

ANNOTATED READING LIST FOR A BODY OF KNOWLEDGE ON INFRASTRUCTURE REGULATION

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Chapter IV. Regulating Overall Price Level

Introduction

It is time to address incentive regulation, which is the third instrument that regulators use to control market power and address the asymmetry between the government and the operator with respect to objectives and information. In many instances this topic is intertwined with financial analysis, which is the subject of Chapter III.

Incentives can be used in several contexts. For example, policymakers in the United States used a quid pro quo incentive when some of the U.S. incumbent local telephone companies were allowed to enter long distance markets only if they first cooperated in opening their local markets to competition. This chapter focuses on incentives related to the regulation of the overall price level of the service provider. First, the basic forms of regulation used to regulate price levels are addressed. Then the underlying principles of incentive regulation are explained, and how each form of regulation addresses those principles is summarized. How each form of regulation is implemented and the issues that regulators face is reviewed, followed by describing the regulatory processes used to review overall price levels. Following this chapter's narrative are a list of case studies and lists of references. References are organized by topic.

Basic Forms of Regulation¹

There are four primary approaches to regulating the overall price level – rate of return (or cost of service) regulation, price cap regulation, revenue cap regulation, and benchmarking (or yardstick) regulation.² Rate of return regulation adjusts overall price levels according to the operator's accounting costs and cost of capital. In most cases, the regulator reviews the operator's overall price level in response to a claim by the operator that the rate of return that it is receiving is less than its cost of capital, or in response to a suspicion of the regulator or claim by a consumer group that the actual rate of return is greater than the cost of capital. However regulators in some countries practice rate of return regulation by scheduling price reviews in advance, such as conducting an annual price review. Chapter III Section G on Financial Analysis describes how rate of return and cost of capital are calculated. Once the regulator, using rate of return regulation, has decided to review the operator's price level, she estimates the operator's actual rate of return, applying the prudence, used and useful, and known and measurable standards discussed in Chapter III Section F. The regulator also identifies what she believes to be the operator's cost of capital and orders a rate level change that is intended to bring the actual rate of return in line with the cost of capital.

Price cap regulation,³ which is sometimes called RPI-X regulation,⁴ allows the operator to change its price level according to an index that is typically comprised of an inflation measure, *I*,

¹ See Section A.

² 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.

³ See Section B.

⁴ RPI stands for Retail Prices Index and is a measure of inflation used in the United Kingdom.

and a “productivity offset,” which is more commonly called the *X*-factor. The precise meaning of the *X*-factor and principles for choosing *I* are described in more detail below. Typically with price cap regulation, the regulator groups services into price or service baskets and establishes an *I – X* index, called a price cap index, for each basket.⁵ Establishing price baskets allows the operator to change prices within the basket as the operator sees fit as long as the average percentage change in prices for the services in the basket does not exceed the price cap index for the basket.⁶

Revenue cap regulation⁷ is similar to price cap regulation in that the regulator establishes an *I – X* index, which in this case is called a revenue cap index, for service baskets and allows the operator to change prices within the basket so long as the percentage change in revenue does not exceed the revenue cap index. Revenue cap regulation is more appropriate than price cap regulation when costs do not vary appreciably with units of sales. An example might be electricity distribution where distribution lines drive costs, but prices are often based on kilowatt-hours of electricity sold.⁸ Revenue caps also relieve the regulator from the duty of overseeing price structures, which in some cases can be costly to regulate because they are complex.

Benchmarking is comparative competition in that the operator’s performance is compared to other operators’ performance and penalties or awards are assessed based on the operator’s relative performance.⁹ For example, the regulator might identify a number of comparable operators and compare their cost efficiency. The most efficient operators would be rewarded with extra profits and the least efficient operators would be penalized. Because the operators are actually in different markets, it is important to make sure that the operators’ situations are similar so that the comparison is valid, and to use statistical techniques to adjust for any quantifiable differences over which the operators have no control. As noted elsewhere, benchmarking is rarely used by itself and is commonly combined with price cap regulation as an input for determining the *X*-factor.

The two most common forms of statistical analysis used in benchmarking are data envelopment analysis (DEA) and regression analysis. DEA estimates the cost level an efficient firm should be able to achieve in a particular market. Using DEA analysis the regulator would reward operators whose costs are near the efficient frontier with additional profits. Regression analysis estimates what the average firm should be able to achieve. Using regression analysis the regulator would reward firms that performed better than average and penalize firms that performed worse than average.

Recently, regulators have begun using a virtual company approach in which analysts construct a simulation model of the operator and estimate the cost level of an efficient operator. The virtual company approach is subject to strategic behavior by analysts because the model represents what the analyst says the operator should do, which is by design not what the operator

⁵ Because of this feature, some authors refer to price cap regulation as service basket or price basket regulation.

⁶ As Chapter V explains, in many instances the regulator and the operator are in agreement on how prices should be designed. This feature of price cap regulation allows the operator to use his superior information to make decisions that the regulator would also make if she had the same information as the operator.

⁷ See Section C.

⁸ In some instances regulators combine price and revenue caps, applying price caps to costs that vary with sales and revenue caps to costs that do not vary with sales.

⁹ See Section D. See Chapter II for information about competition in the market and competition for the market.

really does. With any approach, best practices indicate that the regulator should account for varying operating conditions across firms and that are beyond the operators' control. Such factors could include macroeconomic conditions, geography, demographics, and history.

