

ANNOTATED READING LIST FOR A BODY OF KNOWLEDGE ON INFRASTRUCTURE REGULATION

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Revised August 15, 2008

Funding for this project was provided by:



The authors thank Farid Gasmi and José I. Távora, who co-authored the original document with us in 2004, for their important research and contributions. Special thanks are owed to Rossana Passaniti and Cynthia Stehouwer for their organizational and editorial work, and to Janice Hauge, Lynne Holt, Mark Hoekstra, Hamilton Silva, Troy Quast, Juan-Daniel Oviedo, Rich Gentry, and Abhay Dhingra for their research efforts, and Michael Rodriguez for his web design expertise. In addition, the authors thank the members of the 2008 review committee – Martin Rodriguez Pardina, Rohan Samarajiva, Jorry Mwenechanya, and Pippo Ranci – for their advice and recommendations, as well as the World Bank staff and attendees at the original review meetings at Eynsham Hall and Arlie House for their helpful suggestions and comments. The authors take responsibility for all errors and omissions.



Overview of Infrastructure Regulation

A. Introduction

There is a growing consensus that the successful development of infrastructure – electricity, natural gas, telecommunications, water, and transportation – depends in no small part on the adoption of appropriate public policies and the effective implementation of these policies. Central to these policies is development of a regulatory apparatus that provides stability, protects consumers from the abuse of market power, guards consumers and operators against political opportunism, and provides incentives for service providers to operate efficiently and make the needed investments.

Because the way regulation is implemented plays such a vital role in infrastructure development and use, most discussions of infrastructure policy focus on how regulation should be done: for example, how to introduce and facilitate competition, how to provide operators with incentives for improved performance, and how regulators should involve stakeholders. The academic literature calls such work normative theories of regulation, but the authors will simply refer to this as normative work.

Normative work is the primary focus of this Overview and the following chapters. The “primary” focus is on normative work because the authors would be in error if they failed to recognize why regulation occurs. For example, there is always a political context within which a country chooses to initiate, continue, or change its regulation of infrastructure. The motivations for regulation affect how regulation occurs and are considered by a second basic school of thought on regulatory policy, namely, positive theories of regulation.

Positive theories focus on the roles of stakeholders in the policy-making process, the results of their advocacy of solutions that address their individual interests, and broader motivations, such as political interests and the public interest.¹

The purpose of this Overview is to provide a broad description of the motivations for regulation and the issues that regulation addresses.² It begins by describing the regulatory problem, which includes issues of market power, opportunism, and asymmetric information. Then the basic approaches of regulation for dealing with these issues are described. Market structure, which examines monopoly power and competition is covered first. Then financial analysis, which regulators use to ensure financial viability, oversee system development and expansion, and protect against excessive price levels is covered. Regulating the overall price

¹ Section A of the first chapter examines theories of regulation and the rationale for regulation. Section H of this Overview and Chapter VII that follow specifically examine how regulators can address this political context of regulation.

² In this Overview, the authors generally refer to the “government” when referring to the development of policies, and to the “regulator” or “agency” when referring the implementation of policy. The authors recognize that the institutional arrangements for developing and performing regulation vary across countries. For example, in some countries, regulatory agencies take initiative in opening markets to competition, while in other countries all such work is done within a ministry. However, it is too cumbersome to try to reflect all possible divisions of responsibilities for regulatory policy in this narrative, so language is simplified here.

level is considered next, followed by issues of rate design. Finally non-price issues, such as service quality, environmental impacts, and social issues, are reviewed, as is the regulatory process, including the management of information.

The remainder of this Overview is organized as follows. Section B defines the regulatory problem from different perspectives and identifies the basic approaches for overcoming the market power and information issues that tend to underlie many regulatory policies. Section C describes the first approach, namely the use of competition. Section D summarizes the second approach, which is the gathering and use of information on markets and operators. Section E examines the last approach, the use of incentive regulation. The remaining sections examine related issues. Section F describes issues in tariff design. Section G covers service quality, environmental, and social issues. Section H examines the regulatory process. Section I provides concluding observations.

B. The Regulatory Problem

It seems fair to say that governments establish regulation of utilities to improve sector performance relative to no regulation. What might be meant by “improve sector performance,” however, can be subject to considerable debate. Often “improve sector performance” means that the government wants to control market power and/or facilitate competition. It may also mean that the government wants to address commitment issues; that is to say, the government may create a regulatory agency to protect operators and customers from politically-driven decisions that would sacrifice long run efficiency for short term political expediency.

“Improve sector performance” might also mean that the government has chosen to regulate in order to favor particular types of customers or to protect operators from competition. In some countries, for example, regulation has been used to subsidize electricity for farmers. In the 20th century many counties used regulation to protect monopoly telephone companies from competition.

