While the former is most unlikely in the water supply and sewerage sector where technology advances have been slow and limited, the latter is a real possibility. For example, most publicly-owned water utilities in the region are overstaffed: ratios of 5 to 10 employees per 1 000 water connections are common compared with a ratio of 2 to 3 employees per 1 000 connections for an efficient utility (Idelovitch and Ringskog, 1995). Under favourable conditions, drastic improvements in efficiency can mean low tariffs and yet generate sufficient profits to attract private participation. One example is afforded by the Buenos Aires water supply and sewerage concession. It was awarded in 1993 resulting in an important tariff reduction, yet since then water supply and sewerage services have improved dramatically and important investments have been made.

Taken together, these considerations imply that, although the private sector is potentially a very attractive source of funds, private investment is not always be the best way to finance the water supply and sewerage industry. Although private ownership often brings better management skills and private participation can be associated with better incentives, "better management might not be worth the cost. If for example, equity investment costs a typical 25 — 30 percent, the country might be better off with less efficient management and lower costs of capital" (Wells, 1999). On the other hand, although private sector participation "can be seen as a very expensive way of, in effect, replacing a failed public sector manager (and/or organisational culture) but if the alternatives are to continue that failure through political inability to make internal changes then the cost is not so high" (Franceys, 1997).

1. The problem of commitment

World-wide, there is no shortage of private capital to make the necessary investments in the water supply and sewerage industry. "There is, however, a shortage of confidence" (Graham, 1995a). An adequate supply of private capital to the industry will only be forthcoming if investors are confident that they will earn a market rate of return on their capital expenditures which is commensurate with the risk they take: "the bottom line is that companies will only invest in the water and sewage sector if risk and uncertainty are kept to acceptable levels" (Rees, 1998).

This is a major challenge for most Latin American and Caribbean countries where historically price-setting in the water supply and sewerage industry has been subordinated to short-run political interests undermining the financial viability of publicly-owned water utilities. For example, a review of the investments in water supply and sanitation in the eighties concluded that: "In the Latin American and Caribbean countries, it is not difficult to find provisions in legislation governing public utilities stipulating that tariff levels should cover costs and provide a return on capital sufficient to facilitate the financing of investments. Unfortunately, such policies have not been pursued in practice and the ability of public utility companies to finance their investment programmes has been considerably

reduced. The main reason for the persistence of inadequate tariffs is the tendency of governments ... to consider tariff increases inopportune due to political or macroeconomic policy reasons. Consequently, tariff levels have been usually kept low bearing little or no relationship to the cost of the services provided, the financial needs of the utility or of the consumer's capacity to pay" (ECLAC, 1990).

The sunk nature of capital and the fact that regulation takes place in a dynamic setting (prices are not and cannot be set forever rather they are reset periodically) give rise to the hold-up problem. The hold-up problem arises from a fundamental asymmetry: on the one hand, regulated variables, such as price, are short-term and are easy to alter, while on the other, investment decisions typically are long-term and irreversible (the capital stock cannot be adjusted downwards other than slowly through depreciation) (Besanko and Spulber, 1992). This asymmetry implies that in public utility industries, the rates of return on new investment will be mainly a function of future regulatory decisions rather than of the decisions made at the time of privatisation or investment, but regulators and governments in general cannot bind their successors.

After the utility has invested in sunk assets, the regulator has an incentive to opportunistically exploit this situation ex post (this is termed the problem of ex post opportunism) by ensuring that allowable prices only cover future avoidable costs and the return on non-sunk assets but that there is no profit margin to compensate the utility for its investment. Since in public utility industries fixed assets are highly immobile and very durable, regulators can reduce prices without risking immediate supply failures. In such circumstances the utility is likely to be willing to continue operating, because exit does not allow it to recover its sunk investments, while shutting down involves additional expenses. The incentive to behave opportunistically is especially strong if the regulator's horizon is: (i) time-limited, because the temptation for opportunism just before the relationship ends is very strong; and (ii) short, because the short-term costs are often small compared to the short-term benefits of such action (Cowan, 1993; Guasch and Spiller, 1994; Salant and Woroch, 1992).

If the utility anticipates this incentive for the regulator to behave opportunistically ex post and hence takes this into account in its response to policies established at the beginning of the relationship, then the cost of capital will be increased to include a premium for regulatory risk or the utility may be deterred from investing efficiently in sunk cost assets in the first place (Rees and Vickers, 1995). Limited commitment ability of regulators creates incentives for underinvestment relative to the policy with credible commitment. It is for this reason that the objective of regulation can be thought of alternatively as the protection of consumers from exploitation by monopolies, or the protection of private investors making irreversible investments from exploitation by government.

Although an incentive to act opportunistically ex post exists in any multi-period relationship, "opportunism may be more characteristic of the policies of public agencies than of private parties because although courts will prohibit inefficient breach by private parties they generally will not proscribe revisions of policies by regulatory or administrative agencies. Instead courts tend to restrict their review to procedure, process, and consistency" (Baron and Besanko, 1987). The problem is likely to be more acute in

countries, like many Latin American and Caribbean countries, with political and social instability, a lack of a history of independent state institutions, few if any useful regulatory precedents, unclear and largely untested judicial constraints, where the future course of regulatory policy is unpredictable, and which have allowed their water supply and sewerage sector to deteriorate rather than set tariffs high enough to recover costs. In addition, given the speed with which privatisation programmes have been carried out in many countries and the lack of government experience in regulation and of political consensus about appropriate regulatory policy, investors also face the possibility that the regulatory framework itself might radically change.

The water supply and sewerage industry is especially prone to underinvestment problems because of its huge sunk costs, durability of its fixed assets whose lives greatly exceed the regulatory lag, and the extremely limited scope for direct market competition: "Regulatory opportunism is particularly damaging in the utility sector since costs are dominated by investment in long-lived infrastructure" (Williamson, 1997). The social, health and environmental importance of these services increases their vulnerability to the hold-up problem even more: "because of the political sensitivity of the sector, the issues are highly charged and many governments in developing countries lack credibility as a regulator" (Nigam and Rasheed, 1998).

Unless there is a credible commitment to rules that regulatory decisions will provide a reasonable opportunity for potential investors to recover their investment and operating costs, including an appropriate return on the investments, the rational fear of ex post opportunism will deter efficient investment in long-lived sunk assets and raise the cost of capital to regulated utilities. This will put an upward pressure on tariffs as investors will demand sufficiently high prices to recover their investment in a short period of time, thus undermining the benefits in terms of lower prices from the potential efficiency gains associated with private sector participation: "As well as large productive inefficiencies from underinvestment, there could be serious allocative inefficiency because of high prices needed to meet the regulatory risk premium in the cost of capital" (Armstrong, Cowan and Vickers, 1994).

The fact that a regulator lacks the power to credibly commit to future policy could also bias the utility's activities toward improving short-term performance at the expense of long term one and bias its technology choice toward less durable and less capital-intensive types of equipment and technologies with a smaller sunk cost component. In this sense it is not surprising that, in electricity generation, private sector participation has coincided with a move from hydroelectric to thermal power, and in telecommunication with a move from fixed to mobile telephony. In such circumstances investors will also try to transfer the financing of sunk costs to users (e.g., through high connection charges as has occurred in various countries) (Spiller and Savedoff, 1999). Attempts to secure private sector participation in an uncertain regulatory environment will result in smaller proceeds from privatisation and higher financing costs, and thus higher tariffs, and would tend to attract mainly those entrepreneurs who have greater lobbying power or with greater willingness to take risks. In effect, these considerations mean that unless the regulatory system provides a credible means of commitment regarding policies to be offered in the future, privately-owned utilities may perform worse than publicly-owned ones (Willig, 1993), and

private investment may not be the best way to finance public utility industries (Sappington, 1993).

Since investors must be assured of a fair return on their investments in order to induce future efficient investment, rate-of-return regulation, as implemented in the United States with its inherent promise of a fair return on capital that is considered to be used and useful, can be viewed as a highly effective and flexible means of commitment that both addresses the underinvestment concern and gives the regulator flexibility to respond to changing circumstances: "Given a need for renegotiable utility prices, rate-of-return regulation ... is effectively equivalent to an almost ideally flexible system of sequential market value promises" (Greenwald, 1984). According to this view, rate-of-return regulation can be viewed as a form of implicit long-term, incomplete contract that protects investors against ex post opportunism and, therefore, mitigates underinvestment and offers a type of long-run commitment which is crucial for the long-term investments need in public utility industries (Besanko and Spulber, 1992; Laffont, 1994). In the United States, regulatory authorities rarely have strayed far from the principle that a utility is entitled to a rate of return approximately equal to its cost of capital (Gilbert and Newbery, 1994). Instead, the focus of regulatory conflicts has been mainly on the assets that should be included in the rate base.

Under price-cap regulation, the longer regulatory lag than typical in rate-of-return regulation acts to protect investors from ex post opportunism in the short-term. In the longer-term, however, price-cap regulation has serious drawbacks as far as commitment is concerned because it does not include a formal guarantee of a fair rate of return on investments. Unless clear guidelines for resetting price caps are laid down, or emerge from precedent, the cost of capital is likely to increase and there will be an incentive for underinvestment. These guidelines, however, will negate the superior incentive effects claimed for price-cap regulation (Beesley and Littlechild, 1989).

The temptation to behave opportunistically is often particularly pronounced when realised returns on investments are unexpectedly high (Sappington, 1993). This implies that rate-of-return regulation is less vulnerable to the underinvestment problem because it restricts the variation in profitability (prices accurately reflect actual costs), and hence removes one of the main reasons for ex post opportunism (Newbery, 1998). Under price-cap regulation, in contrast, profits can diverge significantly from normal levels, putting regulatory commitment under strain. It is for this reason that it is sometimes suggested that, to avoid this problem under price-cap regulation, it may be advisable to take measures to make the link between increased earnings and increased effort, diligence and creativity, if any, on the part of the regulated utility as apparent as possible to customers so that they understand why the utility's profits are higher that they have been historically (Sappington, 1994). These considerations also suggest that, if price-cap regulation is used, it may be advisable to combine it with profit sharing arrangements.

Alexander, Mayer and Weed (1996) reviewed evidence from a large number of countries and industries in order to analyse the extent of regulatory risk under alternative regimes. Their results seem to imply that public utilities under price-cap regulation "are exposed to much higher levels of systematic risk in comparison with those under rate-of-return regulation, and that the cost of capital for these firms is, therefore, likely to

be higher". It is for these reasons that it is often argued that price-cap "regulation is less likely than rate-of-return regulation to support an efficient investment path" (Gilbert and Newbery, 1994).

In the water supply and sewerage industry in England and Wales, the commitment problem was addressed by: (i) the requirement that the DGWS must act in a way he or she considers is best calculated to ensure that water companies are able to finance their functions, in particular by securing a reasonable rate of return on their capital; and (ii) the decision to recoup much of capital expenditures as they are incurred rather than gradually over a longer period of time (i.e., the companies are by and large funding their large investment programmes directly out of cash flow from customers' tariffs rather than through borrowing) (Franceys, 1997; Vickers, 1991; Searjeant, 1994).

Although the mechanism of price regulation has important implications for long-term commitment, "the decisive influence probably has more to do with the structure and behaviour of institutions, both regulatory and political, than with the form of price regulation *per se*" (Rees and Vickers, 1995). The principal potential institutional solutions to the problem of ex post opportunism include complete contracts and incomplete contracts (see page 21). Other potential solutions are either not suitable for the water supply and sewerage sector,[1] not attractive or incompatible with efficient regulation,[2] or rely on public financing of infrastructure investments (in effect, this is the public ownership solution with private sector participation limited to service, management and lease contracts and other arrangements which leave the responsibility for major investments in the hands of the public sector) which is not a realistic proposal for the countries which seek to reduce the impact of infrastructure spending on government budgets.

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[1] The principal examples are the deregulation and technological approaches. The former involves placing most of the rights to resolve future questions in the hands of the utility itself. This approach is clearly not suitable in the water supply and sewerage industry where there is no prospect of direct market competition, and hence conduct regulation will need to be permanent. The latter approach involves structuring the operating procedures and production technologies in a regulated industry to limit the incentives for opportunistic behaviour (Sappington, 1993). One solution would be to encourage the adoption of technologies that rely on mobile capital. One examples is afforded by the so-called "power barges", floating power plants, that have been used in Central America (The Economist, 1995). The scope for this approach in the water supply and sewerage industry is very limited and the technological solutions available are not particularly attractive.

[2] For example, it has been suggested that, to overcome the commitment problem, preference should be given to investors from a country that has the power and will to retaliate strongly against ex post opportunism; and that it may be advisable to make it more difficult to measure realised returns on investments (e.g., by designing accounting systems for making profits less visible or encouraging vertical integration or diversification by the regulated utility so that "creative" transfer prices can reduce measured profits in the core business) (Sappington, 1993). The latter is a real and troublesome problem that surrounds private investment in infrastructure: "In order to compensate for risk, as oppose to managing it, investors often insist on high rates of return. But, at least intuitively managers often recognize that high rates of returns can, in politically sensitive industries, actually increase the risks. As a result, investors often try to lower visible returns by transferring profits to affiliated entities through prices charged for inputs, loans from related companies, expenses for home office, and technical and management fees" (Wells, 1999). A somewhat more attractive protection against ex post opportunism would be to ensure that there are many domestic shareholders rather than a few foreign ones: "It is relatively easy for authorities to quash tariff increases when the owners of the ... companies are foreigners or a few friends of the former prime minister. It is much harder to do so when the pensions of many local citizens depend on the dividends paid by these companies" (Tenenbaum, 1995). The main potential disadvantages of this approach are weaknesses in corporate governance and that it risks creating a constituency in favour of monopoly provision (Carbajo and Fries, 1997).