Some regulators release benchmarking information to the media. If the media publish the information, this has the advantage of bringing public pressure on poorly performing operators.

Generally regulators use a combination of these basic forms of regulation. Combining forms of regulation is called hybrid regulation. For example, U.K. regulators combine elements of rate of return regulation and price cap regulation to create their form of *RPI-X* regulation. Some regulators use earnings sharing,¹⁰ which is an approach that allows the operator to keep some portion of its earnings above its cost of capital and bear some portion of the difference if earnings are below the cost of capital. Revenue sharing is another option in which the operator keeps only some portion of revenue changes.

Incentive Features and Other Properties

The opportunity to keep additional profits is the incentive feature employed in the basic forms of regulation. This raises two challenges. For the regulator of a state-owned operator, the prospects of additional profit may not be an incentive for improved performance. This means that the regulator must identify other rewards that the operator finds attractive and design an incentive scheme around those rewards. Also, whether the regulator uses profit or some other incentive, the regulator must determine how much reward is needed to induce the operator to improve performance and to know whether the additional efficiency gained is worth the additional reward allowed. Smaller incentives are needed for easy efficiency gains than for more difficult efficiency gains.

To simplify the exposition, throughout the remainder of this chapter, incentive regulation will be described as if the reward were profit. Regulators using other rewards should note that they will need to adjust the incentive mechanisms according to the reward(s) they will use.

Regulators use two approaches to allowing operators additional profits or losses. One approach is simply to commit¹¹ that the operator can keep at least some portion of its earnings that are above the cost of capital. In the case of pure price cap regulation,¹² the operator is allowed to keep all of these earnings, but the operator is also required to bear all of the cost of having earnings below the cost of capital. This is called a high-powered incentive scheme. With earnings sharing, the operator keeps or bears something less than 100 percent of the difference between the actual earnings and the cost of capital. Schemes under which the operator keeps only a small percent are called low-powered incentive schemes.

¹⁰ See Section E. In U.K.-style price cap regulation, financial modeling is used to estimate the *X*-factor. In these approaches, the cash outflows of the operator are forecasted as is the rate base value that will exist at the end of the price control period. These values are discounted back to the present. Then revenues are forecasted, using an iterative process until the net present value of the enterprise is zero.

¹¹ Chapter I includes discussion of the difficulty governments have with keeping commitments.

¹² See Section B.

The other approach that regulators use to allow operators to keep additional profits or losses is to allow the operator to keep the difference between its earnings and its cost of capital for some period of time before adjusting overall price levels. This is called regulatory lag. Rate of return regulation typically incorporates regulatory lag by using historical test years, which is a system by which price levels following the price review (or rate case) are based on costs incurred in a previous year. U.K. regulators also use regulatory lag in their *RPI-X* schemes when they wait until a scheduled price review before establishing glide paths to adjust price levels that align actual earnings with the cost of capital. A glide path is a transition period for such price changes.

A mechanism that regulators may inadvertently use to allow operators to keep additional profits or losses is to misestimate the cost of capital. If the allowed rate of return, which is the regulator's estimate of the cost of capital, is greater than the actual cost of capital, then the operator has an incentive to increase returns to shareholders by increasing its investments. This is called the Averch-Johnson effect, or gold plating or padding the rate base, and is a common criticism of rate of return regulation. If the regulator errors in the opposite direction, the operator has an incentive to under invest.¹³

Allowing the operator to keep additional profits or losses has the additional effect of shifting risk from customers to shareholders.¹⁴ If the operator's earnings are constantly kept in line with its cost of capital, then profits are stable, but the prices that customers pay change to match changes in the business. In this scenario, customers are bearing at least some portion of the business risk. In the other extreme, such as pure price cap regulation, shareholders must bear all of the fluctuations in earnings, so they bear most of the risk. In general, it is preferred that shareholders bear risk rather than customers because shareholders are generally in a better position than customers to diversify their risk by creating diversified investment portfolios. Furthermore, regulators sometimes use glide paths, which phase in price changes over time, to soften price impacts on customers or to distribute risk between customers and investors.

If the regulator is using both competition and incentive regulation to overcome information and objective asymmetries,¹⁵ and if the incentive regulation includes elements of rate of return regulation, then the operator has a mechanism to shift costs from its non-regulated operations to its regulated operations. This has the effects of increasing total profit and possibly giving the operator a greater market share in the competitive market and decreasing risk. Regulators attempt to control for this by employing sophisticated accounting separation techniques, as described in Chapter III Section E.

Features of Price Cap and Revenue Cap Regulation¹⁶

Price cap regulation adjusts the operator's prices according to the price cap index that reflects the overall rate of inflation in the economy, the ability of the operator to gain efficiencies relative to the average firm in the economy, and the inflation in the operator's input prices

¹³ See Section A.

¹⁴ Chapter III Sections A and G examine risk.

¹⁵ See Chapter I for a discussion of the basic approaches for overcoming information asymmetries.

¹⁶ See Sections B and C.

relative to the average firm in the economy.¹⁷ Revenue cap regulation attempts to do the same thing, but for revenue rather than prices. The underlying theory is as follows.