Except where otherwise noted, this Overview addresses normative issues of regulation, with the perspective that regulation, and in particular regulation by a regulatory agency, is intended to improve welfare.³ In this context, welfare means the aggregate benefit that infrastructure services provide, including benefits to consumers,⁴ benefits to operators, and externalities.⁵ Externalities are benefits or costs from a transaction that are received or born by

³ Focusing primarily on welfare is not meant to imply that distributional issues in regulation are unimportant. Distributional issues address how different stakeholder groups are affected differently by how infrastructure services are provided. Situations where governments use regulation to benefit some groups over other groups have been already mentioned. Portions of Chapters V, VI, and VII are devoted to distributional issues, namely, assisting the poor. Welfare is the focus because it is the measure of benefit most often used in research and because policies that emphasize welfare do not preclude also adopting policies that address distributional issues.

⁴ Benefits to consumers is generally measured as net consumer surplus, which is the difference between the gross value that the customer receives when consuming the service (called willingness to pay) and the amount the customer pays.

⁵ This Overview does not address the individual weight that the government may give to each element. These weights are important, but they are set aside here because each regulator can use her or her government’s own weighting system to determine which tools described herein to apply and how to apply them.

third parties who are not part of the transaction. Air pollution produced by electricity generation or by transportation vehicles is an example of a negative externality.

At this point, it is important to note that some observers make convincing arguments that policymakers sometimes have more nefarious motives than maximizing welfare, for example, to gain short term political advantage or to benefit political supporters. Such motives raise the issue of how citizens can regulate their government and the regulator. Review of this issue is reserved to Section H of this Overview and to Chapter VII.

From a normative perspective, regulation of a service provider may be desirable if (1) the welfare objectives of the government are different from the objectives of the operator, (2) the operator has an information advantage over the government, and (3) the operator has market power.

To illustrate why regulation may be appropriate when the government and the operator have different objectives, consider a situation in which the government and the operator each has a single objective, namely, the government wants service expansion in rural areas and the operator wants to maximize profit. An unregulated operator with market power would restrict output to maximize profit and would invest in areas that give the highest profit. It is unlikely that either of these outcomes would be consistent with the government's objective, so the government may want to take steps that would make it in the operator's best interest to expand service in rural areas. In the case of a state owned operator, the management may have an objective of maximizing its political influence. This could lead the management to use its resources to employ a lot of people or to target investments to politically powerful areas. Neither would likely be consistent with the goal of expanding service in rural areas.

Now consider a situation where the government and operator have the same objective, say to offer service of a particular service quality throughout the country at the lowest possible cost. In this case, the government could simply give the operator whatever relevant information the government had and let the operator pursue this objective on its own. Regulation would not be needed in this situation because the government could not improve results by regulating the operator, that is to say, regulation, if designed to persuade the operator to do what the government wants the operator to do, would be redundant with the operator's own strategic objectives.

Of course the world is not so simple. Many developing countries have not privatized their utilities, but have established regulatory agencies with varying degrees of independence. An important challenge for these regulators is that the state-owned utilities often do not operate on a commercial basis.⁶ The utilities sometimes are torn between the short-term social stability interest and the long-term viability of the utility enterprise. Therefore there are many opportunities for conflicts between the utility and the government even if the interests would appear to coincide.⁷

⁶ This experience is not unique to developing countries. Studies have found that government-owned utilities in developed countries do not operate on a commercial basis.

⁷ The authors are grateful to Jorry Mwenechanya for this insight.

In practice a government's objectives are typically different from an operator's objectives. For example, the government may be primarily concerned with new investments, service expansion, and low prices. In contrast, a privately owned operator is likely to want to maximize profit, an objective that, left unchecked, is generally understood to be inconsistent with widely available services and low prices across the board if the operator has market power. State-owned operators may want to satisfy key political supporters, maintain high levels of employment for politically powerful unions, or secure large budgets, which would also be inconsistent with government's objectives. Because of these differences in objectives, governments typically adopt instruments to induce operators to achieve the government's objectives.

To illustrate the importance of the operator having an information advantage – a situation generically referred to as an information asymmetry⁸ – suppose that the government and the operator have different objectives and that the government knows just as much as the operator about customer demand and the operator's ability to satisfy customer demand. In this case, the government could simply micro-manage the operator – i.e., tell the operator when to maintain lines, how many workers to employ, etc. – to achieve the government's objectives. This approach is called command and control regulation, and is in effect complete government management of the operator.⁹

Furthermore, it is also generally the case that there is an information asymmetry between the government and the operator. Asymmetric information in this context means that the operator has what economists call private information about its ability to operate efficiently, about patterns of customer demand, or about the amount of effort that is required for the operator to be efficient.