Both complete and incomplete contracts, as well as other potential solutions to the commitment problem, involve an inescapable trade-off between regulatory flexibility (i.e., the ability to adapt policies, rules, etc. to changing circumstances) and regulatory commitment (i.e., recovery of investment, repayment of debt, reasonable rate of return commensurate with risk taken); and going "too far toward either extreme is not likely to yield regulatory institutions that perform well over long periods" (Joskow, 1998). On the one hand, regulatory commitment and stability are necessary to provide investors with the certainty they need to invest at the efficient level in assets with a high sunk cost component. On the other hand, regulatory flexibility is needed to adjust to changing conditions. The problem is that although some degree of flexibility is necessary and desirable, the track record of many governments in its use is generally perceived as being so problematic that safeguards are needed to restrain regulatory flexibility to some extent (Estache and Martimort, 1999).

The complete contract approach (see page 22), also known as "regulation by contract", relies on long-term contracts or very specific legislation. It arises out of a fundamental distrust of government. This approach works best when dealing with observable and verifiable outcomes and where technological and market uncertainty is not great and adequate information is available to both parties. This approach can provide strong short- and medium-term guarantees against opportunistic behaviour, and, for this reason, is often favoured by investors: "All terms and conditions of regulation should be specified in the contract, leaving little discretionary power to the regulating authority — private providers are reluctant to supply services unless the key aspects of regulation including price, quantity and quality are specified in the contract document" (Richard and Triche, 1994).

The complete contract approach might encourage private investments, as suggests the experience of Chile and Argentina which have adopted very specific regulatory laws and strictly limited regulatory discretion, but is neither likely to prove sustainable in the long-term nor to be conductive to productive and allocative efficiency. The principal reasons for this are that:

- Such a contract or law would be immensely complex to write, negotiate and enforce because it will have to specify completely, unambiguously and in advance both all the potentially relevant contingencies and how performance should depend upon each contingency. In addition, having all the rules set out in detail creates incentives for informal renegotiation of unsustainable regulatory contracts and this informal procedures may be open to substantial abuse.

- This approach lacks flexibility to make socially desirable changes in response to changing circumstances, makes it difficult to tailor responses to situations and to provide incentives for efficiency, and precludes the use of flexible regulatory schemes that require regulatory discretion to be feasible. In addition, since the rules of the game are completely specified, it is easy for regulated utilities to exploit their deficiencies.

- Over-reliance upon this approach is fraught with danger if a government lacks the skills and bargaining leverage to ensure that the contract fairly balances public and private interests. For example, according to a recent review of the working of water utility contracts in developing countries (see page 22): "Even where the contractor is known to be generating levels of profit of around 50 percent greater than comparable contracts in Europe, it is impossible for the host country to share in outperformance, because of the terms of the concession contracts which last 25 years or longer ... found a number of examples of clients becoming so dissatisfied that they started court proceedings. This legal action rarely solves the problems of unsatisfactory contracts" (Booker, 1999).

- The commitment this approach provides may lack long-term credibility because investors will recognise that at least some contract terms will have to be renegotiated as event unfold and will take that possibility in consideration. One example is afforded by Chile which was the first country in Latin America to privatise its electric industry. Problems caused by imperfections in the regulatory framework adopted at the time of privatisation have generated pressures for change and as a result "the perception of regulatory risk has remained high" (Jadresic and Fuentes, 1999). The implication is that governments can reduce regulatory risk by privatising carefully (i.e., pursuing more vigorous policies towards regulation and avoiding weakening the initial framework of regulation in order to attract investors).

In short, this approach risks introducing rigidities in the regulatory system and making it crudely and inefficiently insensitive to future developments. It effectively transfers the responsibility for regulation to the courts or to the legislature, a task which they tend to be poorly equipped to undertake, in part because they lack the specialised knowledge and resources to deal effectively and in a timely manner with the difficult and complex economic, financial and other issues of the utilities. In the United States, where judicial regulation and direct legislative regulation were used in the nineteenth century, both had many limitations and proved poor methods for controlling natural monopoly industries (Phillips, 1993).[1]

[1] Phillips (1993) describes this early experience with judicial regulation as follows: "Litigation was (and still is) expensive ... Lacking staffs of trained accountants, economists, engineers and rate experts, the courts had no special competence to deal with the issues brought before them, especially those involving intricate industry-specific problems ... Further ... only negative action could be taken ... The courts, moreover, could decide only the cases brought before them; they could not take the initiative. And the court system was unable to handle the required volume of cases that arose from regulatory adjudication. Under such limitations, regulation was discontinuous, expensive and often slow". The situation is very similar in Chile at present where "legal processes are slow in general and especially so in litigation that involves regulatory problems. Moreover, for lack of specific knowledge or interest, the judicial authority does not always have the capacity to solve such conflicts, which frequently involve intricate technical or economic issues" (Bitrán and Serra, 1998). As for direct legislative regulation, the experience of the United States indicates that it "was, above all else, inflexible ... Adjustments were required if regulation was to be up-to-date. Each adjustment, however, necessitated an amendment of the law ... Under such circumstances, continuous regulation was impossible. Little effort was extended to enforce regulatory provisions of charters, and, in the absence of effective accounting and financial control, rate regulation was inadequate. Just as the courts lacked specialized knowledge of regulatory problems, so did the members of state legislatures" (Phillips, 1993) (see also Box 4).

The conclusion to draw from this discussion is that the use of complete contracts as a means of ensuring commitment is more appropriate when private sector participation is limited in scope (e.g., BOT (build, operate and transfer), BOO and BLT (build, lease and transfer) generation, wastewater treatment, etc. projects), but is much less suitable when private participation is more comprehensive. Nevertheless, in spite of its important disadvantages, this approach, if used with care, may play a useful role in the countries which need to establish a reputation for credible regulatory rules to attract private investment to public utility industries but lack regulatory traditions and independent institutions.

Under the incomplete contract (relational contract or trust relationship) approach (see page 22), key long-term principles and policies are defined in laws, licenses or contracts that leave a number of aspects to be resolved — according to pre-established rules and procedures and with residual discretion being carefully limited — as events unfold. There is a hierarchy of deliberation and difficulty in changing these principles and policies, a hierarchy that provides ascending protection to investors, from action by a single minister, to action requiring approval of the executive branch of government, to simultaneous involvement of the executive and the legislature, to special legislative procedures, and finally to requirements to amend the Constitution (Moran, 1999). What approach is appropriate depends principally on the country's institutional endowment and on the characteristics of the industry in question.

To safeguard investors against ex post opportunism in the day-to-day implementation, enforcement and monitoring of these key principles, rules and policies, this responsibility is entrusted to an independent regulatory agency, while the role of the executive branch of government is limited to strategic planning and policy formulation. To ensure that the regulatory agency is free from political interference and gives a credible commitment to investors, the discretion it enjoys in the performance of its duties should be carefully delimited through reference to criteria and objectives, legislative oversight, and opportunities for judicial review. In addition, the entity itself should: (i) be insulated from short-term political pressures and other extraneous influences; (ii) enjoy a high degree of organisational autonomy; and (iii) be encouraged to build up a reputation for giving investors a fair return on their investment in order to induce future efficient investment.

While there is no magic formula that a country can apply to create an independent regulatory agency that gives a credible commitment to investors and it is clearly impossible to do this overnight, there is a high degree of consensus that the following safeguards are usually required (Smith, 1997a and 1997c; Klein, 1996b; Swartwout, 1992). Their objective is to maximise the independence, impartiality and non-political nature of regulatory agencies. The implementations of these safeguards must be sensitive to the legal and political institutions and conditions of the country and industry in question.

- Providing the regulator with a distinct legal mandate, free of ministerial control, and establishing clear objectives and specific duties to which it can be held accountable. These requirements usually imply that it may be advisable to locate the regulator outside of the executive branch of government. Otherwise pressures to set prices on the basis of short-term political considerations may be

strong and the regulator may fail to provide a type of long-run commitment which is crucial for investments in water supply and sewerage.

- Appointing heads of regulatory agencies by politicians, rather than electing them directly by citizens (a regulator elected on a pro-consumer or pro-utility platform cannot be fairly expected to be impartial). In the United States, for example, there is weak, but inconclusive, evidence suggesting that the incentive to invest tends to be smaller in states that elect their utility commissioners (Besley and Coate, 2000). Regulators should be appointed on the basis of professional rather than political criteria. The key is to select regulators with the personal qualities needed to exercise independent judgement. It is important to provide checks and balances in the appointment process in order to legitimise regulators' authority and prevent partisan appointments. A common approach is to involve both the executive and the legislative branches.

- Appointing regulators for fixed terms and protecting them from arbitrary removal. Longer terms have the effect of increasing the continuity of decision-making and help build an institutional memory thereby providing conditions conductive to impartial decision-making. It may also be advisable to stagger the terms in time so as the appointment of regulators does not coincide with the election cycle and the term of a sitting regulator is longer than the term of a single political administration; and, for a board or commission, to stagger the terms of the members so that they are replaced one by one and not all at the same time. This fosters independence and minimises politicisation of the regulators. For a board or commission, it may also be advisable to ensure that there can be no more that a certain percentage of commissioners from any one political party.

- Providing the agency with an independent and reliable source of funding (e.g., licence fee paid by the industry it regulates), in order to reduce reliance on politically-directed budgetary allocations, and exempting it from civil service recruitment and salary rules, in order to attract and retain qualified staff with sufficient expertise to acquire and analyse necessary information and make fair and reasonable decisions. The resources, such as overall budget, number of staff, salary levels and research facilities (e.g., computers, a research library, internet access), available to regulators are decisive for the effectiveness of regulation. The limitations on salaries of government employees, as well as other budgetary restraints, can put regulatory agencies at a marked disadvantage: "Is it likely that a $15,000-a-year (or even a $45,000-a-year) civil servant will be able to detect the machinations of $100,000-a-year accountants? The more complex the regulatory structure, the more likely that the differences in resources will come into play" (Stiglitz, 1993).

There is also some evidence that locally accountable regulatory agencies tend to provide less commitment and to be more vulnerable to politicisation than regulatory agencies accountable to a higher level of government. The principal reasons for this are threefold. First, institutions are often weaker at the local level where they frequently lack the specialised expertise to deal effectively with the complex issues of the utilities.

Second, local-level regulatory agencies are often move vulnerable to the intrusion of party politics. Third, sub-national entities do not internalise all the long-run costs of regulatory opportunism (i.e., they "export" bad regulation to other jurisdictions) (Artana, Navajas and Urbiztondo, 1999a). For example, in the early years of utility regulation in the United States, the negative effects of regulator populism on incentives to invest were, in part, behind the reason for replacing regulation at the local level by state level public utility commissions (Besley and Coate, 2000). It has also been suggested that in the water supply and sewerage concession in Tucumán, Argentina, "the fact that the regulatory agency was local may have eased the way for the politicization of the conflict" (Artana, Navajas and Urbiztondo, 1999a).[1]

There is obviously a need to find a proper balance between independence, on the one hand, and accountability and hence legitimacy, on the other. The objective should be to ensure short-term independence and autonomy while maintaining long-term accountability. The following measures are usually adopted to ensure that the regulator is accountable for its actions (Smith, 1997a and 1997c):

- Requiring transparency in decision-making. Characteristics of a transparent regulatory process include: notice to those affected; provision of all interested parties with the information they need to formulate their views; an opportunity to be heard and present evidence before the decision is made; rational standards for decision; and a public announcement and publication of the decision with its rationale. Transparency reduces opportunities for improper influence on the regulators, and underscores the fairness and legitimacy of their decisions.

- Prohibiting conflicts of interest. The key is to select regulators with the personal qualities needed to resist improper pressures or inducements. A common disqualification for appointment is having a financial interest in the regulated industry and, in some countries, being related to the president or ministers. To reduce the possibility of regulatory capture, it is also advisable: (i) to ensure that regulators are not only technically qualified, but are also well paid relative to the regulated industry; (ii) to restrict post-employment contacts between regulators and the industry they regulate (the "revolving door" phenomenon (i.e., in many countries regulators are likely to come from the industry they regulate and are likely to return to it sooner or later) is one of the most effective means of regulatory capture); and (iii) to restrict *ex parte* non-public contacts between regulators and interest groups affected by their decisions.[2]

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[1] Because of the conflict, the concession was terminated and the case is pending before the International Centre for Settlement of Investment Disputes (ICSID). This case is illustrative of the reluctance of foreign investors to subject disputes to local jurisdiction. The implications of the case for Latin American and Caribbean countries are discussed in ECLAC (2000). A discussion of the role of international dispute settlement mechanisms in reducing the regulatory risk for private infrastructure investment in developing countries is available in Sacerdoti (1999), Schwartz and Paulsson (1999) and Waelde (1999).

[2] In the United States, to ensure that the decision-making process is fair and impartial, regulatory commission employees, utilities, and other parties in regulatory proceedings are held to certain standards regarding "ex parte" communication on cases under review (MPUC, undated). Ex parte communication is defined as any oral or written, off-the record communication made to or by commissioners or commission decision-making personnel, without notice to parties, that is directed to the merits or outcome of an on-the-record proceeding. Generally, the ex parte rules prohibit commissioners from engaging in informal

- Providing effective arrangements for appealing the regulator's decisions. In most countries, appeals of regulatory decisions go directly to the courts. In some countries, however, there is an intermediate step in which appeals go to a body (e.g., antitrust agency) that has more technical expertise than the courts and that can respond more quickly to appeals. The grounds of appeal are usually limited to errors of fact or of law.

- Subjecting the regulator's conduct and efficiency to public scrutiny; and permitting his or her removal from office for malfeasance, incompetence, neglect of duty or upon proof of other improper actions.