Consider how the price (or revenue, in the case of revenue caps) level for the average firm in a competitive market changes relative to inflation. Inflation reflects two things, namely, the change in the value of the country's money and the change in the productivity of the firms in the economy. By definition, the input prices for the average firm in the economy change at the rate of inflation and its productivity changes at the average rate for the economy. As a result, the average firm's retail prices change at the rate of inflation and the firm continues to receive earnings that are equal to its cost of capital.

Now consider how a utility operator might be different from the average firm in the economy. First, assume that the operator is just like the average firm, except that the operator's input prices change at a rate that is different from the rate of change for the average firm. If the operator's input prices increase faster than (conversely, slower than) the rate of inflation, then the operator's retail prices (revenue) will need to increase faster than (conversely, slower than) the rate of inflation for the operator to be able to have earnings that are at least as great as the operator's cost of capital.

Now assume that the operator is just like the average firm, except with respect to the operator's ability to improve efficiency. If the operator increases its productivity faster than (conversely, slower than) the average firm, then the operator's retail prices (revenue) will need to decrease (conversely, increase) relative to the rate of inflation.

Combining these two possible differences between the operator and the average firm in the economy, the operator's retail prices (revenue) should change at the rate of inflation, minus (conversely, plus) the extent to which its input prices inflate less than (conversely, greater than) the rate of inflation, and minus (conversely, plus) the extent to which the operator's productivity is expected to improve at a rate that is greater than (conversely, less than) the average firm in the economy.

The above analysis identifies two things. First, the inflation rate I used in the price cap index represents the general rate of inflation for the economy. Second, the X -factor is intended to capture the difference between the operator and the average firm in the economy with respect to inflation in input prices and changes in productivity. That is to say, the choice of inflation index and of the X -factor go hand in hand. Some regulators choose a general measure of inflation, such as a gross national product price index. In this case, the X -factor reflects the difference between the operator and the average firm in the economy with respect to the operator's ability to improve its productivity and the effect of inflation on the operator's input costs. Other regulators choose a retail (or producer) price index. In these cases, the X -factor represents the difference between the operator and the average retail (or wholesale) firm. Lastly, some regulators construct price indices of operator inputs. In these cases, the X -factor reflects productivity changes of the operator.

¹⁷ Only in pure price cap regulation do regulators explicitly compare the operator to the average firm in the economy. However, all price cap schemes effectively follow this logic by adopting a price cap index based on inflation and a productivity offset.

The regulator typically constructs service baskets with an eye towards 1) allowing the operator to realign prices within the basket, and 2) restricting the operator's ability to realign prices between baskets.¹⁸ When the operator is allowed to realign prices, the operator will generally change prices in accordance with their price elasticities of demand.¹⁹ That is to say that prices for products whose price elasticity of demand is more inelastic will rise relative to the prices for products whose price elasticity of demand is more elastic. This improves economic efficiency, but may be contrary to certain regulatory goals, such as protecting poor customers or customers in the least competitive markets. Sometimes the regulator limit's the operator's ability to realign prices within a basket by placing restrictions on individual price changes, such as a maximum percentage by which a price may increase in a given year.

Earnings Sharing

Earnings sharing is a popular form of hybrid regulation. With earnings sharing, the regulator allows the operator to keep some portion of the earnings it receives from the market and requires the operator to give the rest to customers, perhaps through price reductions, refunds, or increased investment.

A typical earnings sharing mechanism might work as follows. The regulator establishes a price level that equates the rate of return r that the operator receives from the market with the operator's cost of capital k .²⁰ The regulator also establishes a range with endpoints above and below the cost of capital, say from r_l to r_h , within which the operator retains all of the earnings it receives from the market place, i.e., no earnings between k and r_h are given to customers through a price decrease or other mechanism, and the operator is not compensated for earnings between r_l and k . Below r_l and above r_h , the regulator establishes another range, say between r_L and r_H . For earnings between r_L and r_l , customers bear some of the difference between the r_L and r_l , and for earnings between r_h and r_H , the operator shares some of its earnings with customers. Customers bear the entire burden and receive all of the benefits for earnings below r_L and above r_H .

Issues in Regulating the Price Level

Two issues are common to most forms of incentive regulation. The first issue is how to treat extraordinary events that impact earnings. In rate of return regulation, where high or low earnings relative to the cost of capital trigger price reviews, it is unusual for the regulator to make price adjustments simply because of an extraordinary event. Instead, the regulator normalizes the financial impact of the event, which means that the regulator spreads the effect over time. With price cap regulation, the price cap index captures how the event affects the average firm in the economy, so the regulator considers the impact of the event only if the event affects the operator disproportionately relative to the average firm in the economy. If the effect on the operator is

¹⁸ Rate design is discussed in Chapter V.

¹⁹ Elasticity of demand refers to the extent to which customers change the quantities they purchase in response to a change in price. If demand is inelastic, then customers' percentage change in the quantities they purchase is smaller in absolute terms than the percentage change in price. If the opposite is true, then demand is said to be elastic.

²⁰ See Chapter III Section G regarding estimating the cost of capital.

disproportionate, then the regulator considers the extent to which the effect of the event on the operator is within the operator's control because, for the incentives built into price cap regulation to be effective, the regulator should not intervene in areas where the operator should be taking action. Following this analysis, if the event affects the operator disproportionately and if the effects are beyond the operator's control, then the regulator may make a price adjustment. The situation for revenue cap regulation is the same as that for price cap regulation. With benchmarking, the regulator first considers whether the event affects this operator disproportionately relative to the other operators included in the benchmarking analysis. If the effect is disproportionate, then the regulator again considers the extent to which the operator can affect the impact of the event.