There are three basic approaches to dealing with market power and with the asymmetries described above, namely, (a) subjecting the operator to competitive pressures, (b) gathering information on the operator and the market, and (c) controlling market power by applying incentive regulation.¹⁰ In the following sections, each of these approaches and how regulators put them into practice is reviewed. Regulators typically use some combination of these three approaches and the proper mix depends on the country's needs and objectives, institutional capabilities and arrangements, cost or difficulty of obtaining information, and potential for competition.

C. First Approach: Competition¹¹

It is tautological to say that increasing competitive pressure can diminish problems of market power. However, competition also addresses the information asymmetry problem in two

⁸ Information asymmetries are noted in Section I of the first chapter.

⁹ This of course cannot happen in practice because information asymmetries exist even for government controlled enterprises.

¹⁰ Information gathering is a critical tool in both of the other options, but it is listed separately because knowledge and information are valuable in all facets of regulation.

¹¹ Chapter II on Market Structure and Competition covers competitive issues, except for competition between markets, which is covered in Chapter IV on Regulating the Overall Price Level.

ways. The first way is that the operator, in its pursuit of profits, has an incentive to provide service quality levels and price levels that are best for customers, subject to the operator's need to cover its costs. Competition can provide this result because fully informed customers will buy only from those operators that provide the most beneficial combinations of quality and price. In other words, each customer seeks to maximize his net consumer surplus.

Even if the operator in a competitive market is state owned, competition presses the operator to act as a privately owned operator because the state-owned operator must be responsive to customers in order to finance its operations. Of course a state-owned service provider might be able to use its relationship with the government to gain an advantage over rivals, which would at least in part thwart the discipline of the competitive market. For example, if a state-owned operator were allowed access to taxpayer-provided monies when cash flows are unable to support investments, the state-owned operator could have an incentive to make uneconomic investments that further the operator's political goals or reduce competitive pressures.

The second way that competitive pressure addresses the information asymmetry problem is that competitive market outcomes reveal actual customer demand, the operator's innate ability to be efficient, and how much effort the operator is willing to exert to be efficient. Even if competition is weak, competing firms can benefit from using all of the information at their disposal to succeed in the competitive marketplace.

Competition has additional benefits. It limits a government's ability to use regulation to favor certain stakeholders or to sacrifice long term efficiency for short term political goals. It also limits operators' abilities to raise prices and creates opportunities for different firms to try innovative ways to attract customers.¹²

Policy makers or regulators subject operators to competitive pressures by liberalizing markets and facilitating competition. There are three basic approaches. The first approach is to have multiple operators compete in the market for customers. This is called competition in the market and examples include having multiple mobile telecommunications service providers and multiple operators of electricity generation plants. The second method, called competition for the market, is to have operators compete for the market by having the operators bid for the right to be a service provider.¹³ Franchise bidding to operate a city water system is an example of this second approach. The third technique is to have operators in different markets compete by comparing the efficiency and effectiveness of their operations and rewarding those operators that provide superior performance. Competition in the market is reviewed next, followed by competition for the market. The third approach, called competition between markets, but also called benchmarking or yardstick regulation is covered in the section on Incentive Regulation.

¹² This is not to imply that competition is without problems. There may be situations where operators compete aggressively in lowering prices and so do not have adequate cash flows to make needed investments. Competition has generally been most successful in telecommunications.

¹³ Operators may also bid for the right to be a service provider in situations of competition in the market. This might be the case in mobile telephony, for example, where radio spectrum limits the number of possible operators.

1. Competition in the Market¹⁴

There are several approaches to facilitating competition in the market. When all elements of the utility service can be competitive, then generally a primary job of the regulator is to remove barriers to entry or competition. Typical steps include removing licensing restrictions or large licensing fees,¹⁵ reducing switching costs, and requiring access to essential inputs, such as telephone numbering resources.

When some elements of the utility service have monopoly characteristics, such as gas distribution lines, and other elements can be competitive, such as gas production, then regulators also use tools such as structural separation and unbundling to facilitate competition. Structural separation separates the potentially competitive portions of the utility service from the non-competitive portions. For example, electricity generation is generally considered to be potentially competitive, but electricity distribution is not.¹⁶ These non-competitive, yet essential portions of the service are called essential facilities.¹⁷ Structural separation prohibits a single operator from providing both the competitive and non-competitive portion of the service.

The intent of separation is to ensure that the provider of the essential facility does not use its control of the essential facility to hinder competition. Structural separation is sometimes called unbundling, but some forms of facility or service unbundling may be less severe than structural separation. With simple unbundling, for example, the regulator may allow a single operator to combine competitive and non-competitive elements to provide bundled service, but also require the operator to allow rivals access to the essential facility so that the rivals are not disadvantaged relative to the operator's own competitive service.¹⁸ For example, some regulators require incumbent fixed line telephone operators to allow rivals to lease local telephone lines, but the regulators also allow the incumbent operators to continue to offer a retail service that bundles the local telephone line with usage. Regulators that want to facilitate competition generally take steps to remove barriers to entry, even if structural separation or unbundling is required.