There is also the question of whether to entrust regulatory decision-making authority to a single individual, as in the United Kingdom, or to a commission or board, as in the United States. The former approach requires less resources, facilitates more expeditious decision-making, promotes accountability and ensures predictability, at least in the short and medium-term (Smith, 1997c). It, however, grants more power to a single individual, which implies that regulatory policies can change dramatically with a change in the regulator (Joskow, 1998). As a result, it may be relatively more difficult to attract new private investment, especially when a regulator has substantial discretion. The commission or board approach has important advantages in that it leads to greater continuity and consistency in decision-making, reduces dependence on views and attitudes of individual regulators, affords greater potential to reflect multiple perspectives, and reduces the potential for capture as well as vulnerability to improper influences.

2. Asymmetric information and other issues related to investment regulation

To set prices regulators must make assumptions concerning public utilities' capital investment needs. Because of the asymmetry of information between regulator and public utilities, there may be an incentive for the latter to forecast high investment requirements (and low revenues) at review time in order to justify higher price increases. They can then claim, at the next regulatory review, that the reason for the difference between actual expenditure and the expected level is that they have achieved greater efficiency savings than the regulator anticipated in its assumptions when tariffs were originally set (Waddams, 1999).

A public utility may be tempted to underinvest or to delay investments if it perceives that it will not be held accountable for the supply shortages, poor service quality or excessively rapid depreciation of plant and equipment, etc. that occur sometime in the future. This is a particularly acute problem in fix-term franchise contracts, so the

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communications with parties that could influence how a case is decided. Under the rules of ex parte communications, parties may not, for example, present information to commissioners about the facts or merits of a case, extend offers of employment, or offer gifts or favours. Communication between commission staff and parties is allowed without documentation for procedural, scheduling, and status inquiries, or other inquiries or requests for information, as long as they have no bearing on the outcome of the proceeding. Staff may also engage in ex parte communication about the merits of the case, but such communication must be documented.

monitoring and auditing of the investment and maintenance programmes must become tighter as the end of the contract approaches. A utility may also be tempted to underinvest as a strategic move to influence later regulatory decisions if it expects that by doing so and confronting the regulator with these problems it will improve its bargaining position and obtain a more favourable regulatory regime.

Since in most countries the tariff within a water utility's service area is based on the average costs of the whole area, there is an incentive for the utility to expand or improve service in the areas where the tariff exceeds costs and to neglect those where the tariff is below costs. One example is afforded by the water supply and sewerage concession in Corrientes, Argentina where the price structure is the same in all the cities served by the concessionaire. The result of this regional cross-subsidy is the need for more close supervision by the regulatory agency because the concessionaire has a clear incentive to delay investments in the high provision cost areas (Artana, Navajas and Urbiztondo, 1999a). A similar problem also exists in the Buenos Aires concession (Alcázar, Abdala and Shirley, 2000). Similarly, all else being equal, utilities are likely to prefer to expand to high- and middle-income neighbourhoods at the expense of low-income ones because billing and collection are likely to be more complicated and the costs of service provision higher in the latter than in the former.

For all these reasons, regulatory agencies must analyse and audit the investment plans of the regulated utilities and the objectives that they are designed to achieve. It is equally essential to monitor carefully capital and maintenance expenditures and the achievement of objectives relative to plans in order to ensure that the utilities deliver the service outputs assumed in the prices set. Obviously, monitoring should be backed by a system of financial and other penalties. The importance of this was demonstrated during a recent drought in Chile when a high-income area in Santiago experienced severe interruptions in the water supply. The problem occurred in part because the privately-owned utility in charge of the area failed to invest in the infrastructure necessary to expand its water supply. The regulator was unable to prevent this situation in part because the fines it could impose on the utility were insignificant (Bitrán and Serra, 1998).

The need for close monitoring is underlined by the capital intensive nature of the water supply and sewerage industry which provides scope for utilities to evade the constraints imposed by price regulation by reorganising their investment profiles to enhance short-term financial performance at the possible expense of longer-term efficiency and prospects (Bishop and Kay, 1989). The fact that long-term investment planning in this industry is subject to a considerable degree of uncertainty adds to the expense and complexity of regulation. Further, water supply and sewerage infrastructure plays a crucial role in urban development, so there is a need to ensure that new investment to extend the system reflects public priorities (see page 86).

When regulators update the regulatory asset base from one price review to the next, they can use ex ante or ex post valuation of new investments, or some combination of these two basic approaches (Burns and Estache, 1998 and 1999). The ex ante approach provides strong incentives to reduce costs and delay investments as much as possible, but encourages underinvestment and the provision of misleading information to the regulator. The ex post approach provides weaker incentives for cost reduction and

encourages the realisation of investments as early as possible. The decision on what approach to use depends on many factors including: (i) the magnitude and importance of the investment programme; (ii) the scope for efficiency savings; (iii) the regulator's ability to estimate the efficient level of investment for the utility; and (iv) the mechanism of price regulation and the nature of the incentives it creates for cost reduction.

In the United States, public utilities are entitled to recover "prudent" investments when they become "used and useful" (Phillips, 1993). In a prudence review, regulators determine the reasonableness of the utility's actions (i.e., whether these actions, based on all that the utility's management knew or should have known at the time were reasonable and prudent under the circumstances which then existed). The term "used and useful", in its traditional interpretation, refers to needed capacity (i.e., a determination as to whether a plant is actually used in service and is useful in providing service). The definition, however, has in some cases been broadened, for example, to refer to investments that are considered needed and economically desirable. If any expenditure is found imprudent, or not used and useful, all or part of the investment in a plant is excluded from rate base.

In the water supply and sewerage industry in England and Wales, utilities set out in their strategic business plans (see Box 2) their view of the investment required to meet their obligations (OFWAT, 1998f). These projections are challenged by OFWAT and adjustments are made to the level and nature of investment activity as well as the assumed cost of that activity. These estimates form the capital expenditure assumptions included in price limits. Utilities are judged according to whether their outputs are being met, not according to how much money they spend. They are asked, however, to give an explanation for variances where total expenditure is more than 10% below the amounts assumed in price limits. Lower than expected levels of expenditure can arise due to the following main reasons:

- Where capital programmes have progressed slower than assumed, OFWAT needs to have confidence that outputs will still be met by the required dates.

- Where utilities have achieved greater efficiency savings than OFWAT anticipated in the price limit assumptions, the financial benefit is shared between utilities and customers. Since utilities must be allowed some benefit from the savings they have made in order to maintain incentives, their shareholders are allowed to earn a return on the assumed amounts of capital investment for five years, even if actual expenditure is lower. Subsequently, a return is only earned on the actual amount spent. This adjustment is made on a year by year rolling basis so that utilities' do not benefit from postponing capital expenditure to the last minute. This lower level of capital unit costs will also be considered in the capital expenditure assumptions at the next regulatory review.

- Where lower than expected levels of expenditure are due to factors outside utilities' control, these savings can, in certain pre-specified cases, be passed through to customers (see page 52). In all other cases (e.g., changes in construction prices), utilities benefit from unanticipated savings, but must equally bear any unanticipated costs.

- If OFWAT determines that lower than expected levels of expenditure are due to the misleading information provided at a price review, it will take actions to correct for this, for example, by changing price limits or imposing higher standards of service.

D. Diversification

Diversification is a common tendency in many public utility industries, including the water supply and sewerage sector. Although this tendency is generally regarded as understandable and beneficial, regulators should be concerned about the possible adverse effects that diversification could have on core (regulated) businesses of public utilities.

The tendency to diversify is understandable because these is an obvious incentive for any public utility to reduce its reliance on regulated activities, and to enter other markets that offer greater freedom to generate earnings which fall beyond the controls of regulatory authorities.[1] In general, it may be said that the stronger regulation of the core business and the lower its growth potential, the stronger is likely to be the incentive to diversify. The tendency is also potentially beneficial because it allows to realise economies of scale and scope, improves productive capacity utilisation, and allows to spread risks and compensate for fluctuations in demand. For example, public utilities often say that involvement in more than one utility sector enables them to operate more efficiently and reduce their costs. They also often say that the possession of a customer base in one utility service may present opportunities for them to sell other utility and even non-utility services to the same customers, and to invest in new metering, billing and information technologies at a lower cost per customer. These potential benefits of diversification explain why a blanket prohibition on the diversification of public utilities "would not serve public policy well" (Braeutigam and Panzar, 1989) and "would ... not generally lead to efficient resource allocation" (Braeutigam, 1992).

On the other hand, the effects of diversification are not necessarily always positive. There are three principal reasons why regulators should be concerned about diversification:

- ***Diversification reduces the quantity and impairs the quality of the information available to for regulatory purposes*** and thereby worsens the asymmetry of information between regulators and public utilities. This occurs because diversification: (i) makes estimation of the value of capital assets, operating costs, and especially the cost of capital more difficult; (ii) reduces the

[1] There are reasons to believe that these incentives are likely to be particularly strong in the water supply and sewerage industry, especially in countries where the need for new investments is limited. According to Schofield and Shaoul (1996), demand in the water industry is largely static allowing little possibility of increasing revenues by organic growth. Thus, for profits to rise, purchases, wages and/or capital maintenance charges (depreciation) must be driven down. There are, however, particular problems in the water industry which complicate this approach. The amount spent on bought in goods and services is small. Labour's share of value added is unusually small limiting the gains from reducing labour costs; and the depreciation charge is set by the capital base which is large. Finally the water industry has a vast underground network of infrastructure assets which have a long life and must be maintained indefinitely. Thus although the absolute amount of cash per dollar of sales revenues is unusually high in the water industry, these constraints mean that management's ability to increase net income is very limited; so growth must be sought by other means.

regulator's ability to implement yardstick competition (see pages 26 and 106), either by reducing the number of available comparators or by degrading their comparability with each other; and (iii) usually leads to a loss of capital market information.

- ***Diversification allows scope for cross-subsidisation through transfer pricing in intra-company transactions***, which could result where the regulated business pays higher prices than the market rate for the goods and services provided by associated companies or where associated companies pay lower prices that the market rate for the goods and services provided by the regulated business. Transfer pricing can be used to circumvent economic regulation and to support anticompetitive behaviour of affiliated companies. In many public utility industries, there is "a long tradition of regulated firms paying excessive prices to affiliated, unregulated companies" (Laffont and Tirole, 1993). One example is afforded by a water concession in Mexico which was awarded to a subsidiary of a large construction company (Lee, 1998). There was a common perception that the concessionaire was more interested in the construction possibilities that the contract provided for its parent company rather than in operating the system. A related concern is that, because of the crucial role which public services and infrastructure play in urban development, there is the potential for a diversified utility, especially if it provides two or more public services in the same geographical area, to use the scale, timing and location of investments (e.g., utilities usually have their own preferred development sites based on spare capacity in networks and their own land and property assets) to enhance land values strategically and control new industrial, commercial and housing developments (Marvin and Graham, 1994). In part because of these concerns, Chile has recently modified the "*Ley General de Servicios Sanitarios*" to limit the diversification of electricity distribution and local telephone companies into the water supply and sewerage industry.

- ***Diversification can be detrimental to the core business***. For example, a failure of a related non-core (unregulated) business might negatively affect the ability of the utility to raise capital for and operate the core business; diversification into a riskier business is likely to increase the cost of capital; the acquiring party might be financially incapable of providing an adequate service at reasonable rates or operationally incapable of running the system properly; merger negotiation, integration and the operation of a non-core business might consume excessive amounts of management time, energy and resources distracting them from the operation of the core business; and the management of the core business might be subject to pressure to act other than in accordance with the best interests of the core business. These fears are not entirely groundless. A recent survey of the largest mergers completed between 1996 and 1998 found that "only 17% of deals had added value to the combined company, 30% produced no discernible difference, and as many as 53% actually destroyed value. *In other words, 83% of mergers were unsuccessful in producing any business benefit as regards shareholder value*" (KPMG, 1999). According to Aylott (1996), most privatised water supply and sewerage companies in England and Wales have experienced problems in areas where they have diversified.

All these are real problems: "The general point is that cross-subsidization between regulated and non-regulated activities, the handling of common costs and transfer pricing in intra-company transactions, risk shifting and cost shifting, and the hiding of profits in costs are not abstract bugaboos dreamed up by academic industrial organization theorists or Veblenian institutional economists. They are real and troublesome problems that surround diversification issues ... It is no surprise that regulators worry about them" (Jones, 1992).

It is sometimes argued that rate-of-return regulation exacerbates the problems associated with diversification. Braeutigam and Panzar (1989) developed a model which implies that rate-of-return regulation encourages public utilities to misreport cost allocation and view diversification decisions inefficiently. In theory, price-cap regulation gives public utilities incentives to diversify into a non-core market if and only if diversification is efficient. In practice, however, diversification poses essentially the same problems under price-cap regulation as under rate-of-return regulation (Armstrong, Cowan and Vickers, 1994). The principal reasons for this are that: (i) the result of Braeutigam and Panzar (1989) depends on the regulator having complete information and this is obviously not the case in the real world where there is the asymmetry of information between regulator and public utilities; (ii) under price-cap regulation, public utilities usually have more discretion over relative prices than under rate-of-return regulation, so the scope for anticompetitive behaviour is potentially larger; and (iii) price-cap regulation, as implemented in most countries and particularly in the water supply and sewerage sector, incorporates most of the features of rate-of-return regulation.[1]

Diversification could offer benefits to consumers in terms of reduced prices and improved services which may not otherwise be achieved. To the extent that there are such benefits, the regulators' task is to ensure that at least a part of these are passed on to customers. An important question for regulatory policy is, therefore, how to structure the regulatory system to take advantage of the potential benefits of diversification while avoiding its potential negative effects.