The second and related issue that is common to all of the forms of regulation, except pure price caps, is the treatment of controllable and non-controllable costs. Controllable costs are those that the operator can influence and, conversely, non-controllable costs are those that the operator cannot influence. In some instances the regulator allows the operator to pass through to customers changes in non-controllable costs. A historical example is the cost of fuel for electricity generation. This price was traditionally considered beyond the control of the electricity generator. For this reason, and because fuel was a significant portion of the cost of generation and fluctuated frequently, regulators frequently allowed changes in fuel prices to be passed through to customers.

Properties of Benchmarking and Yardstick Analyses

Benchmarking²¹ quantifies the relative historical performance of organizations or divisions, controlling for external conditions. Once the purposes and uses of benchmarking are known, the first step is to survey the information that is available. Such information might include system operations, network capacity, financial flows, and outputs. Then with purposes and possibilities in mind, the regulator can choose the metrics to use in benchmarking and how they will be used to provide incentives for improved performance.

In general there are five types of metrics that can be used for benchmarking. It is important to understand the strengths and limitations of different methodologies so that they are used appropriately. Poorly performed, benchmarking may hinder good performance rather than promote it.²²

One type of metric – Core Overall Performance Indicators – include measures that are generally available and simple to understand, such as output per employee, number of complaints, system loss, coverage, and key financial indicators. These indicators help regulators identify trends, but it is difficult to account for the relationships among the different factors. Regulators can use another type of metric, Performance Scores based on Production or Cost Estimates, to identify the best and weakest performers in a group of service providers. This approach can use sophisticated quantitative techniques to determine relationships between the

²¹ To ease the exposition, the term benchmarking will be used in this portion of the narrative.

²² It is beyond the scope of this narrative to explore the strengths and weaknesses of each metric. See the references in this chapter for information on the properties of each metric.

results being measured (such as cost per unit) and the factors beyond the operators' control that can affect the results (for example, population density). Data availability can make these types of analyses complex, as can the difficulty of fully accounting for differences between operators than are beyond the operators' control.

A third type of metric – the model or virtual company approach – is sometimes used to establish a baseline for measuring operator performance. This method creates an optimized economic and engineering model of a company. The methods are complex and can be controversial because it is difficult to ground in reality the numerous assumptions that must be made in constructing the models. Process Benchmarking is the fourth approach and focuses on individual production processes, such as pumping, transport, and treatment in the provision of water. This approach provides regulators with detailed information on specific stages of production, but they can be problematic in a regulatory incentive scheme because they focus on management issues of how services are provided rather than the outcome issues of the costs and quality that customers experience. Generally management decisions should be left to the operator since it is the operator that is take on the risks of good or poor management decisions.

Customer Survey Benchmarking is the last form of benchmarking and focuses on customer perceptions. Customer perceptions can be measured through surveys, focus groups, complaint monitoring, and the like. This approach has the advantage of directly gauging the customer's experience, but customers' views can be influenced by attitudes and experiences that are beyond the operators' control.

Conducting a Price Review

A price review consists of four basic procedures, namely: decide what to regulate, evaluate the existing price control scheme, choose how prices will be controlled going forward, and implement the new control.²³ The first of these steps applies primarily to telecommunications, where competition serves as an effective regulator in many instances. Chapter II on Competition and Market Structure and Chapter V on Tariff Design focuses on how to assess the competitiveness of a market.

There are several approaches to completing the last three procedures. The general practice in the U.K. is a two-year process that begins with gathering and analyzing information on costs,²⁴ investment plans, and demand forecasts; forecasting revenue requirements;²⁵ choosing whether to use price caps or revenue caps;²⁶ projecting revenue and cash flows using different price control parameters; and making the announcement.²⁷ Time is allowed at the end of the process to complete appeals²⁸ before the old price control scheme expires. In the U.S., resetting the *X*-factor

²³ See Section A. The references in Section A provide other ways of dividing the work of a price review into multiple steps.

²⁴ See Chapter III for information on obtaining, managing, and using financial information.

²⁵ See Chapter V Section F for information on demand forecasting.

²⁶ See Section A for information on choosing the form of regulation.

²⁷ See Chapter VII Section D for information on strategies for dealing with the press and communicating with the public.

²⁸ See Chapter VII Section B for information on appeal processes of regulatory decisions.

in price cap regulation has involved extensive productivity studies and other information gathering.²⁹ Developing countries often use a combination of the U.K. and U.S. approaches, depending on institutional capabilities and available information.

Most price review processes include multiple opportunities for receiving stakeholder and informing stakeholders of decisions.³⁰ For example, Ofwat in the U.K. has followed a procedure that receives stakeholder input in the planning stages, data gathering stages, modeling stage, data analysis stage, and conclusion stage. The regulator issues numerous preliminary conclusions, explains the reasons for those conclusions, and asks for comments.