When structural separation or unbundling do not involve separate ownership, regulators often require accounting separation or ring fencing to ensure that there is no cross-subsidization from the non-competitive operations to the competitive operations. Accounting separation is described in more detail below in the subsection on Financial Analysis and in Chapter III.

Access pricing is an important element of regulatory policies designed to facilitate competition in the market. When a utility service is unbundled, the rivals often pay the operator

¹⁴ Chapter II Section B covers competition in the market.

¹⁵ Large license fees are a barrier to entry when they limit the number of entrants that can profitably enter the market. When there is another binding constraint on the number of possible competitors, such as a physical limit on the availability of radio spectrum, then the license fee determined through a competitive process, such as an auction, serves to determine who enters the market rather than the number of entrants.

¹⁶ The experience to date in some countries is that governments have stopped short of selling the unbundled parts, which raises problems if private operators are asked to compete with a state-owned enterprise.

¹⁷ A facility is considered to be an essential facility if it is necessary for the provision of the final product and cannot be economically produced by rivals to the essential facility provider.

¹⁸ Some jurisdictions use the term unbundling to refer to accounting separations, which is the act of separating accounting costs and revenue between the competitive and non-competitive portions of the enterprise. We use unbundling to mean the unbundling of services or facilities, not accounts.

an access price for use of the non-competitive element of the service. Because this price is a source of revenue for the incumbent operator – the operator that provides both the competitive and non-competitive portions of the service – and a cost for the incumbent’s rivals, the incumbent has an incentive to raise this price to a level that limits competition. In cases such as telecommunications where competitors must interconnect their networks in order to allow customers of rival networks to communicate, regulators generally require service providers to negotiate such interconnection arrangements and adopt cost-based prices.

2. Competition for the Market¹⁹

Competition for the market may be desirable when competition in the market is infeasible or impractical. In such cases, the right to be the monopoly provider of the service²⁰ could be auctioned off through an efficient auction. An efficient auction is one in which (1) the most efficient firm wins the auction, and (2) the winning operator gives up most of its monopoly profits. An efficient auction achieves cost efficiency because the most efficient firm is the firm that can afford to pay the highest price for the right to be the monopoly. In paying this high price, the successful bidder gives up at least some portion of its monopoly profits, which can be distributed to customers. In general, monopoly profits are profits above the operator’s cost of equity²¹ that result from the operator having market power. Post-auction regulation may still be necessary if prices need to adjust to unanticipated events, but periodic re-bidding may substitute for typical price regulation in some situations.

D. Second Approach: Obtaining and Analyzing Information²²

In addition to using competition to overcome asymmetries in information and objectives, regulators can also decrease information asymmetries by obtaining information on the operator and markets, typically including financial data and operating statistics. Obtaining the information is not enough: Regulators need to use the information for decision making. But set information gathering out separately as a tool because it is critical to all aspects of regulation.

The financial data that regulators require from operators typically include balance sheets, capital structure, income statements, cash flow statements, and depreciation schedules. Regulators can gather financial data from a variety of sources, including reports to shareholders and taxing authorities, but the most common approach is to require the operator to provide the regulator with financial statements annually in accordance with a uniform system of accounts, which is a set of regulator-determined accounting rules that define the accounts and the accounting practices that the operator must follow when reporting financial information to the regulator. Analysis of this information for purposes of regulating overall price levels is described below in the subsection on Financial Analysis.

¹⁹ Chapter II Section C covers competition for the market.

²⁰ Chapter II Section A examines monopoly market structure.

²¹ Cost of capital is reviewed in the subsection on Financial Analysis in this Overview and in Section G of Chapter III on Financial Analysis. The appropriate measure for the cost of capital is the weighted average cost of capital (WACC).

²² Chapter III focuses on obtaining and using information.

Operating statistics typically include information on prices, quantities of individual services sold, numbers of customers, numbers of employees, quality of services provided, sources of fuel or water, electricity generator or water treatment operating statistics, etc. usually annually or monthly. In electricity markets, where competition among electricity generators takes the form of an auction for the right to sell electricity for a given time period, regulators may need to obtain information on bid prices and actual sales.

Information is also important for the regulator whose job it is to monitor or facilitate competition. In these cases, the regulator would need information on such things as prices, sales, market shares, essential facilities, services offered, and geographic areas served.