To deal with the issue of diversification, regulators can adopt a number of measures including requiring public utilities to maintain separate accounts and issue separate financial statements for the regulated part of the business or to separate the regulated part of a company from the unregulated activities and impose an arm's length relationship between the two parts of the business (IEA, 1994). To ensure that the core business would not be compromised if financial problems occur in other parts of the parent company, regulators can prohibit debt finance that contains cross-default covenants or require that the core business retains investment grade credit ratings (London Economics,

[1] Although the form of price regulation does not seem to have any appreciable implication for the incentives of regulated utilities to diversify, its effectiveness could have some effect. Aylott (1996) describes the situation immediately following the privatisation of water supply and sewerage companies in England and Wales as follows. There is persuasive evidence that the initial regulatory settlement was generous to the privatised companies. The initial settlement left them cash-rich from a core business that was mature and whose future returns to shareholders seemed under threat from an anticipated tighter regulatory review. In addition, any distribution of funds to shareholders in the short term ran the risk of inviting an even tighter regulatory review. It is not surprising to observe, therefore, that the companies quickly used the funds to take up the new opportunity to diversify. See also Shaoul (1994).

1999). To deal with the problem of transfer pricing, regulators typically require public utilities to market test transactions with related companies and to establish market prices at which transactions should take place (Mayer and Vickers, 1996). These measures can be strengthened by close supervision of dividends, loans, asset transfers and other financial transactions between regulated business and the group and by prohibiting the regulated business to lend, extend guarantees, pay dividend or transfer assets to the other companies in the group without the regulator's consent. Implementing these regulations can impose formidable information requirements on regulators.

One common concern of regulators is that an acquisition of a water utility usually entails its delisting from the stock market. Since no separate share price will be observable any longer, acquisitions can cause a significant loss of information to the regulator. Specifically, the regulator will not be able: (i) to monitor the share price performance of the core business; (ii) to identify the systematic risk of the utility separately from the business as a whole; (iii) to compare the book or regulatory value of assets employed with their market value; and (iv) to rely on investors who are concerned about the performance of the subsidiary as distinct from its parent in its efforts to police transfers of resources out of the core business (Mayer and Vickers, 1996). A related but minor concern is that the delisted water utility will no longer be under direct observation of the financial community. The loss of information for the regulator can be significantly ameliorated by requiring the separate listing of the core businesses. In Western Europe, for example, it is commonplace for diversified companies to list a minority of shares, often from 20 to 30%, of a subsidiary on a stock market (Mayer and Vickers, 1996).

Another common concern is that, usually, the shareholders of the target utility will not support a merger unless the acquiring utility offers them a premium above the market value of their stock and this expense must be borne by someone (Knickerbocker and Davis, 1999). In the United States, for example, historically, regulatory agencies have required public utilities to exclude the acquisition premium from rate base. This stance was taken to prevent ratepayers from paying higher rates for the same property that had been providing them utility service prior to the acquisition simply because that property had changed hands. Since preventing recovery of acquisition premiums from ratepayers in all cases might discourage beneficial mergers, there are some exceptions to this general rule. For example, regulators usually permit the recovery of an acquisition premium when the utility that is taken over is "troubled" (i.e., badly managed or too small to be efficient). In addition, if the utility can demonstrate clear benefits to ratepayers, some states have permitted the utility to recover the premium, of a portion of it, from the ratepayers. However, quantifying benefits to ratepayers and determining whether alleged savings are the direct result of a merger is not easy.

In the water supply and sewerage industry in England and Wales, although companies are at liberty to diversify, the DGWS must ensure that diversified activities are not detrimental to the core business and that customers are protected from any potential losses resulting from diversification (OFWAT, 1996a). To deal with the issue of diversification, OFWAT has adopted the following main measures in recent mergers:

- ***Each company is required to have sufficient assets (land, plant and equipment) at its disposal to perform its functions*** (OFWAT, 1996a). The following

requirements are placed upon the directors of the companies: (i) they must act at all times in the manner best calculated to ensure that the companies have adequate financial and managerial resources to run the core business; (ii) they must annually certify to OFWAT that they have adequate financial and managerial resources to ensure the proper running of the core business for the coming year; and (iii) after any material diversification takes place they must re-certify that they will continue to have the necessary resources. At the same time, the DGWS wishes to be satisfied, in each merger or take-over, that the prospective owner has the probity and operational and financial capacity to assume that role (OFWAT, 1998e).

- ***Companies are under a duty to trade at arm's length and to ensure that there is no cross-subsidy with respect to transactions between the core business, on the one hand, and associated companies and the non-core business, on the other*** (OFWAT, 2000a). These arrangements ensure: (i) that the prices paid for services provided by associated companies are based on proper market testing; (ii) that the transfer of assets from the water company to any associated company is prohibited without the DGWS's consent; (iii) that the water company's dividend policy does not undermine its ability to finance the proper carrying out of its functions; and (iv) the co-operation of the parent company in complying with the water company's responsibilities (OFWAT, 1999c). OFWAT issued guidelines to establish a framework with which companies must comply (see Box 11).

- ***To strengthen management independence of the core business in a diversified utility, the DGWS and the industry have agreed on the following licence amendments***: (i) the company should be required to conduct its core businesses as if it were substantially the sole business undertaken and it were a separate public limited company; (ii) the composition of the board should be such that it could act independently of the parent company, and the directors should act exclusively in the interests of the core business if conflicts of interest arise and that they should not vote on contracts where they have interests by virtue of other directorships; (iii) the water company's dividend payments should not exceed amounts which would preserve its ability to continue to discharge its water and sewerage utility functions and to finance them; and (iv) the water company should be required to obtain from its parent company an undertaking to ensure that the core business' board contains at least two non-executive directors of standing and having relevant experience in the recognition and protection of customers' interests (OFWAT, 1998e).

- ***The DGWS has also adopted measures to secure continued access to sufficient high quality information to allow him or her to carry out his or her functions***. In many mergers and take-overs, the DGWS expressed concern that the water business would no longer be listed separately on the Stock Exchange (OFWAT, 1998b). This would deprive the regulator of stock market information when setting price limits and reduce the transparency of the company's financial performance. These detriments might be remedied in one of several ways: (i) the company could agree to publish financial information as if it were listed and

Box 11

OFWAT's guidelines on transfer pricing in the water industry

The guidelines are based on the following principles: (i) the core business pays a fair price for services and products received; (ii) costs are allocated in relation to the way resources are consumed; (iii) transfer prices for transactions between the core business and associated companies are based on market price or less, and where no market exists, transfer prices are based on cost; and (iv) market testing is used to establish market prices for supplies, works and services provided to the core business. Companies are required to demonstrate, through the application of these principles, the basis of arm's length trading and that cross-subsidy does not exist. They must develop processes and procedures to meet their own specific circumstances, and ensure that transactions are supported and documented. The onus will be on core businesses to determine whether or not any company with whom they trade is an associated company.

Principles of cost allocation

Cost allocation is the means by which costs are divided between the core and non-core activities within the company, and to specific products and services. Cost allocation rules apply to transfer prices from associated companies where no external market exists, including services received from the parent company, or where costs are incurred commonly by core and non-core activities. The key principle is that costs should be allocated in relation to the way resources are consumed. This approach views a business as a series of activities, each of which consumes resources and, therefore, generates costs. An activity based approach should result in the majority of the total costs being allocated on a meaningful basis. Cost allocation must be fair and reasonable and there must be consistent treatment of costs for core and non-core activities. Any charges paid to the parent company must be related to the services provided and should be charged at cost. Where it is not possible to charge for services on an activity basis, costs should be distributed fairly between each subsidiary of the parent and in a way that reflects the activities the parent undertakes on behalf of the individual subsidiaries.

Principles of transfer pricing

The primary principle is that transfer prices should be based on market price or less and that market price should be determined by market testing. In general, market price should be the most economically advantageous price taking into account objective criteria such as completion date, quality, running cost, after sales service, technical merit, whole life cost, etc. The market testing process must be applied in a fair, open and transparent manner with no guarantee of success for associated companies. Where a service is market tested it should be a real market test and the work should be awarded to the tender that is the most economically advantageous.

Transfer prices can also apply to staff where they provide services or are seconded to associated companies and vice versa. Where company staff undertake work for associates, the company should be reimbursed to reflect the individual's salary and overheads associated with that individual's employment. In addition, payment should reflect the lost opportunity costs to the company of that individual's unavailability to it.

Where assets are transferred out of the company to an associate, the associate should pay a fair price, as determined by net book value or a fair market price, for those assets. Associates should not receive assets from the company at a price below that which would be charged by a third party.

Principles of market testing

Market testing is the process of determining a market price for a particular supply, works or service. There are a number of methods of market testing: (i) competitive letting; (ii) comparison to published list prices; (iii) third party evaluation; and (iv) benchmarking. The most robust means of determining a fair market price is to invite independent contractors to tender a price for a given work or service. Competitive letting is the only means of market testing which objectively tests and preserves the competitive market. The company will be expected to make a strong case for using methods other than competitive letting and will need to demonstrate the robustness of the methods used. Companies should establish and apply clear policies and procedures for market testing. The reasons for the methods, thresholds and criteria adopted should be transparent and should be capable of withstanding scrutiny by the DGWS, customers and competing contractors. Policies and procedures should include the following as a minimum: (i) market testing methods to be used; (ii) procedures to be adopted with respect to each method; (iii) materiality levels for types of contract; (iv) frequency of market testing; (v) review procedures; (vi) responsibilities for conducting market testing; and (vii) documentation of procedures.

Partnering

Where core businesses pursue partnering arrangements with associated companies they should take account of the following principles: (i) selection of partners should be made following a competitive letting process; (ii) the partnering arrangement should run for a stated period of time; and (iii) any partnering agreement should include mutually agreed and reasonable targets for improving performance and reducing costs. Core businesses will need to take steps to enable them to demonstrate that arrangements with associated companies operate at arm's length and are producing tangible benefits in terms of improved performance and reduced costs.

Source: OFWAT (2000a).

subject to the rules of the Stock Exchange; (ii) it might agree to re-list its water interests on the Stock Exchange; (iii) it might list a class of equity, which would provide investors with a return related to the water business' performance, as well as financial information for them and the DGWS; or (iv) it might list preference shares (or other financial instruments) in the core business' holding company, which would provide some market information, albeit less than would a listing of equity (OFWAT, 1998e).

E. Multiple regulators: the problem of common agency

If a public utility faces separate regulators with different objectives, duties, information, instruments and powers there is the potential for tension between them as well as for inefficiency. This is a special case of the common agency problem, where several regulators, whose preferences for the various possible actions typically conflict, simultaneously and independently attempt to influence the actions of a common agent, such as a water utility (Bernheim and Whinston, 1986). For example, water utilities usually respond to separate regulators for economic aspects of their operation, for water resources allocation, and for water pollution control. An important question for regulatory policy is thus how to regulate pricing, drinking water quality, water pollution, water abstraction, etc. simultaneously.

In the water industry, higher standards demanded by environmental regulators inevitably require additional expenditures and have, therefore, implications for rate setting. If the environmental regulator does not need to consider the costs of achieving a given standard for quality and the environment then it will tend to set standards which are too high from the point of view of economic efficiency. The economic regulator will then have to set prices to ensure that the costs of reaching the inefficiently high standards can be financed by the water utilities. Pollution control is likely to present a particularly serious problem for regulatory co-operation when those who bear the costs and those who receive the benefits are in different jurisdictions, and their interests are represented by different regulators. Baron (1985) presents a theoretical analysis of the regulation of a public utility by separate environmental and economic regulators and illustrates the kind of conflicts and inefficient outcomes that can arise (see Box 12). Both Baron (1985) and Acutt and Elliott (1999) find that improvements in efficiency would arise from direct co-operation between economic and environmental regulators.

The potential for inefficiency underlines the need for defining the role of each regulator as clearly as possible, for close co-operation and effective communication among different regulators, for their responsibilities being compatible, for institutional procedures that guarantee collective and co-ordinated decision-making, for full assessment of all benefits and costs of new quality and pollution standards, and for considering the effects of new standards on prices and consulting those who have to implement and pay for them. There is also a clear case for giving consumers a voice in the regulatory process (obviously, if they are to provide meaningful input, consumers must have access to sufficient relevant information both on the cost and benefits of new quality and pollution

standards), for considering their preferences and willingness to pay for environmental improvements, and for ensuring that water pollution control programmes are efficient.

Box 12

The common agency problem

Baron (1985) considers the case of a public utility that is subject to regulation by a public utility commission, responsible for tariff setting on the basis of the costs of production and pollution control, and an environmental protection agency, responsible for achieving an acceptable balance between the damage from pollution and the cost of pollution control. The public utility is assumed to have private information about the characteristics of its production process and hence about the effectiveness of alternative means of pollution control.

Although co-operation (i.e., joint regulation of emissions and prices) would internalise the conflicting interests and mandates of the regulators, the distributive consequences of the regulatory alternatives inhibit co-operation (the public utility commission wants to minimise pollution control costs and the environmental protection agency does not want co-operation to impede achievement of its pollution control objectives). In an attempt to obtain less stringent pollution control requirements from the environmental protection agency and a higher price from the public utility commission, the public utility has an incentive to overestimate the difficulty in achieving pollution control standards. In the non co-operative equilibrium, the environmental protection agency sets the maximum emission fee enforceable by the courts and mandates an emission standard that is more stringent than the regulators would choose in a co-operative equilibrium. This forces the public utility commission to respond with prices that are higher than would be set under co-operation. As a result, pollution control is carried beyond the point of economic efficiency and the output of the public utility is lower than with co-operation.