With most forms of price control, the regulator fixes the time between price reviews. Typical time periods are four and five years. The length of time depends on the confidence the regulator has in her price control parameters, the stability of the economy and industry, and the desired power of the incentive scheme. Setting the duration of the price controls involves a trade-off between the efficiency incentives and the need to keep the overall price level in line with the overall cost level, but in general, high confidence, a stable economy, and high power indicate long times between price reviews. Low confidence, unstable economy, and low power imply short times. Agency and operator resources must also be considered. With other forms of price control, such as rate of return regulation as practiced by the states in the U.S., high or low earnings relative to the cost of capital trigger price reviews, which are called rate cases. The regulator generally relies on the operator or a consumer representative to raise the issue of whether earnings are out of line with the cost of capital. If that happens, then the regulator conducts a rate case.

Concluding Observations

As indicated above, most regulators use a hybrid scheme to regulate overall prices. The appropriate combination of rate of return tools, price or revenue caps, benchmarking, and length of time between price reviews depends on a country's goals, institutional strength, level of competition, and economic stability to name a few. In fact, in some instances the regulator gives the operator a menu of options from which the operator can choose its hybrid scheme. These options generally include tradeoffs between price decreases and profits such that if the operator chooses an option that has aggressive price decreases, the operator is allowed to keep all or a significant portion of whatever earnings it receives from the marketplace. Conversely, if the operator chooses an option that has conservative price decreases, then the operator has to give back all or a significant portion of its earnings if they exceed the operator's cost of capital.

Of the general approaches to regulating overall price levels, rate of return regulation generally provides flexibility in addressing changes in costs and earnings. Price and revenue cap regulation provide the greatest pricing flexibility for the operator. Furthermore, rate of return regulation provides the greatest predictability of earnings, if the regulatory environment is considered to be predictable. Price and revenue regulation provide the greatest predictability for overall price levels.

²⁹ See Section B.

³⁰ See Chapter VII Sections A and D for approaches to involving stakeholders in regulatory processes.

Regardless of the form of regulation, the regulator is better off knowing more about the industry than less. The next chapter on examines issues in obtaining and managing information.

Case Studies

Artana, Daniel, Fernando Navajos, and Santiago Urbiztondo. “Governance and Regulation: A Tale of Two Concessions in Argentina” in Spilled Water: Institutional Commitment in the Provision of Water Services, edited by William Savedoff and Pablo Spiller. Washington, D.C.: Inter-American Development Bank, 1999, pp.197-248.

Gómez-Ibáñez, José, Regulating Infrastructure: Monopoly, Contracts, and Discretion. Cambridge, MA: Harvard University Press, 2003, Chapter 9.

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OFWAT Setting water and sewerage price limits for 2005-10: Framework and Approach. Periodic Review 2004. March 2003.

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A. Principles

1. **Alternative forms of regulation: cost of service, price cap, revenue cap, benchmarking, hybrid approaches**

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Discusses need for revenue to cover total cost. Describes rate of return regulation, price cap regulation using RPI-X, issues of excess returns, profit sharing approaches, error corrections, benchmarking, and yardstick regulation.

Farrier Swier Consulting, “Comparison of Building Block and Index-based Approaches,” paper prepared for the Utility Regulators Forum, Australian Competition and Consumer Commission, 2002.

Examines price cap and revenue cap regulation in Australia, focusing on efficiency incentives, risk, robustness, transparency, simplicity, administration, and cost and availability of information required. Considers whether regulators should incorporate utility-specific factors, benchmarking, and appropriateness to statutory objectives.

Guasch, J. Luis, and Pablo Spiller, Managing the Regulatory Process: Design, Concepts, Issues, and the Latin America and Caribbean Story, Washington, D.C.: The World Bank Group, 1999, Chapter 5.

Summarizes rate of return regulation, earnings sharing, price caps, revenue caps, and yardsticks. Discusses U.K. case for electricity and telecommunications.

Kahn, Alfred. The Economics of Regulation: Principles and Institutions. Cambridge, MA: MIT Press, 1988, Reissue Edition, vol. I, Chapter 2.

Describes traditional rate of return regulation for the U.S.

King, S., “Principles of Price Cap Regulation,” in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 46-54.

Explains that a price cap simply sets a maximum allowed inter-temporal path for the price of a specific product. The rules for the path are set in advance and only depend on factors that are beyond the control of

the regulated firm. Finds that in practice, however, price caps tend to be more complex because firms produce multiple products and these products may be bundled together in the price cap, the price cap may automatically adjust for exogenous changes in specific prices that have strong implications for the profitability of the regulated firm, and price regulation may have associated regulation covering service quality. Explains that a variety of forms of price cap are used when a regulated firm produces multiple products, such as fixed weight price cap, average revenue regulation (current quantities), average revenue regulation (lagged quantities), and tariff basket regulation.

Sectoral References

ELECTRICITY

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 2.

Describes two major kinds of price control, namely price baskets and revenue yield controls. Describes how price baskets (price caps) allow a firm to charge more efficient prices by increasing some prices by more than the allowed average provided that others are increased by a lesser amount. Explains use of weights and two-part tariffs. Describes revenue control, which does not require the regulator to specify a list of prices, which may not be possible if the set of prices is complex. States that pass-through terms may be included in a price control if the firm faces significant costs that are both uncertain and outside its control, and if consumers can better bear the risk than can the firm. Mathematical formulae for both price basket and revenue yield controls are specified.