E. Third Approach: Incentive Regulation²³

The third approach to dealing with information asymmetries and limiting the effects of market power is for the regulator to design and implement incentive schemes that reward the operator for using its private information to achieve the government's objectives. To be most effective, the reward should (1) provide the operator with additional units of something it wants – for example, profits – when the operator gives the government something it wants – for example, lower prices; (2) give the operator performance options that provide higher rewards for accepting more challenging performance goals; and (3) allow the operator to keep only a minimal reward – for example, accounting profits that are no greater than the operator's cost of capital – when the operator chooses the least challenging performance goal. Cost of capital is the financial return that the operator must give to its investors and creditors to induce them to provide capital for the firm.²⁴

1. Basic Approaches to Incentive Regulation²⁵

Incentive regulation is generally implemented by controlling the overall price level of the operator. There are four basic schemes to regulating overall price levels. The first approach is generally called rate of return regulation or cost of service regulation. This regulatory instrument establishes an overall price level that allows the operator to receive accounting profits that are just equal to the operator's cost of capital at the time the price level is set. Actual profits may deviate from the cost of capital until the next time the regulator reviews the operator's profits.

The second approach is called price cap regulation or RPI-X regulation, which is a method that establishes the operator's overall price level by indexing the price level according to inflation minus an offset, called an X-factor.²⁶ The X-factor should reflect the difference between this operator and the average firm in the economy with respect to their abilities to improve

²³ Chapter IV on Regulating the Overall Price Level provides the primary information on incentive regulation, although Chapter VI on Quality, Social, and Environmental Issues also examines incentives.

²⁴ Section G of Chapter III notes how to estimate the cost of equity and the cost of capital.

²⁵ Section A of Chapter IV covers this topic in more depth.

²⁶ As explained below, some regulators using price cap regulation incorporate elements of rate of return regulation.

efficiency and to changes in input prices. Directly measuring these efficiency and input price inflation differences to establish an *X*-factor, while ignoring the operator's actual profits, is called pure price cap regulation.

The third approach to regulating the overall price level is called revenue caps. This is similar to price caps except that the inflation-minus-*X* formula applies to revenue rather than prices.

The fourth approach is called benchmarking or yardstick regulation. This form of regulation provides competition between markets by comparing operators across markets, in effect forcing the operator to compete against the performance of comparable operators in other markets. In practice benchmarking or yardstick regulation is an input used in price cap or revenue cap regulation, and sometimes in rate of return or cost of service regulation.

Many regulators adopt hybrid incentive schemes, which are approaches that combine features of the three basic methods of incentive regulation described above. For example, the U.S. Federal Communications Commission once combined elements of rate of return regulation and price cap regulation. Under its scheme, operators could choose from a menu of options. Each option included an *X*-factor and a formula that determined the proportion of accounting profits that the operator would be allowed to keep. Options with more aggressive (larger) *X*-factors allowed operators to keep larger proportions of their accounting profits. Regulators in the U.K. often use elements of rate of return regulation and benchmarking analysis to establish *X*-factors in price cap regulation. This is described in the subsection Financial Analysis.

Another approach for combining elements of rate of return regulation and price or revenue cap regulation is to include pass through elements in the scheme. For example a regulator might use revenue caps to regulate the revenue of an electricity distribution operator, but allow the operator to pass through changes in fuel costs to the extent that these cost changes are beyond the operator's control.

2. Financial Analysis²⁷

It is very rare for incentive regulation to not involve extensive financial analysis. Such analysis includes determining the operator's cost of capital, historical costs, and projected costs. The cost of capital consists of two elements, the cost of debt and the cost of equity. Regulators typically obtain debt costs from operators' financial reports, where the operators list their long-term debt instruments and the interest rates paid. Estimates of the operator's cost of equity can be obtained using financial models. Regulators combine the operator's cost of debt and cost of equity into a weighted average, called the Weighted Average Cost of Capital (WACC).

Some regulators, such as those in the U.K., use historical and projected operating and investment costs to set *X*-factors. (Historical information alone is generally used in rate of return regulation.) The operator's historical operating and investment costs can be obtained from the operator's accounting records. Care must be taken when using historical accounting data in

²⁷ Financial analysis is covered in Chapter III.

situations where accounting standards were historically weak or inconsistent over time. In the U.K. approach, projected operating and investment costs, existing net investment in regulatory assets or rate base, and projected net investment are used in a net present value or equivalent analysis to establish X-factors. This method involves making demand forecasts, identifying investment requirements to meet the projected demand, and the forecasting of associated operating expenses. These projections are analyzed and adjusted by the regulator to determine how the operator's overall price level should be allowed to change relative to inflation.