The public utility prefers that the public utility commission and the environmental protection agency not co-operate because it then earns greater rents on its private information.[1] The environmental protection agency is likely to prefer not to co-operate because it is better able to serve its own mandate if it does not take into account the interests of the public utility commission. Only the public utility commission prefers co-operative to non co-operative regulation because co-operation would reduce both the costs of pollution control and the asymmetry of information between it and the utility.

Source: Baron (1985) and (1989).

Note: [1] Shaoul (1994) describes the situation in the water supply and sewerage industry in England and Wales as follows. The capital investment programmes to meet new requirements for both drinking water quality and environmental quality provide the basis for a higher sales revenue and in turn a higher absolute level of profits than would otherwise be possible. While the utilities may complain about new environmental and quality obligations, "these are only ritual protestations since it is the investment programmes [that] provide the basis for much of their profits".

In the water supply and sewerage industry in England and Wales, as economic regulator, OFWAT does not decide on environmental policies, but ensures that the functions of water companies are properly carried out and decides what price limits are necessary to enable the companies to deliver their environmental obligations. It ensures that decision-makers have all the necessary facts and strives to ensure that costing is available and that alternative solutions have been considered (Booker, 1994). OFWAT impresses on the environmental regulators the importance of carrying out adequate economic analysis before they adopt more stringent standards, and encourages water companies to research the views of their customers. It also impresses on both environmental regulators and water companies the need to arrive at efficient solutions in which quality and environmental objectives are achieved in a cost-effective way. In order to clarify current and future quality obligations and the scope for other environmental improvements, OFWAT works closely with: (i) the Environment Agency, which has overall responsibility for water resources management and pollution prevention and control; and (ii) the Drinking Water Inspectorate, which regulates standards for the quality of drinking water (OFWAT, 1997b). The Environment Act of 1995 requires the Environment Agency to take into account the likely costs and benefits when considering whether or not to

exercise its statutory power or in deciding the manner in which to exercise its powers. In order to ensure that water companies are able to plan their investment programmes in a stable regulatory environment, it has been agreed that, in principle, major changes in environmental policy would be implemented to coincide with the periodic reviews wherever possible (Helm and Rajah, 1994).

In the United States, fragmentation of regulatory authority in the water area is a persistent issue (Beecher, 1997). To deal with this issue, some state public utility commissions have begun to co-ordinate economic regulation with the regulatory activities of other state authorities involved in water resources policy. This co-ordination takes various forms: several states have adopted memoranda of understanding to promote co-ordination, while others use less formal means of collaboration. In some states, the need for closer co-ordination between economic and environmental regulation has led to calls to transfer these responsibilities to a single agency, as has been done in Texas where the Texas Natural Resource Conservation Commission (TNRCC) is in charge of all aspects of water utility regulation, including economic regulation (other state agencies regulate other utility industries) and natural resources management (Little Hoover Commission, 1996; Beecher, 1997).

Although the integration of economic and environmental regulation reduces the danger that the two types of regulation would be conducted in isolation from each other, this approach presents its own problems: (i) the creation of a single regulatory body could increase the possibility of regulatory capture (with separate regulators, the economic regulator acts as a constraint on the environmental regulator and vice versa); and (ii) merely putting the two organisations under one roof does not necessarily resolve the fundamental conflict between different regulatory objectives — maximising environmental quality while at the same time minimising bills (Helm and Rajah, 1994). This approach may also give rise to concern that the integration of economic and environmental regulation would give insufficient weight to environmental or other interests.

The common agency problem is not limited to the possible conflict between economic and environmental regulation. The regulators of the water, electric, gas, telecommunications and other infrastructure industries all face many similar issues in relation to the regulation of their particular sectors. These common issues underline the importance of close co-operation and co-ordination and effective communication among all regulatory agencies. At the same time, as a result of merges, take-overs, etc., patterns of ownership and control begin to cross boundaries between the regulated sectors and multi-utilities (i.e., companies providing a number of different utilities services) are starting to emerge. In the countries where each sector is regulated separately, the emergence of multi-utilities creates the danger of inconsistent treatment among different regulators.

Effective management of the regulatory issues associated with multi-utilities requires consistency and collaboration between regulators over as a minimum: (i) the principles of transfer pricing and cost allocation for merged monopoly utilities; (ii) the consistency of approach to price setting for monopoly services, including the estimation of the cost of capital and the treatment of claimed synergy savings from mergers, etc.; (iii) the transparency and consistency of regulatory accounts; and (iv) the rigour in monitoring compliance with ring-fencing requirements (DGES et al., 1998). Consistency

and collaboration are particularly important: (i) in the case of public utility services that are subject to substitute competition (e.g., gas and electricity); and (ii) where one company provides two or more local monopoly services in the same area (e.g., water supply and electricity distribution).

In the United Kingdom, the five regulators for water, telecommunications, rail, gas and electricity meet several times a year and joint working groups look at specific issues (OFWAT, 1999d). They also have regular contact on a range of topics with the Office of Fair Trading and the Competition Commission (successor to the Monopolies and Mergers Commission (MMC)). In addition, the regulators have recently agreed to strengthen and put on a formal basis their current arrangements for working together, and the government has proposed that there should be a duty on regulators to give collective consideration to matters of common interest (OFTEL et al., 1999).

This special case of the problem of common agency is important for the ongoing debate on whether it is better to have industry-specific regulatory agencies, as in Argentina, Brazil, Chile, Peru and other countries, that follow the United Kingdom model of regulating each industry separately, or multi-industry regulators, as in Costa Rica, Jamaica, Panama and other countries, that follow the model adopted in most states of the United States of having one regulator for all public services or at least for a group of closely related services. The principal and traditional argument in favour of the former approach is that it allows specialisation among regulators and ensures that they acquire deep expertise about the industries they regulate, leading to better regulatory decisions (Tovar, 1997; Joskow, 1998). This approach is also sometimes preferred because it avoids creating powerful bureaucracies. On the other hand, there are also strong reasons for preferring multi-industry regulatory agencies (Joskow, 1998; Smith, 1997b; Kim and Horn, 1999; Helm, 1994b):

- This approach reduces the scope for the problem of common agency and minimises the risk of inconsistency in the regulatory process. It also expands opportunities for learning based on experience with other industries and new regulatory mechanisms.

- It allows to realise the economies of scale which exist in regulation (e.g., it avoids the duplication of staff with common skills that are needed in the regulation of two or more industries). These economies of scale are potentially large because there are many important common issues in regulation of most utility industries (e.g., asset valuation), and most activities of regulatory agencies have many common elements (e.g., handing complains and monitoring service quality). This is especially important in countries with limited regulatory capacity and that lack a strong pool of professionals with relevant technical experience.

- It helps reduce the asymmetry of information between regulator and utilities, because there will be multiple sources of information, as well as the risk of regulatory capture by a single interest group and the scope for political interference.

Whether industry-specific or multisectoral approach should be preferred is an empirical problem that necessarily depends on country-specific conditions. However, whatever approach is adopted, there is a clear need for close co-operation between different regulatory agencies, both those in charge of different industries and those existing in different jurisdictions as in some federal countries (e.g., Argentina). The benefits of close co-operation include but are not limited to: (i) realising economies of scale in research of regulatory issues of common interest; (ii) informal exchanges on lessons of experience in dealing with particular issues, and collaboration in development of model contracts, accounting guidelines, etc.; (iii) realising economies of scale in training activities; (iv) mutual support and provision of technical advice on specific regulatory problems; and (v) development of a system of yardstick competition (World Bank, 1996).

In some countries, these considerations have led to the creation of national associations of regulators. One example is afforded by the National Association of Regulatory Utility Commissioners (NARUC) in the United States. Its objectives are the advancement of public utility regulation through the study and discussion of subjects concerning the operation and supervision of public utilities, the promotion of uniformity of regulation of public utilities by the several commissions, the promotion of co-ordinated action by the commissions of the several states to protect the common interests of the people with respect to the regulation of public utilities, and the promotion of co-operation of the commissions of the several states with each other and with the federal commissions represented in the association (NARUC, 1999).

Finally, as a result of a globalization process in which international capital and transnational corporations are increasingly investing in the water supply and sewerage industry, a new form of the common agency problem is beginning to emerge. The regulation of public utilities owned by transnational corporations presents new challenges for national regulators because these corporations are subject to simultaneous regulation in several countries but there are no co-ordination mechanisms. However, the rules imposed in one country often affect the behaviour of the corporation in other countries, and the corporations are in a position to play national regulators against each other. National regulators must recognise, therefore, that the regulatory policy adopted in one country "affects and depends on the policy in place in the other countries", and that traditional approaches are "not directly applicable to the problem of regulating multinational enterprises" (Calzolari, 1999). There is also a clear case for international and bilateral co-operation in regulation as well as for regular exchange of information among national regulatory agencies of different countries.

III. Structure regulation

Structure regulation is concerned with the way in which an industry is organised. It aims to reduce or remove the opportunity and incentives for undesirable behaviour by exercising direct control over the structural environment in which the regulated utility operates.

The structure of an industry largely determines the conduct of its member utilities. It is useful to distinguish between two groups of industries. At one extreme, there are industries, such as electricity and telecommunications, that can in principle be restructured to ensure workable competition in some of their segments (e.g., electricity generation and long-distance telephone service). These industries combine both natural monopoly and potentially competitive components. In them, the purpose of structure regulation usually is to introduce changes in their structure so as: (i) to allow effective competition in their potentially competitive segments as a means to the end of achieving economic efficiency and reducing the regulatory burden; and (ii) to facilitate effective conduct regulation of the segments where competition is not possible.

At the other extreme, in industries with a high degree of natural monopoly, such as water supply and sewerage, where competition cannot be relied on to ensure socially desirable outcomes, conduct regulation, rather than structural reform and the promotion of competition, is the appropriate policy response. In these industries, structure regulation should seek to facilitate conduct regulation, in particular by improving the quality and quantity of the information upon which regulators make their decisions.

As a matter of general principle, any restructuring of a public utility industry should preferably be done while it is still state-owned. First, in the case of industries that can be restructured to ensure workable competition in some of their segments, the experience of privatisation reforms both in Latin America and in developed countries strongly suggests that it is extremely difficult to introduce competition where a dominant incumbent controls an essential facility (e.g., transmission network) and where competition relies on access to that facility. In such conditions liberalisation without structural reforms is not generally sufficient to encourage the emergence of effective competition. Second, by shifting emphasis in corporate objectives towards profit maximisation, privatisation is likely to increase dangers of anticompetitive behaviour and encourage attempts to reassemble monopolies, and so increase the benefits of restructuring as a solution to this problem (Vickers, 1991). Third, in order to determine the price they are willing to pay, investors need to know under what regulatory regime the utility will operate and how it is likely to evolve in the following years: “Where a monopoly is transferred to private investors, the most valuable asset may not be the physical infrastructure, but rather the license or right to provide the monopoly service under specified conditions” (Guislain, 1992). Unexpected post-privatisation restructuring might constitute a breach of commitments given to

investors at the time of sale, and uncertainty about future reforms is likely to result in lower investor interest and sale price, and might discourage investment, seriously undermine investment planning, and increase the cost of capital.

A. Horizontal restructuring

Horizontal separation breaks up, or unbundles, public utilities by markets, by geographical regions or by individual units, creating entities which can directly or indirectly compete with each over. A typical example of horizontal separation is the division of a national water supply and sewerage utility into state, provincial, regional, municipal or other units. In many Latin American countries, the water supply and sewerage sector has already been decentralised or is in the process of decentralisation (ECLAC, 1999). In some countries of the region, however, the sector is quite fragmented being unable to realise economies of scale, and so horizontal integration rather separation is order of the day.

Unaffected by the kind of technological changes that are opening the telecommunications and electric industries to competition, water supply and sewerage utilities are expected to remain natural monopolies for the foreseeable future, so conduct regulation would need to be permanent. Since the water supply and sewerage industry displays almost no scope for direct market competition (see page 99), the main advantage of a horizontally fragmented industrial structure is that it can improve the effectiveness of conduct regulation as yardstick competition can be used (see page 106). Its other, but much less significant, potential advantages are that it increases the scope for franchising (see page 110) and facilitates capital market competition (see page 109).

Horizontal separation is, however, by no means a panacea; it will certainly involve some costs. In order to determine its optimum degree and form, it is important to balance its potential benefits, in terms of improved regulatory effectiveness and better incentives, against the costs involved. In addition, many other factors need to be carefully analysed, such as technological, economic and social constraints to horizontal separation and the legacy of history and institutions. The main potential costs of horizontal separation are:

- ***The loss of economies of scale***: where economies of scale are significant for a relevant market size, water supply and sewerage services can be provided more economically by a single utility and horizontal separation will raise the costs of service provision.

- ***Increased regulatory burden***: while horizontal separation facilitates conduct regulation and improves its effectiveness, a highly fragmented industrial structure is likely to increase regulatory burden.

- ***Reduced scope for cross-subsidisation***: by reducing the size of individual service areas and possibly making them more homogeneous, horizontal separation may limit the potential for cross-subsidisation if one of the service areas contains an insufficient proportion of high-income households to cross-subsidise low-income ones resulting in unaffordable tariffs or connection charges for the latter. An important point to note is that the costs of service provision tend to be greater

in low-income neighbourhoods because they are often developed in an unplanned manner, located far from the existing networks, or situated in areas with difficult topographical conditions (Johnstone, Wood and Hearne, 1999).

- ***Reduced attractiveness to the private sector***: small water supply and sewerage utilities are likely to be unattractive to the private sector, at least individually.

- ***The costs of sector restructuring***.

The principal potential cost of a horizontally fragmented industrial structure is the loss of economies of scale. Good data on economies of scale for different segments of the water supply and sewerage industry are typically not available in many countries and the exact figure is highly regionally specific (varying with population density, topography, technology, etc.). Nevertheless, it is widely accepted that water supply and sewerage services are subject to significant economies of scale. In the United States, for example, the average water system investment to serve a residential family (of three persons) ranges from US$ 200 per capita for the larger systems to US$ 1 600 for the smaller systems (Phillips, 1993).