TELECOMMUNICATIONS

ICT Regulation Toolkit. Washington, D.C.: infoDev and the International Telecommunications Union, 2007, Module 2.

Describes different approaches for regulating telecommunications prices, including discretionary price setting, rate of return regulation, rate of return-incentive regulation (banded rate of return, rate case moratoria and earnings sharing), and price cap regulation.

Sappington, David E.M., and Dennis L. Weisman, Designing Incentive Regulation for the Telecommunications Industry. Cambridge, MA: MIT Press, 1996, Chapters 1 and 3.

Describes advantages and disadvantages of price cap regulation and rate of return regulation.

TRANSPORTATION

Muller-Jentsch, Daniel *Transport Policies for the Euro-Mediterranean Free-Trade Area: An Agenda for Multimodal Transport Reform in the Southern Mediterranean* World Bank, Washington, D.C., 2007.

Maps out national and cross-border policy reforms that would be needed to create a 'common transport space' that spans both sides of the Mediterranean sea. Benchmarks against international best practice; and draws lessons from the EU-internal reform experience in the transport sector.

Kopicki, Ron and Louis Thompson Best Methods of Railway Restructuring and Privatization CFS Discussion Paper Series, number 11, World Bank, Washington, D.C., 1995.

Focuses on "best" methods built on seven case studies of recent railway restructuring efforts. The case studies cover Japan National Railway, New Zealand Railways, Argentina Railways, Swedish Railways, British Railways, and railroads in the United States, and Canadian Railways.

Estache, Antonio Privatization and Regulation of Transport Infrastructure: Guidelines for Policymakers and Regulators World Bank Institute Development Study, World Bank, Washington, D.C., 2000.

Discusses privatization and regulation trends, price and quality regulation issues that characterize the sector, and performance indicators that the sector's regulators should be able to rely on to be effective in their jobs.

Kidokoro, Y. *Rate-of-Return and Price-Cap Regulations for Urban Railways*. Osaka University, The Institute Of Social And Economic Research(I.S .E.R.), 6-1 Mihogaoka Ibaraki Osaka 567 Japan 1997.

Using a simple model of commuter railways where congestion exists, shows that price cap regulation causes congestion compared to rate-of-return regulation, shows the following results: (i) price cap regulation, in which the cap is made contingent on congestion, can correct the congestion without distorting cost-reducing efforts, (ii) price cap

regulation, in which the cap depends on investment in transportation capacity, can also correct the congestion but distorts cost-reducing efforts.

WATER

OFWAT Setting water and sewerage price limits for 2005-10: Framework and Approach. Periodic Review 2004. March 2003.

Describes incentives for efficiency in Ofwat's price cap system and how the benefits are passed on to customers.

Key Words

Incentive regulation, Efficiency, Rate of return, Cost of service, Price, Price cap regulation, Benchmarking, Revenue caps, Price basket controls, RPI-X, Yardstick regulation, Service quality, Rate base

- 2. Differences between alternative forms of price regulation: allocation of risks and incentive properties, ability of company to adjust individual prices within overall price control, incentives, and regulatory procedures**

Core References

Alexander, Ian and Chris Shugart, "Risk, Volatility and Smoothing: Regulatory Options for Controlling Prices," 1999.

Examines price caps, revenue caps, and hybrids. Considers advantages and disadvantages, with particular attention to price volatility. Discusses options for addressing price volatility.

Berg, S., "Introduction to the Fundamentals of Incentive Regulation," in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 37-45.

Explains that incentive regulation is about creating incentives for the utility to adopt efficient pricing and patterns of investment, that the need for incentive regulation comes about from the inherent informational asymmetries that exist between utility and regulator, and that successful regulation will depend largely upon the degree of incorporation of relevant fundamental economic principles in the design of an incentive mechanism for each particular case.

Farrier Swier Consulting, “Comparison of Building Block and Index-based Approaches,” paper prepared for the Utility Regulators Forum, Australian Competition and Consumer Commission, 2002.

Examines price cap and revenue cap regulation in Australia, focusing on efficiency incentives, risk, robustness, transparency, simplicity, administration, and cost and availability of information required. Considers whether regulators should incorporate utility-specific factors, benchmarking, and appropriateness to statutory objectives.

Kahn, Alfred. The Economics of Regulation: Principles and Institutions. Cambridge, MA: MIT Press, 1988, Reissue Edition, vol. I, Chapter 2, vol. II, Chapter 2.

Describes rate of return regulation for the U.S. Describes of regulation distorts incentives for efficiency.

Sectoral References

ELECTRICITY

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 2.

States that price baskets (price caps) are only feasible when the set of prices is relatively small and unchanging, and some limits on price rebalancing may be appropriate. Describes disadvantages of revenue-yield control. Says that “revenue drivers” must be included in the formula to tie total revenue to factors such as the number of customers and sales to each customer group; specific examples are given and discussed.

TELECOMMUNICATIONS

ICT Regulation Toolkit. Washington, D.C.: infoDev and the International Telecommunications Union, 2007, Module 2.

Describes weakness of rate of return regulation, incentives of earnings sharing mechanisms and rate case moratoria. Explains that price cap regulation is meant to provide incentives that are similar to competitive market forces. Advantages of price cap regulation are detailed.

Laffont, Jean-Jacques, and Jean Tirole, Competition in Telecommunications, Cambridge, MA: MIT Press, Chapter 2.