When using accounting costs, whether they are historical or projected, regulators place below the line any costs that are not needed to provide the utility service or that are considered excessive. The effect of this below the line treatment of costs is that prices for regulated services are not intended to provide revenue to cover the costs. Costs for items needed to provide the utility service are considered to be used and useful and so are kept above the line, which means that they can be recovered through prices charged for regulated services. Costs that are excessive, perhaps because the operator paid too much for an item or made an avoidable mistake in an investment are considered imprudent and the excess is placed below the line.

3. Ring Fencing and Accounting Separations²⁸

Accounting separations, which is the process of separating costs and revenues of regulated operations from non-regulated operations, is another important aspect of determining the overall price level for the operator. It is not unusual for an operator to provide services that the regulator does not regulate. For example, an operator may provide utility services in another country, offer utility services that have been deregulated, or offer non-regulated, non-utility services such as data processing. Accounting separations places the associated costs and revenues of these operations below the line.

A regulator's accounting separations policies typically prescribe (1) accounts used to record only regulated activities, accounts used only for non-regulated activities, and accounts used for both types of activities; (2) how the costs and revenues in accounts that are used for both regulated and non-regulated activities are to be divided between the two types of activities; (3) how the operator is to value transactions between the regulated portion of the business and the non-regulated portions of the business (called transfer pricing); and (4) reporting and auditing requirements.

Some regulators use the term "ring fencing" to be synonymous with accounting separations. Other regulators use the term ring fencing more broadly by including such practices as providing different regulatory treatment for different services. Throughout the rest of this Overview, the terms "ring fencing" and "accounting separations" will be used interchangeably.

4. Benchmarking or Yardstick Regulation²⁹

²⁸ Section E of Chapter III examines ring fencing and control of cross-subsidization.

²⁹ Section D of Chapter IV covers benchmarking and yardstick regulation. Some analysts consider benchmarking or yardstick analysis to be an input into rate of return regulation, price cap regulation, or revenue cap regulation rather

The third form of incentive regulation provides competition between comparable operators in separate markets. When using this form of regulation, regulators generally should choose performance measures that are general in nature and that operators can affect. An example of a general performance measure might be cost per kilowatt hour and an example of a more granular performance measure might be line maintenance cost per kilowatt hour. General performance measures allow operators to make economic tradeoffs – for example, between capital investments and operating expenses – while granular performance measures restrict the means by which operators can improve measured performance. In addition to being used for regulating overall price levels, benchmarking can be used for regulating such items as service quality and network expansion.

F. Tariff Design³⁰

Once the overall price level has been established for the operator, the work of establishing the rate (or price) structure still remains. This work is called tariff design or rate design and refers to relationships among the individual prices (or rate elements) that the operator charges. In some instances, the regulator may choose not to regulate the price structure. Examples include (1) situations where the objectives of the operator are in line with, or at least do not contradict, the objectives of the regulator, at least as they relate to rate design, and (2) situations where the regulator's resources are limited and regulating price structure is a low priority.

Most economists agree that efficient price structures cover total cost and align prices with marginal costs. Marginal cost is the additional capital and operating cost that results from increasing output by a single unit.³¹ Marginal cost pricing may be difficult in situations where there are economies of scale or economies of scope because prices equal to marginal costs would not cover all of the costs of the operator and thus would not attract investment. In these situations, regulators and operators generally favor multipart pricing or in some instances Ramsey pricing.³² Multipart pricing is an arrangement where the operator charges separate prices for different elements of the service. For example, a water provider may charge a connection fee plus a usage fee. With Ramsey pricing, which is also called differentiated pricing or the inverse elasticity rule, the operator charges higher prices to customers with inelastic demand and lower prices to customers with elastic demand.³³

than as method of incentive regulation that could be used by itself. It is true that with benchmark or yardstick regulation prices are generally capped, which arguably makes the system look very much like price cap regulation. Here it is treated as a separate form of incentive regulation because some regulators treat it that way, but the authors recognize that benchmark or yardstick analyses are generally used as an element of a hybrid regulation scheme.

³⁰ Chapter V covers tariff design.

³¹ If the system is capacity constrained, meaning that capacity cannot be increased, marginal cost would also include the marginal congestion cost.

³² Regulators generally limit the use of Ramsey pricing to services that are not considered basic or essential to customers the regulator is particularly trying to protect, such as low income or residential customers.

³³ Customers have inelastic demand if they do not change the amount they purchase by very much if the operator changes its prices. Conversely, customers have elastic demand if they respond to changes in prices by making large changes in the quantities that they purchase. More precisely, inelastic demand means that a one percent change in

G. Service Quality, Environmental, and Universal Access/Service Issues³⁴

In addition to addressing pricing issues, regulators address issues of service quality, environmental protection, infrastructure development, and access to services for the poor. An operator with market power may have an incentive to degrade retail service quality if doing so increases profits, or to degrade quality for inputs sold to competitors if doing so decreases competitive pressures.³⁵ Regulators often adopt schemes for regulating service quality to address these problems. Service quality regulation generally includes quality standards, mechanisms for monitoring quality, and penalties for not meeting the quality standards. It is less typical for the operator to receive a reward for exceeding service quality standards.