In Latin America, there is strong evidence that water supply and sewerage services in communities with population of less than 150 000 to 200 000 (less than 20 000 to 40 000 connections) can be provided more efficiently and at a lower cost if they are managed and operated by regional companies (Yepes, 1990). This evidence also indicates that operating costs per connection continuously improve to at least 1 million connections. The United Kingdom experience suggests: that a service area of less than about 500 000 customers is likely to lead to suboptimal operation (World Bank, 1997); that the optimal operating scale could be below 1 million served customers (Rees, 1998); and that economies of scale are exhausted at population of 500 000 to 1 million (Cowen and Cowen, 1998).

Economies of scale are usually more important in large population centres and suburbs compared to less densely populated areas (Hunt and Lynk, 1995). On the other hand, very large systems often suffer from organisational diseconomies of scale. Large and centralised national organisations are, therefore, not an optimal solution. Experience during the sixties and seventies in Argentina, Colombia, Mexico and other countries of the region indicates that central water supply and sewerage agencies stretched managerial capacity to the point where gross service inefficiencies were readily observable (Yepes, 1990).

1. New opportunities for direct market competition

The water supply and sewerage industry is a classic case of a local natural monopoly.[1] It is considered “the most monopolistic of utility services” and, as such, is uniquely resistant to

[1] There are two principal natural monopolies in the water supply and sewerage industry: water distribution and wastewater collection (Vickers and Yarrow, 1988). Natural monopoly conditions derive from the established local networks of water mains and sewers. Economies of scale are usually less significant in raw water extraction and treatment, and in wastewater treatment and disposal. Separation of water distribution from wastewater collection would generally be inefficient because: (i) the equipment used and the experience gained in operating and maintaining water mains are also of use for sewers; (ii) the demand for

direct market competition (Marvin and Simon, 1997). Most forms of direct market competition between public utilities in the provision of water supply and sewerage services within a given region would entail inefficient, wasteful and prohibitively costly duplication of the network of water mains and sewers as well as cause disruption in the streets. Moreover, at least in the foreseeable future, the barriers to direct market competition in this industry are unlikely to be reduced to any significant extent by the kind of technological progress which opened the telecommunications and electric industries to competition.

It is for these reasons that regulators always rigidly control entry into the water supply and sewerage industry, and each water utility has responsibility for its own exclusive geographical area, which does not overlap with any other. The overall purposes of this control are: (i) to avoid unnecessary duplication of facilities and the associated economic waste in this extremely capital intensive industry; (ii) encourage the achievement of economies of scale; (iii) to protect the necessarily significant utility investment from ruinous and destructive competition, and thereby provide the protection that is needed as an incentive for the large capital investments and long-term commitment that are essential for the effective and efficient operation of utilities; and (iv) to avoid the public inconvenience that results from the installation and maintenance of duplicative facilities (Swartwout, 1992).

In spite of this traditional regulatory practice to avoid direct market competition in the water supply and sewerage industry, there are opinions to the contrary (Robinson, 2000). For example, in England and Wales, the government believes that the development of competition in the water industry is desirable (see Box 13). According to van den Berg (1997), this interest appears to be inspired mainly by political considerations. There is also interest in some forms of direct market competition in Chile. It is important to note, however, that, for reasons discussed below, "at the distribution or delivery level, competition in water supply is highly impractical" (Mann, 1999), that "direct product-market competition is unlikely to be as prevalent and as successful in water as it has been in other regulated markets" (Cowan, 1997), and that "in water no amount of restructuring will remove natural monopoly and the need for continued public regulation" (Rees, undated).

Horizontal separation creates the following three limited opportunities for direct market competition:

Common carriage occurs when one utility supplies water or sewerage services to its customers by using another utility's network. This form of competition is possible in the electric and telecommunications industries (see page 110), but in the water supply and sewerage industry "no one has yet succeeded in implementing this sort of competition" (Klein and Irwin, 1996). The principal impediment to this form of competition is that,

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sewerage services is complementary to the demand for water, so the two services must be expanded simultaneously; (iii) residential sewerage pricing is closely related to water pricing, and the simplest way to enforce payment for sewerage services is to cut off water supply; (iv) separation would increase the costs of metering and billing; and (v) integration at the river basin level could promote internalisation of some externalities associated with source water protection and water pollution control.

Box 13

Direct market competition in the water supply and sewerage industry in England and Wales

The DGWS has a duty to facilitate effective competition in the water supply and sewerage industry in England and Wales. The framework for competition was set out in the Water Industry Act 1991 and the scope was extended by the Competition and Services (Utilities) Act 1992 and the Competition Act 1998. The latter Act strengthens crucially the legal powers available to the DGWS to prevent abuse of a dominant position and other anti-competitive behaviour. There are four main ways at present to achieve greater market competition.

Inset appointments

Inset appointments provide for the existing regulated water or sewerage supplier to be replaced by another, for a specific site. A successful inset appointee can serve its new customer(s) either using its own resources or methods of treatment, or by requesting the use of the existing supplier's assets. An inset application must meet one of three criteria: (i) the customer uses (or is likely to use) at least 250 million litres of water in any period of 12 months (this is known as a "large user inset"); (ii) it is a site not currently being served by a regulated supplier (this is known as a "greenfield inset"); or (iii) the existing regulated supplier agrees to the inset.

Cross-border supplies

Companies have a duty to allow connections to their water mains from outside their areas. This means that customers are entitled to receive water from any regulated company, for domestic purposes, irrespective of where they live, as long as they are prepared to pay the reasonable costs of making this connection. Owners of private sewers and drains have a similar entitlement to connect to the public sewer. An anomaly that exists for the moment is that companies are required to make cross-border supplies for domestic purposes if asked, but are not obliged if the supply is for non-domestic purposes (although they may still do so).

Unregulated supplies

Most people in England and Wales receive their water supply and sewerage services from regulated companies. Some private operators exist, who are not regulated by the DGWS, and customers are entitled to buy water and sewerage services from them. The terms and conditions of supply to their customers are not regulated, although private supplies are subject to quality standards, enforced by local authorities. Customers can also use their own on-site water resources or waste treatment plants, either instead of or in conjunction with public supplies. This continues to be an effective form of competition, particularly with respect to pre-treatment of effluent.

Common carriage

Common carriage occurs when one service provider shares the use of another's assets, such as its pipes or treatment works. Common carriage between companies occurs now, but is limited in scale. Some new entrants to the industry (and some existing companies) are interested in using others' networks to supply customers. To do so a competitor needs to be allowed to share the monopoly inherent in water and sewerage networks, on fair terms. The DGWS considers that it is not his/her job to prescribe in advance the principles by which incumbents will govern the shared use of their infrastructure. This is for companies to decide. The DGWS has, however, given guidance on a number of important issues that each incumbent should take account of when implementing common carriage arrangements (see page 104). If an incumbent supplier refuses a request to share the use of its networks with potential new entrants, or makes the terms unreasonable, the DGWS will investigate whether the incumbent has any objective justification for such refusal. If the incumbent is found to be abusing a dominant position, the DGWS will direct it to change its conduct and, if appropriate, impose financial penalties.

Results

Although the scope for competition is limited at present, its threat has already delivered some tangible benefits to some customers. Perhaps the most significant of these benefits is the introduction and development of tariffs for large users. These began as reductions from the standard tariff for users above the 250 million litres per year threshold and have since been extended to include users of as little as 0.5 million litres per year, as well as offering seasonal and interruptible tariffs.

Proposals

The DGWS has recommended to the Government a reduction in the threshold for inset appointments to 100 million litres per year. This measure would increase eligibility from around 500 customers at present to about 2 000 customers.

Other proposals to increase competition include:

- A revised system of regulating water abstraction, to allow greater trading of rights to abstract.
- Provision of cross-border supplies of water for non-domestic purposes.
- Allowing premises to be combined to meet the consumption limit for a large user inset.
- Removing the companies' current monopoly on making connections to the water mains.

Source: OFWAT (2000b) and (2000c); DETR (2000).

usually, unlike in electricity, gas and telecommunications, there are no national or even extensive regional networks of water mains and sewers. For example, in England and Wales, "plans for a national water grid ... have been ruled out as too expensive" (Wood and Serjeant, 1996).

Water supply and sewerage services are essentially local, or at most, regional monopolies, and the industry tends to have a fragmented rather then integrated horizontal structure in most countries. The principal reasons for this are threefold: (i) investment costs in the networks of water mains and sewers are extremely high; (ii) water and sewage are heavy and non-compressible, so the costs of transportation tend to be very high in relation to the costs of water abstraction, storage, treatment and retailing, and sewage collection and treatment; and (iii) water is easily storable, so the benefits from interconnection tend to be small. The benefits of interconnection are likely to be especially small and its costs especially large in sparsely populated but abundant in water areas typical of most Latin American countries where many population centres are located at larger distances from each other than in Western Europe or in the United States. This is the reserve of the situation in the electric industry where the product is generally non-storable and the bulk of the costs are usually in the generation and retail segments (Webb and Ehrhardt, 1998). In Argentina, for example, transmission represents only about 10% of the total value added of the electricity sector (Artana, Navajas and Urbiztondo, 1999a).

Without a national network, competition through common carriage can only take place at a local (e.g., in the cities served by two or more water utilities), and in some cases, regional (e.g., where water utilities have established regional networks as security against localised water shortages) level. Even this limited competition is extremely unlikely to be effective because there is usually only a very small number of potential competitors. This means that competition, even where it emerges, is likely to be oligopolistic, if not duopolistic, in nature. For example, the opportunities for supplying water from potential new sources (or treating wastewater in other locations) are very limited in most areas: (i) by the availability of sources of good quality water which can be accessed at a reasonable cost and in an environmentally acceptable way; (ii) by economic factors such as the possible need for costly treatment to meet regulatory standards; and (iii) by the cost of pumping to overcome topographical obstacles (DETR, 1998). As for wastewater treatment, economies of scale are not sufficiently great to justify high levels of either national or regional concentration in this activity (Vickers and Yarrow, 1988), but due to the difficulty of finding adequate sites for facilities, the need to safely dispose of wastes, the heterogeneous nature of sewage (i.e., its composition differs depending on local conditions and this has implications for treatment), and the fixed nature of the transport system, "it is hard to envisage numerous sewage treatment facilities competing with each other" (Hyman, 1995).

Another fundamental source of difficulty has to do with the terms on which an incumbent utility should be required to provide access to essential facilities, such as networks, required by its competitors. On the one hand, a utility in danger of losing profitable customers obviously has strong incentives to deny competitors access to essential facilities on reasonable terms. On the other hand, "there are dangers of inefficient entry and cream-skimming if access is required to be sold too cheaply" (Vickers, 1997). The determination of the terms and conditions of access to network facilities "is perhaps

the most controversial of all pricing structure questions in regulated industries" (Vickers, 1997), so the regulatory burden is likely to be large.[1]

To be feasible, common carriage for water supply would also require sophisticated metering, complex information technology to facilitate customer switching, a high degree of co-ordination (e.g., in a distribution system, flow and pressure must be continuously balanced throughout the system to cope with varying levels of demand from customers), strict and continuous monitoring and control of the quality of water that each utility supplies to the common network,[2] and allocating responsibility for managing emergency procedures and security of supply to customers (see Box 14). In the case of sewerage services, there is a variety of additional issues which may prove even harder to resolve than in the case of water supply (e.g., it is difficult to control and monitor exactly what customers discharge into a sewerage system as well as to ensure that each company extracts the appropriate volume and strength of waste products for treatment from a sewerage system that is being used for common carriage) (DETR, 2000). None of these issues will be straightforward or without controversy. On the whole, common "carriage is not likely to be a major feature of the water industry in the future" (Cowan, 1997).

Cross-border competition is direct competition for large industrial, commercial and agricultural customers. Although duplication of the network of water mains and sewers is almost always inefficient, direct competition for larger customers might conceivably be desirable, especially if there is sufficient demand (e.g., new town, major factory) or if there is product differentiation (i.e., the rival offers a different quality of water supply or wastewater treatment) (Cowan, 1997). In addition, some systems are so run-down that the construction of a competing network is some areas could conceivably be economic (Webb and Ehrhardt, 1998). In practice, however, even where regulatory agencies actively promote this form of competition, "it has proved remarkably difficult to achieve" (Rees, 1998). Historical evidence also supports this conclusion. For example, in the United States, in the nineteenth century, direct competition between water utilities seldom occurred, even in cases in which there were no legal barrier to entry (Jacobson and Tarr, 1995).

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[1] See Armstrong and Doyle (1995), Valletti and Estache (1999) and Vickers (1997) for a discussion of the theory of access pricing. Baker, Hern and Ayres (2000) analyse the issues that arise in setting facilities' access prices in the water supply and sewerage industry. They evaluate the principles that prices should be centred on Long Run Marginal Cost (LRMC) or alternatively on the Efficient Components Pricing Rule (ECPR), and conclude that the latter approach is more appropriate in the current circumstances of the water supply and sewerage industry. The reasons for this conclusion are that in the early stages of competition ECPR is more likely than LRMC: (i) to lead to access prices that reflect the need to cover total costs; (ii) to avoid inefficient entry; and (iii) to allow utilities to meet existing customer service obligations and to limit the possibility of cream skimming that would put pressure on utilities to unwind existing cross-subsidies. In addition, the regulatory and transactional costs of ECPR are likely to be relatively low compared to the LRMC approach.