Describes economics of price cap regulation for telecommunications. Provides narrative and technical explanations.

Sappington, David E.M., and Dennis L. Weisman, Designing Incentive Regulation for the Telecommunications Industry. Cambridge, MA: MIT Press, 1996, Chapters 1 and 3.

Compares price cap regulation and rate of return regulation for telecommunications.

Sappington, David E. M., “The Effects of Incentive Regulation on Retail Telephone Service Quality in the United States,” Review of Network Economics 2(4): 356-375, December 2003.

Describes how price cap regulation affects service quality in telecommunications.

TRANSPORTATION

Coelli, Tim, Antonio Estache, Sergio Perelman, and Lourdes Trujillo A Primer on Efficiency Measurement for Utilities and Transport Regulators World Bank, Washington, D.C., 2003.

Reviews regulatory techniques for recently “privatized” utilities and transport services. Designed as a starter kit, surveys the options available and provides guidelines as to how to choose between these options, identifying the costs and benefits of the various approaches in situations most relevant to regulators. Covers the measurement of efficiency in the context of a tariff revision aiming at redistributing at least some of the efficiency gains from the producers to the users. Also addresses the challenges from comparative efficiency assessments allowing the introduction of yardstick competition.

Other References

Alexander, Ian, and Timothy Irwin, “Price Caps, Rate-of-Return Regulation, and the Cost of Capital,” Note no. 87 in Public Policy for the Private Sector. Washington, D.C.: World Bank Group, September 1996.

Demonstrates that price cap regulation results in a higher cost of capital for regulated firms than does rate of return regulation, indicating that price cap regulation shifts risk from customers to shareholders.

Vickers, John, and George Yarrow, Privatization: An Economic Analysis. Cambridge, MA: MIT Press, 1988, Chapter 4.

Explains Averch-Johnson effect, regulatory lag, information asymmetries, RPI-X regulation and Ramsey pricing, and implications of competition.

Key Words

Incentive regulation, Efficiency, Information, Rate of return, Cost of service, Price, Price cap regulation, Benchmarking, Revenue caps, RPI-X, Yardstick regulation, Service quality, Rate base

3. Use of extraordinary price adjustments and other techniques for handling major changes in financial/economic equilibrium

Core References

Bernstein, Jeffrey I., and David E. M. Sappington. "How to Determine the X in RPI - X Regulation: A User's Guide," *Telecommunications Policy* 24(1): February 2000, pp. 63-68.

Explains that the proper choice of an X-factor is critical for price cap regulation. Too small an X-factor could lead to excessive profits and thereby jeopardize the legitimacy of the regulator. Too large an X-factor could hurt the financial integrity of the operator. The X-factor should reflect the extent to which the regulated industry has historically achieved higher productivity growth and faced lower input price inflation than other industries in the economy. Details, conditions, and exceptions are examined.

Booker, A. "Incentive Regulation in Water – Case Study," in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 68-74.

Explains that to ensure real productivity gains in U.K. water regulation, Ofwat introduced quality service monitoring. The initial caps were allowing substantial profits, which were retrieved using a glide path. The second periodic review will take even more notice of service quality and place more importance on environmental concerns.

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 4.

Describes how regulators choose the form of price control in a price review process. Describes pass-through terms for price caps and revenue caps.

King, S., “Principles of Price Cap Regulation,” in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 46-54.

Explains that in price caps, the regulator decides how input prices are to be passed through to consumers, as any allowed cost pass through will reduce incentives to minimize costs. Another key design issue is the price review. Further explains that any ‘allowed profit’ aspect to price cap reviews – including using past performance to set future price caps – will tend to reduce the incentives of an operator to reduce costs. Raising an X- or a catch-up factor if the firm exceeds expected productivity performance also decreases incentives to improve performance.

Key Words

Incentive regulation, Efficiency, Information, Rate of return, Cost of service, Price, Price cap regulation, Benchmarking, Revenue caps, Price basket controls, RPI-X, Price review, Yardstick regulation, Service quality, Rate base

4. Treatment of different categories of costs (controllable vs. non-controllable) in price controls

Core References

Alexander, Ian and Clive Harris, The Regulation of Investment in Utilities: Concepts and Applications. Washington, D.C.: The World Bank, 2005.

Examines approaches for determining whether assets should be included in the rate base.

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 4.

Explain that the past and future projected operating costs of the regulated firm should be collected from the firm and broken down by customer group, activity (such as customer service), and category (such as

labor). Further explains that the regulator should divide these costs into three groups: ongoing controllable costs, ongoing uncontrollable costs, and one-off costs. Holds that the best available forecast of uncontrollable costs should be included in the projected cost, while some type of benchmarking or yardstick competition should be used to set a target for controllable costs that an efficient firm could meet.

Sectoral References

ELECTRICITY

Alexander, Ian and Clive Harris, “Incentive Regulation and Multi-year Price Controls: An Application to the Regulation of Power Distribution in India,” International Journal of Regulation and Governance 1(1): 25–46, 2001.

Considers regulator’s ability to commit to multi-year tariffs. Finding that such commitments are not credible, evaluates whether this is a barrier to incentive regulation. Considers a hybrid incentive methodology that rewards for improvements in efficiency for items under the operator’s control.