Environmental regulation is similar to service quality regulation in that it often includes standards, monitoring, and penalties or rewards. In some instances markets can be used for environmental regulation. For example, the government may issue tradable emission permits to electricity generators so that a generator that has low pollution control costs can profitably decrease its emissions and sell some portion of its permit to a generator which has higher pollution control costs. In many countries, the utility regulator does not have direct responsibility for environmental regulation. Where this is the case, the regulator generally should be aware of the country's environmental policies and regulations because the utility regulator's incentive mechanisms and decisions on above- or below-the-line treatment of environmental protection costs affects the operator's incentives to cooperate in reaching the country's environmental goals.

In some instances, the regulator may want the operator to provide services that are not commercially viable. The most common examples are infrastructure expansion and service or service access to the poor. In the case of infrastructure expansion, the regulator may desire a rapid system expansion, beyond what profit-maximizing operator in a competitive market would choose, or desire network expansion into a rural area, where customers are unwilling or unable to pay prices that would cover the cost of developing the rural infrastructure. The most common solution is a requirement in the operator license or concession contract that sets out network deployment expectations and the rewards or penalties that apply to encourage the operator to meet the expectations. Other approaches include special franchises for rural areas and subsidies for rural areas.

Policies for services to the poor generally use some combination of three basic elements – competition, service quality standards specific to services for the poor, and subsidies. Research has shown that competition provides operators with incentives to find ways to profitably provide service to the poor. For example, competition in mobile telecommunications in developing countries provided operators with an incentive to develop prepaid service, which made it

price results in a percentage change in the quantity demanded that is less than one percent, while elastic demand means that the one percent change in price results in a greater than one percent change in quantity demanded.

³⁴ Chapter VI covers service quality, environmental, and universal access and service issues.

³⁵ Generally the operator in charge of the network for power or water would be a monopoly and so would have market power. Regulators generally focus service quality regulation on such operators.

possible for the poor, who are generally unable to establish credit for post-paid service, to obtain service.³⁶ Competition among entrepreneurs who transport water from wells or streams has also increased the supply of water to the poor in some instances.

Situations also arise where services to the poor can be made affordable by offering services that are of a lower quality than services provided to wealthier customers. For example, a shared sewage system provides a lower level of service than a system that gives each customer his or her own connection, but may be more affordable for the poor than the higher quality system.

Subsidies are also a common feature of policies designed to assist the poor. These generally take the form of service or infrastructure development obligations for operators. (Infrastructure development issues are described above.) In these situations, the operator internalizes the subsidies. In other instances, the subsidies may be explicit. For example, water customers living in low-income areas of Colombia have received credits on their bills. Customers in wealthier areas had surcharges on their bills to fund the subsidies to the poorer customers. Subsidy arrangements should be approached with caution. Research has shown that traditionally higher income customers benefit more from subsidies than do poorer customers.

H. Regulatory Process³⁷

An important feature of utility regulation is the institutional arrangement within which it occurs because these arrangements affect stakeholders' beliefs and abilities to influence regulation, the incentives and capabilities of the regulatory agencies, and the role of politics in the regulatory process. In fact, the institutional structure of regulation takes us back to an earlier point about objectives because this institutional structure plays a significant role in determining the regulator's objectives.³⁸

If the regulatory agency is subject to daily political pressures, for example, then the agency may place more weight on short-term political goals than on long-term infrastructure development goals identified in the country's laws. A consequence of the regulator pursuing short-term political goals may include prices that are so low as to discourage investment or the politically powerful benefiting more from regulatory policies than the politically weak. There is also a danger that the agency may be subject to capture by operator interests and so serve the interests of the industry rather than pursue the provision of efficient utility services.

To avoid these and other outcomes that serve the needs of special interests, experts generally recommend institutional arrangements that (1) focus the country's political efforts on establishing laws under which the regulator performs her function, and (2) make it easier for customers and other stakeholders to regulate the regulator and policy makers. These arrangements are designed to ensure, to the extent practical, that the regulator's objectives correspond to the objectives of the population. These arrangements regulate the regulator and

³⁶ Prepaid service was subsequently adopted even in markets where there was no competition.

³⁷ Chapter VII covers the regulatory process.

³⁸ This topic is covered in both normative theories of regulation and positive theories of regulation.

policy makers by encouraging regulation under the law and independence, transparency, predictability, legitimacy, and credibility of the regulatory system.