[2] This is a serious issue for common carriage arrangements because: (i) as a result of mixing different types of water, customers could experience changes in taste, hardness, etc.; (ii) if one utility puts contaminated water into the system, customers of all the utilities connected to it will be affected; (iii) many industrial water users calibrate their processes to the water's usual chemical composition, so if this composition changes, product quality could be affected; (iv) some waters tend to dissolve certain metals (e.g., lead, copper and zinc) from plumbing systems, so there is concern that effective treatment applied to one water may be undone if another water is subsequently mixed with it; and (v) the inner walls of pipes reach a chemical equilibrium with the water flowing through them, so changing the composition of the water could cause faster corrosion, increased build-up of residue inside the pipe, or the release of previously accumulated residue into the water (Webb and Ehrhardt, 1998; DETR, 2000).

Box 14

Principal issues for common carriage as seen in the water supply and sewerage industry in England and Wales

Quality

Common carriage must not lead to increased risk of unsafe water being supplied. The incumbent can expect the water entering its system to comply fully with the water quality regulations. The entrant will be responsible for ensuring its water inputs meet the statutory standards. There is also a need to check that mixing of waters will not cause any deterioration in water quality reaching customers. The entrant should expect to bear the costs of monitoring and sampling the quality of its inputs to the incumbent's system. These costs could be a part of the access charge. However, the monitoring requirements imposed on an entrant should not be any more onerous than a prudent incumbent normally carries out elsewhere in the course of its day to day operations. The entrant could be given the choice of arranging its own sampling and monitoring procedures.

Liability

Incumbents are responsible for the water supplied. Incumbents cannot contract out of this, but they have a defence if they took all reasonable steps and exercised all due diligence to secure that the water was fit for human consumption when it left the incumbent's pipes. Contracts should contain penalties for entrants if their water gives rise to problems.

Emergency procedures

The incumbent is likely to retain primary responsibility for managing emergency procedures. In practice, the incumbent may want to address emergencies as part of a network strategy. There should be provision within the agreement for each party to offer full assistance and co-operation to the other in the event of an emergency. The parties should agree the types of emergency where this arrangement would apply, particularly if it involves the inability of one party to supply its customers.

Security of supply

The entrant will need to ensure that its inputs are matched by its customers' demands. In terms of how these inputs are delivered into the system (such as pressure and flow rates) the incumbent is likely to manage the entrant's inputs as a part of its overall network strategy. It may be necessary in some cases for the incumbent to control how much water the entrant inputs, to allow it to balance the network, as long as the entrant's customers are still able to take supplies. Where the incumbent causes problems of reliability of supply, such as mechanical breakdown, the entrant could expect to receive compensation from the incumbent or have the incumbent make alternative arrangements to supply the entrant's customers.

The entrant is responsible for ensuring that its water resources are sufficient to provide a sustainable supply to its customers, particularly its household customers. However, the incumbent retains the duty to provide supplies to all customers in its service area. Therefore, if the entrant fails to make enough water available to supply its customers, then the incumbent is obliged to provide a supply if requested. The incumbent should receive adequate payment for being left automatically to supply the entrant's customers.

Access charges

The incumbent should treat the entrant and its customers fairly. It is important that access charges allow incumbents to recover reasonable network costs and capital maintenance charges, without over- or under-recovery. This might be on the basis of average costs, where appropriate, or long-run marginal costs. Charges should be non-discriminatory. The direct costs of entry to the market should be borne by those likely to benefit directly from competition, not spread across the entire customer base.

Metering

Metering will be required to measure the entrant's inputs and the demand from its customers.

Leakage

The incumbent and entrant should agree how to recognise leakage and sewer infiltration in calculating the amount of water taken or effluent discharged by the entrant's customers. Several factors are material to this, including the fact that there may be leakage upstream of the entrant's input point, and that water is used by the incumbent in keeping the system running satisfactorily. If the entrant is required by the incumbent to input water additional to the amount taken by its customers, then this allowance might be equal to the incumbent's published leakage figures or its leakage target, appropriate to the part of the system involved. Once figures were agreed, the incumbent ought to make up any excess leakage deficit. If the entrant provides its own new pipes, then one could expect that these are less likely to leak, at least in the short-term, so leakage allowances might not be necessary.

Other terms

Terms such as duration, termination and notice provision will need to be agreed between the two parties. It may be prudent for both parties to agree upon a time-limited contract or one where proposals allow the terms to be re-examined after, say, five years.

Source: Byatt (1999).

Fringe area competition is direct competition between contiguous utilities for the right to supply customers at the boundaries of their service areas (e.g., new sites). This type of competition can be important only where: (i) new residential, commercial and industrial development is taking place in previously undeveloped and unserved areas on the fringes of existing service areas (Joskow and Schmalensee, 1985); and (ii) these new customers are able to pay the costs of connection across the boundary (Cowan, 1997).

While these limited opportunities for direct market competition do exist, there are both advantages and disadvantages involved in encouraging it, so an important question for regulatory policy is to what extent it should be allowed or promoted. On the one hand, direct market competition is likely to make tariffs more cost-reflective, drive utilities to be more efficient, and encourage the introduction of new services, contracts and tariffs (e.g., quantity discounts and distance-related tariffs). On the other hand, direct market competition and its benefits are likely to be minimal and limited to very large consumers, except in few areas with exceptionally favourable characteristics. In addition to the difficulties discussed above, there are also other problems involved in encouraging it. First, in activities characterised by economies of scale, competition is likely to lead to considerable cost inefficiency (e.g., duplication of fixed assets) (see page 99).

Second, it is exceptionally difficult to get direct market competition to work in the water supply and sewerage industry. Its implementation demands sophisticated regulatory capacity, in part because the determination of the terms and conditions of access to essential facilities is a complex and controversial issue. In addition, competition is likely to lead to some cases of socially inefficient changes of suppliers if water abstraction and water pollution are not adequately regulated, or if tariffs do not properly reflect marginal costs (Cowan, 1997). On the whole, the "costs of introducing product market competition in water are likely to be as high as those in other industries — and they may even be higher" (Webb and Ehrhardt, 1998), but "any resulting benefits from increased competition ... are likely to be considerably less than in other utility industries" (Vickers and Yarrow, 1988). There are also other important issues which any consideration of competition in this industry needs to take into account such as the responsibility for continuity of supply, for emergency measures, for developing, maintaining, and extending water supply and sewerage services, etc.

Third, direct market competition is an additional source of uncertainty and commercial risk. It tends to increase the cost of capital, make financing more problematic and reduces the attractiveness of projects with high capital costs and long amortisation periods: "Any increase in competition, even of the limited variety ..., increases uncertainty and thus increases the financial risk facing the regulated water utility. This increase in financial risk can preclude some financing options for the regulated utility and increase the cost of others" (Mann, 1999). The private sector "may simply not be attracted to situations where there is this source of commercial risk" (Rees, 1998). As a result, in virtually all countries, operators are granted the exclusive right to provide water supply and sewerage services in their concession areas (Komives, 1999).

Finally, direct market competition will highlight and undermine current cross-subsidies (Wenyon, 1999). Cross-subsidies are very common in the water supply and sewerage industry. In most, if not all, countries, customers are not charged individually

according to every characteristic that affects the costs they impose on the system, rather charges are averaged across all similar customers within a company's service area or each supply zone. For example, in most cities single tariff structures are applied across the entire city, resulting in cross-subsidies flow low-cost areas to high cost areas (Johnstone, Wood and Hearne, 1999). Although unwinding these cross-subsidies and moving towards cost reflective pricing may be desirable from the point of view of economic efficiency, their elimination is likely to conflict with concerns for income distribution and universal service provision. In England and Wales, for example, the most significant result of the attempts to promote competition was the introduction by many companies of lower tariffs for their large users to discourage them from switching companies: "The general conclusion from the introduction of the tariffs is that, while the large customers clearly gained, their smaller rivals and other water customers have been made marginally worse-off" (Cowan, 1997). In Australia, the experience has been similar (IPART, 1999).

There is also the danger of cherry picking and cream skimming which occurs when a competitor concentrates on those customers and areas of the market which, for geographical or other reasons, are especially profitable (e.g., large industrial and commercial users capable of being supplied in bulk and with a stable pattern of demand) and leaves the incumbent with high provision cost customers located in hard-to-supply areas and the burden of costly excess capacity (stranded assets) (Rees, 1998). So incumbent utilities would probably need to be protected in order to be able to provide services to high cost of supply users (Wenyon, 1999). On the whole, competition which simply creates opportunities to exploit cross-subsidies, giving benefits to some customers at the expense of others, without promoting real efficiency and innovation, does not seem to be especially attractive, especially given the considerable costs and risks involved.

2. Improved access to information

The prospects for improving access to information for regulatory purposes should be an important consideration in a government's decision about the horizontal structure of the industry to be privatised. Even when horizontal separation leads to regional or local monopolies, unless there is no correlation in the cost and demand conditions among them, it enables regulators to have access to information from a group of independent providers of comparable services, characterised by a variety of common features in the input and output markets (Vickers and Yarrow, 1988). This provides a basis for comparisons across those utilities useful for setting incentives, and hence opportunities for the implementation of more effective regulatory incentive structures, based on yardstick competition (see page 26), than those that are feasible when there is only one utility. In addition, by creating regional or local monopolies rather than a national one, divergent interests among them may be exploited by the regulator, who would receive information from each from their differing perspectives (Klein, 1996b). On the other hand, horizontal separation implies that regulatory agencies may be faced with the prospect of regulating and monitoring many different utilities. This may cause serious administrative problems that could potentially impair the quality of regulation, particularly if the regulatory body does not have adequate resources.

There is a trade-off between the improved effectiveness of regulation when there are several regional utilities rather than a single national monopoly and the possible loss of

economies of scale and scope and other costs that horizontal separation would involve. The benefits of informational advantages in creating and maintaining many similar utilities are particularly important in the industries, like water supply and sewerage, which are characterised by slow changes in the underlying technological and market conditions, and where the scope for direct market competition is extremely limited. These benefits are more likely to outweigh the loss of economies of scale or scope where a regulated industry is mainly an aggregate of several local monopolies, again as in the water supply and sewerage sector, than where the natural monopoly element is itself on a national scale, as in electricity and gas transmission (Beesley and Littlechild, 1989). Another important factor is the degree of correlation in the public utilities' operating environments. The more they are correlated, the more horizontal separation is likely to be desirable (Armstrong, Cowan and Vickers, 1994).

The effectiveness of yardstick competition depends on the existence of a sufficient number of public utilities under independent control in the industry. Two inter-related factors are particularly important for yardstick competition to be effective: (i) that there are sufficient utilities in the industry to distinguish reliably between variations in performance due to differences in efficiency and differences in operating environment; and (ii) that there are sufficient independently owned utilities in the industry to ensure effective rivalry (London Economics, 1999).

Since mergers, take-overs, etc. reduce the number of public utilities under independent control, they also reduce and degrade the availability of information for regulatory purposes by making yardstick competition less effective, and hence worsen both the effectiveness of regulation and the utility's incentives to strive for efficiency gains. The principal reasons for this are that mergers reduce: (i) the quantity of data available or the number of observations (this is important because the number of explanatory factors a statistical model can include depends on the number of observations available, so mergers reduce the precision of statistical modelling); (ii) the quality or accuracy of the data; and (iii) the independence of the observations (i.e., whether the data comes from utilities that are controlled independently) (London Economics, 1999). Furthermore, market concentration might facilitate collusion, as collusion might be easier among fewer utilities. "Hence, even when a proposed merger appears to offer some immediate savings to customers in the affected areas, it can be argued that, in the long-run, the loss of a comparator through a merger may lead to an overall increase in the level of prices charged by the regulated companies as a whole" (London Economics, 1997). For these reasons, regulatory policy should be prepared to impose some constraints on mergers. On the other hand, a prohibition of all mergers would not be in the public interest, because in many cases there may be economies of scale, so cost reductions can be realised when a single utility is able to operate in both geographical areas. Thus, an important question for regulatory policy is what restrictions on mergers and what remedies for their negative effects are necessary.

What remedies exist for the negative effects of mergers on the availability of information for regulatory purposes and the effectiveness of yardstick competition? In the water supply and sewerage industry in England and Wales, for example, the ability of the DGWS to use yardstick competition is protected by the provision in the Water Industry Act of 1991 that requires the Secretary of State for Trade and Industry to refer a merger to the

Competition Commission if the gross assets of each of the water utilities to be merged exceeds £ 30 million (about US$ 47 million). When determining whether a merger will operate against the public interest or not, the Competition Commission is obliged to have regard to the desirability of giving effect to the principle that the number of water utilities which are under independent control should not be reduced so as to prejudice the ability of the DGWS to make comparisons between them. The following general tendencies can be discerned in the treatment of mergers by the Competition Commission and the DGWS (London Economics, 1999):

- In the case of the ten water supply and sewerage companies, the tendency has been to block all proposed mergers between them, because their number is considered the minimum required for effective yardstick competition so that the loss of any comparator would weaken the whole system of yardstick competition permanently. Firstly, since the utilities face very different operating conditions, yardstick competition involves sophisticated statistical analysis, which requires a large number of independent observations. Secondly, the key comparators that are critical for ensuring effective yardstick competition are the "frontier" utilities (i.e., those that are most efficient in each category). Since the identity of these utilities is likely to be different in each category and also to change over time, each of the ten utilities is likely to be at the frontier in some category at some time and so have a significant effect on yardstick competition.