1. Institutional Arrangements

Institutional arrangements in regulation include institutional design, methods for review and appeal of regulatory decisions, mechanisms for encouraging ethical conduct, and processes for managing relationships with stakeholders. The design of regulatory institutions includes such features as appointment processes for regulators, agency financing, scope of responsibilities and authority of the agency, regulatory processes for protecting stakeholders' rights and providing stakeholders with information, and the management structure of the regulatory agency.

Appointment and removal processes for regulators and financing of the regulatory agency affect the regulator's ability to operate independently of short-term political interests and the government's ability to ensure that the regulator is following the government's established policies. For example, if the president, parliament, or ministry of a country can remove the regulator at will, then absent extraordinary self control on the part of politicians, the regulator has an incentive to serve the politicians' short-term interests. On the other hand, a regulator-for-life who has control of her own budget would have extraordinary power and, absent strong judicial oversight, would be able to pursue personal agendas that may conflict with the policies and laws of the country.

Policies that provide due process for stakeholders ensure that the persons affected by regulation are able to provide the regulator with information and opinions that are relevant to the regulator's decisions. Policies that require the regulator to keep records, make the records publicly available, and provide substantive explanations for regulatory decisions allow customers and other stakeholders to observe how the regulator makes decisions and facilitate appeals of regulatory decisions.

2. Review and Appeal

The review and appeal processes for regulatory decisions includes decision making processes, choices of regulatory instruments, stakeholder and government roles in regulatory decision making, mechanisms for appeal of regulatory decisions, and alternative dispute resolution processes. Regulatory instruments include legislation and licenses, the choice of which is often determined by the legal traditions of the country and the methods by which these instruments can be changed. For example, the regulatory process is politicized if a license is the regulatory instrument and the ministry can change the license at will.

In some countries, regulatory decisions are subject to ministry review, which can also politicize regulation. To avoid such situations, some countries provide only judicial review of regulatory decisions or establish administrative tribunals. Some countries allow courts to overrule the regulator only on legal or procedural grounds and not on the substantive grounds of the regulatory decision itself. In some situations legal processes can delay regulatory decisions to

such an extent that the decisions cannot be made in a timely fashion, which degrades sector performance. To avoid such delays, some countries use alternative dispute resolutions procedures, such as binding arbitration, to speed resolution of conflicts.

3. Ethical Conduct

Ethical conduct of regulators is important because control mechanisms, such as appeals and due process, are imperfect and may be costly. Instruments for encouraging ethical conduct include adopting conflict-of-interest standards and codes of conduct. A conflict of interest may occur if, for example, the regulator or the regulator's family members having financial stakes in operators, or if the regulator has either recently worked for an operator or another stakeholder, or has served as a consultant for a stakeholder, or has negotiated future employment or business arrangements with a stakeholder. In the UK, for example, regulators have to obtain permission from ministers to work in their area of regulation after leaving the regulatory authority. Codes of conduct often cover such issues as meetings with stakeholders, record keeping procedures, and political activities.

4. Stakeholder Relations

Stakeholder relations affect the independence of the agency and include the use of advisory boards, communication strategies, grievance procedures, and relationships with the government, consumers, operators, and investors. Some regulators use advisory boards to facilitate stakeholder input, especially on issues of long-term planning and on issues that require ongoing surveillance, such as service quality regulation. Care must be taken when using advisory boards to ensure that the stakeholders represented do not obtain privileged positions for influencing the regulator. Regulators generally receive complaints from consumers related to prices and service quality, and often regulators have special staff designated to handle these complaints.

Some of the regulator's interactions with stakeholders can take the form of negotiations. Such circumstances make it important for regulators to develop strategic negotiation skills, such as identifying parties' interests and win-win solutions.

Lastly, regulators generally dedicate trained staff to dealing with the press because the public receives most of its information about regulation through newspapers and other media. This reliance upon journalists makes it important for regulators to develop good press relations, provide effective press releases, and learn how to provide timely and accurate information to the press.

I. Concluding Observations

Regulation is performed in a network of relationships among persons and institutions that differ in their objectives, incentives, and sets of information. For regulation to result in effective

and efficient sector performance – which is necessary for customers to receive their maximum benefit from the sector – decision-making procedures should be in place to limit information asymmetries and that provide incentives for operators, government, and regulators to work for the best interest of customers and the economy. This generally means that (1) effective competition should be encouraged whenever possible, (2) the regulator should gather information about the sector and should provide stakeholders with information on the regulator and her decisions, (3) incentive regulation should reward the operator with the opportunity for higher profits when he accepts performance goals that make customers better off, (4) requirements should be established for service quality and access for the poor, and (5) regulatory processes should align the goals and capabilities of the regulator with the welfare of customers.