- In the case of mergers involving water only utilities, including their mergers with water supply and sewerage companies, the tendency has been to conclude that the merger will affect the DGWS's ability to use yardstick competition and that this will act against the public interest, but to allow it to proceed so long as most of the expected cost savings are passed through to customers in the form of price reductions sufficient: (i) to compel the merged utility to the forefront of efficiency in the industry, so that new and improved comparators are created; (ii) to ensure that customers, and not only shareholders, benefit from the merger; and (iii) to offset the effect of the proposed merger on the regulatory regime. It is important to note, however, that this relatively lenient policy is likely to change in the future, since the loss of independent comparators gradually erodes the DGWS's ability to use yardstick competition. The DGWS has also called for separate Stock Exchange listing for the regulated business in case of take-overs or mergers, or where a company outside the water industry wishes to acquire a regulated water business (OFWAT, 1995c). Separate listing would provide the regulator with stock market information, would formalise an arm's length relationship between the regulated water business and its group, and would be an important protection against any attempt to run down assets (Murray, 1995).

- In the case of mergers with companies from outside the England and Wales water supply and sewerage industry, whether these be in other industries or in the same industry but outside England and Wales, the tendency has been to allow them to proceed, but to adopt measures: (i) to ensure strong ring-fencing for the regulated water business to separate it from the activities of the acquiring company; and (ii) to enable the DGWS to have proper access to

information about the performance and costs of the newly-merged company, and about the efficiencies and cost savings arising from the merger. These measures are the same as those adopted when water utilities diversify into other activities (see page 85).

3. Capital market disciplines

By reducing the size of individual public utilities, horizontal separation: (i) promotes competition in the market for corporate control, and encourages acquisition and reorganisation of the poorly performing utilities; and (ii) facilitates the generation of comparative information with which shareholders can evaluate performance and which can be used in the design of high-powered remuneration packages for the managers of public utilities (Bishop and Kay, 1989). Competition in the market for corporate control operates through the possibility that a public utility that is inefficient would see this reflected in its share price (it will decline and the cost of capital will increase making borrowing for further investment more expensive), and would be vulnerable to hostile take-over by new investors who think that they can operate it more efficiently. The fear that low earnings will encourage a hostile take-over forces managers of privately-owned utilities to reduce costs and keep profits up. Take-over bids also provide additional information to regulators.

Although the operation of the market for corporate control and the threat of hostile take-overs can bring about pressure on poorly performing public utilities, there are several factors which are likely to inhibit this incentive pressure:

- All mergers and most take-overs (the most likely buyer of a utility is typically another utility operating in the same industry which feels that it can make better use of the assets) reduce the number of public utilities under independent control or affect their comparability and thus are likely to conflict with the need to maintain a sufficiently large number of independent comparators to enable the regulator to conduct yardstick competition (see page 106). In addition, since mergers and take-overs usually increase industrial concentration and market power, there may be a loss of incentives for innovation and managerial efficiency.

- Since water supply and sewerage services are viewed as vital to the well-being of a community, it is highly unlikely that the utility actually providing them would be permitted to go bankrupt, so the ultimate sanction of the market, the economic bankruptcy of the businesses, is clearly not an option.

- Since size is "generally a more important factor in safeguarding firms from takeover than is successful profit performance" (Bishop and Kay, 1989), the large size of public utilities, some of them rank among the largest enterprises in the economy, and the fact that in many Latin American and Caribbean countries capital markets are underdeveloped, reduce considerably the threat of take-overs. There are also other impediments which could limit the role of the market for corporate control as an incentive device for public utilities (e.g., shareholder limits, golden or special shares, etc.).

These considerations have led Alexander and Mayer (1997) to conclude that overall, "it would appear that the market for corporate control is a limited incentive for management owing to the existence of impediments which are specific to infrastructure and other more general impediments to the smooth operation of the market. This does not mean, however, that hostile takeovers have not occurred or that the threat of them is not enforcing managerial efficiency". There are also doubts whether capital market competition actually promotes efficiency in public utility industries: "It could, in fact, have the opposite effect by encouraging companies to exploit their monopoly position, diverting management from the task of running the business, creating uncertainty and strategic planning problems, and incurring the substantial costs in mounting and defending bids. Furthermore, takeovers can occur for reasons which have nothing to do with efficiency, most obviously asset stripping and increasing monopoly power" (Rees, undated).

As for the ability of shareholders to both monitor and influence the management of a public utility, it depends to a large extent on the level of concentration of share ownership (Alexander and Mayer, 1997). The ability of shareholders to discipline inefficient managers can be expected to be higher where there is either a dominant shareholder or a small group of significant and proactive shareholders. Two factors affect the likelihood of such investors existing: (i) the way the public utility was privatised (e.g., full or majority sale, floatation of a minority stake, etc.); and (ii) the institutional environment of the country (e.g., the prevalence of major corporate shareholders, the level of activity of institutional shareholders, shareholder associations, shareholder limits, etc.). On the whole, "it would appear that equity investors have a limited ability to monitor and discipline companies' management (and especially 'protected' utility companies)" (Alexander and Mayer, 1997).

4. Increased scope for franchising

Although there are major practical problems with franchising in the water supply and sewerage industry (see page 19), horizontal separation might increase the scope for franchising and help ameliorate some of its limitations. First, franchising works better where there is a credible threat of replacement of a poorly performing incumbent and the credibility of this threat largely depends on the existence of alternative operators with the requisite skills. Where a single national utility exists, it is unlikely that displacement could be carried out without unacceptable disruption of service provision, even if international alternative operators exist (Alexander and Mayer, 1997). However, where the industry is an aggregate of several local or regional utilities, it should be relatively easier to replace a poorly performing incumbent. Second, where many geographically separate utilities exist, there will be constant competition for renewal of some franchises (Klein, 1996a). Finally, the possibility of missing future contracts is likely to make the incumbent concerned about its reputation as an efficient operator.

B. Vertical restructuring

A public utility can be described as being vertically integrated if it extends its activities over more than one successive stage of the production process of transforming raw materials into final goods and services. Vertical separation breaks up, or unbundles,

activities previously performed by a vertically integrated public utility. Its typical example is the division of the electric industry into separate generation, transmission and distribution utilities as has been done in several Latin American countries as well as elsewhere (ECLAC, 1998a and 1998b).

There are three broad determinants for vertical integration: technological economies, transactional economies, and market imperfections (Perry, 1989). Vertical integration adopted by unregulated firms that are subject to a reasonable degree of competitive pressure generally promotes efficiency and enhances welfare. On the other hand, modern economic analysis suggests that the negative consequences of vertical integration may be sufficient to overturn this general presumption where either: (i) it has not emerged from a process of competition; (ii) there market power exists either in the upstream or downstream markets; or (iii) there are existing regulatory controls (Yarrow, 1991).

In all public utility industries, several distinct economic activities are required to supply the final product or service to consumers. It is often the case that natural monopoly characteristics are more prevalent in some of these activities than they are in others. "The areas of market failure in most utilities are quite narrow" (Bishop, Kay and Mayer, 1995).

All public utility industries contain fixed networks (e.g., water and gas pipes, electricity transmission and distribution lines, and telecommunication systems). Some potentially competitive activities (e.g., electricity generation) are upstream from the network, which typically is a natural monopoly that precludes effective competition since its duplication would be both impracticable and wasteful, while others (e.g., commercial operations) are downstream.

Access on a fair basis to the network is essential for producers to deliver their products and services to final customers. However, the network confers potentially exploitative monopoly power on its owner. Its owner, by virtue of controlling, either directly or indirectly through an affiliate, access to and use of this bottleneck ("essential") facility, which its rivals have no alternative but to use, can extend its monopoly power to the potentially competitive upstream and downstream activities.[1] For example, the owner of the network can stifle entry by cross-subsidising the competitive part of the business with profits from the naturally monopolistic activities. It can also favour its associated companies over competitors in the prices charged for using the network or in other terms of interconnection such as the speed and quality of access. Even where such anti-competitive conduct does not, in fact, take place, the expectation that it might provides a powerful entry deterrent (Helm and Jenkinson, 1997). It is important to note that the existence of conduct regulation in one of the market segments can greatly

[1] The term "essential facilities doctrine" originated in the United States antitrust case law (Van Siclen, 1996). It specifies when the owner of an "essential" or "bottleneck" facility is mandated to provide access to that facility on reasonable terms. For example, it may specify when a transmission or distribution network must be made available on reasonable terms to a rival electricity generator. In the United States, the following four elements are usually considered necessary to establish liability under the essential facilities doctrine: (i) control of the essential facility by a monopolist; (ii) a competitor's inability practically or reasonably to duplicate the essential facility; (iii) the denial of the use of the facility to a competitor; and (iv) the feasibility of providing the facility. A review of the development and application of the essential facilities doctrine in the United States and other countries is available in OECD (1996).

enhance the incentive for its owner to use vertical arrangements to extend market power to other stages of production and distribution (Yarrow, 1991).

Vertical integration tends to hamper effective conduct regulation and, in practice, it can be difficult to hold in check anti-competitive behaviour of vertically integrated utilities by vertical conduct regulation (e.g., regulation of the price and non-price terms and conditions of access to network facilities for competing suppliers) alone, without some measures of structural separation. Experience suggests that, limited forms of separation, such as accounting separation, are not always sufficient to overcome the incentives for the incumbent to engage in anti-competitive behaviour (Gonenc, Maher and Nicoletti, 2000). The principal theoretical solution to these problems is vertical separation. It removes the incentive for anti-competitive behaviour, though the need for conduct regulation may well remain, but achieves this at the expense of the economies of scope that might exist (Vickers, 1991).

These considerations suggest that, as a matter of general principle, public policy should seek: (i) to identify the naturally monopolistic segments of an industry; (ii) to separate and isolate their operation, if not ownership, from the upstream and downstream activities that are potentially competitive, so as to establish in the latter a level playing field for competition between incumbents and new entrants and to prevent the owner of the naturally monopolistic segments from extending its monopoly powers into potentially competitive activities; (iii) to target conduct regulation on the naturally monopolistic segments; and (iv) to promote new entry and competition in the segments that are potentially competitive. These principles are the basis for the restructuring of the electric and telecommunications industries in many countries.

One example is afforded by recent electric industry reforms in Argentina, Bolivia, Peru and other countries (ECLAC, 1998a and 1998b). Electricity supply involves: generation (the production of electricity), transmission (the transfer of electricity in bulk over high voltage networks to consumption centres), and distribution (the delivery of electricity over local networks to final customers). In the current state of technology, competition in generation is possible, whereas transmission and distribution are naturally monopolistic activities and the prospect of effective competition in them is remote. Although there are powerful arguments in favour of a policy of vertical integration (e.g., optimal investment and capacity planning and operational co-ordination), this approach would allow little room for competition in generation, because control over the transmission network, either directly or indirectly through an affiliate, would give its owner an enhanced ability to deter new entry and discriminate in favour of its own subsidiaries: "experience ... has shown that it is very difficult to keep a fair competitive market environment when large vertically integrated companies are allowed to exist" (Jadresic and Fuentes, 1999). In Chile, for example, vertical integration has been the source of a large number of disputes and conflicts (Basañes, Saavedra and Soto, 1999).

These problems have led many countries to vertically separate electricity generation from transmission and distribution, and then to horizontally separate the generation sector into several competing generators. Separation of electricity generation from transmission creates conditions for competition in generation and encourages new entry. Various forms of competition between generators become possible ranging from contract competition to

supply electricity under long-term contracts to spot market (pool) competition. As for transmission and distribution segments, they will continue to be regulated because of their natural monopoly characteristics.

An important point to note is that even if competition in generation does in fact emerge, it is likely to be much less than perfect (in many countries of the region, it is likely to be oligopolistic, if not duopolistic, in nature) and there will still be a need for continuing regulatory action, at least until truly effective competition has been fully established. The market will need to be closely monitored to ensure that effective competition does in fact operate and that anticompetitive behaviour does not occur. The experience of reforms in the electric industry suggests that if privatisation leaves a dominant incumbent with substantial market power, then active pro-competition regulatory policies may be required. There are different regulatory strategies open to regulators, but successful approaches appear to have been those that have acted asymmetrically helping entrants more than incumbents (Powell, 1996).

Although theoretically vertical separation constitutes potentially the most competitive policy wherever a sufficiently large market can be created to sustain workable competition, whether it advantages actually produce enough benefits to outweigh the costs involved is in many circumstances debatable. The attractiveness of this approach depends critically on the possibility of introducing effective competition in generation. The problem is that in many small- and even medium-size developing countries the market can be too small to support enough independent generators to achieve a reasonable degree of competition, unless the generators are so small that they lose economies of scale. In addition, introducing competition in generation is difficult and complex, and in a small system, or one with many transmission constraints, there may be no point in trying to introduce it (Henney, 1995).

Because of these costs, many countries have adopted a more limited approach maintaining vertical integration but liberalising generation (e.g., requiring the vertically integrated utility to seek competitive bids from independent generators when expanding generation capacity or allowing independent generators access to distribution utilities and large users) (ECLAC, 1998a and 1998b). If this approach is adopted, vertical conduct regulation or measures of partial vertical separation will be needed to establish conditions for effective competition. The objective of conduct regulation under this approach is to ensure that the price and non-price terms and conditions of access to the network do not discriminate against the network operator's competitors. The problem is that this is difficult to achieve, both in theory and in practice.

Of all public utility industries, natural monopoly conditions are most prevalent in the water supply and sewerage industry. Unlike other public utility industries, such as the telecommunications and electric industries, where there are national networks, the water supply and sewerage industry consists of regional and local monopolies. In addition, in contrast to most other utility industries, all the successive stages of the provision of water supply and sewerage services, from bulk supply generation to wastewater treatment, are characterised by significant economies of scale. As has been explained above (see page 99), the scope for direct competition of any kind is extremely limited in all successive

stages of production and is likely to remain so in the foreseeable future, and vertical separation is not an attractive option.

One relatively minor area which can, and probably should, be opened to competition is system expansion and plumbing services. Water utilities should use market testing to ensure that any significant construction work, performed either by them directly or by associated companies, is being done at competitive rates (see page 85).

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