Arizu, Beatriz, Luiz Maurer, and Bernard Tenenbaum, “Pass Through of Power Purchase Costs: Regulatory Challenges and International Practices,” Washington, D.C.: The World Bank, February 2004.

Explains the importance of rules on pass through of power purchase costs. Identifies, compares and contrasts pass through methodologies used in both developed and developing countries. Presents lessons learned and best practices. Recommends pass through methods that rely on market prices and competitive procurements. Considers cases where data restrictions necessitate an evolutionary path for pass-through regulation.

Bakovic, T., B. Tenenbaum, and R. Woolf, “Regulation by Contract: A New Way to Privatize Electricity Distribution?” Energy and Mining Sector Board Discussion Paper, Series Paper no. 7, March 2003.

Explains that most regulatory contracts specify a multi-year system that includes a formula that distinguishes between controllable and non-controllable costs. Changes in non-controllable costs are automatically passed through. Changes in controllable costs are benchmarked. States that pass-through of non-controllable costs should be done frequently and automatically. Holds that a common mistake made in designing a multi-year system is the failure to distinguish between degrees of effective control. The nature of control over a particular cost item may be quite different between developed and developing countries.

TELECOMMUNICATIONS

ICT Regulation Toolkit. Washington, D.C.: infoDev and the International Telecommunications Union, 2007, Module 2.

States that price cap regulation is meant to provide incentives that are similar to competitive market forces. The formula is designed to permit an operator to recover its unavoidable cost increases through price increases, but also requires the operator to lower its prices regularly to reflect productivity increases that an efficient operator would be expected to experience.

TRANSPORTATION

Felton, John Richard and Dale G. Anderson. *Regulation and Deregulation of the Motor Carrier Industry*. Ames, Iowa: Iowa State University Press, 1989.

Describes the problem of rate inflexibility with regard to space and time in transportation services. Uses the backhaul problem and peak load pricing to illustrate the theory. Presents regulatory experience of the trucking industry in Great Britain and Australia, as well as the United States.

Key Words

Incentive regulation, Efficiency, Information, Rate of return, Cost of service, Price, Peak-load pricing, Price cap regulation, Benchmarking, Revenue caps, Price basket controls, RPI-X, Price review, Yardstick regulation, Service quality, Rate base, Controllable costs, Non-controllable costs

5. Trade-offs between flexibility and predictability of regulatory arrangements

Core References

Baldwin, Robert, and Martin Cave, Understanding Regulation: Theory, Strategy, and Practice, Oxford: Oxford University Press, 1999, Chapters 6, 17, and 21.

Examines practices for ensuring quality regulation, considering the role of legislation, due process, and agency expertise. Discusses tradeoffs between predictability and flexibility in price cap regulation. Also examines accountability of the regulatory agency, with attention to

oversight of regulatory agency by legislative bodies, government, appeals bodies including courts, super-agencies, and consumers.

Frontier Economics, “Developing Network Monopoly Price Controls: Workstream A: Regulatory mechanisms for dealing with uncertainty,” A final report prepared for Ofgem, March 2003.

Develops a framework for examining the best regulatory response to uncertainty. Considers the “tension between offering the firm incentives to reveal its efficient cost level, and offering it insurance against unforeseen events,” including how the regulatory response affects operator incentives and vulnerability.

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 6.

Explains that one disadvantage of revenue-yield control is that while prices are set initially, revenue cannot be checked until after the fact, which means that a correction factor should be included in the revenue cap formula. Pass-through terms may be included in a price control if the firm faces significant costs that are both uncertain and outside its control, and if consumers can better bear the risk than can the firm.

Newbery, David M., Privatization, Restructuring, and Regulation of Network Industries. Cambridge, MA: MIT Press, 1999, Chapter 2.

Examines problems of regulatory commitment and how it impacts credibility and various regulatory instruments.

Sectoral References

ELECTRICITY

Bakovic, T., B. Tenenbaum, and R. Woolf, "Regulation by Contract: A New Way to Privatize Electricity Distribution?" Energy and Mining Sector Board Discussion Paper, Series Paper no. 7, March 2003.

States that the tariff-setting system should include a mechanism for the pass-through of costs associated with unanticipated external events such as natural disasters or major changes in law, regulations and some taxes. Whenever possible, the regulatory contract should include specific "trigger" mechanisms to adjust tariffs for extraordinary events. In developing countries, the civil law concept of restoring the enterprise's "financial-economic equilibrium" is not a workable approach for dealing with extraordinary events.

TELECOMMUNICATIONS

Sappington, David E.M., and Dennis L. Weisman, Designing Incentive Regulation for the Telecommunications Industry. Cambridge, MA: MIT Press, 1996, Chapters 3, 4, and 7.

Examines the features and economic effects of various forms of regulation, including rate of return regulation, earnings-sharing plans, revenue-sharing plans, and price cap regulation. Discusses regulatory goals, priorities, and resources. Also examines the importance of regulatory commitment, including causes of lack of commitment, the effects of lack of commitment, and the implications of low commitment powers for designing incentive regulation.

6. Main steps in conducting a price review

Core References

Baldwin, Robert, and Martin Cave, Understanding Regulation: Theory, Strategy, and Practice, Oxford: Oxford University Press, 1999, Chapter 17.

Describes how to review prices under price cap regulation.

Booker, A. "Incentive Regulation in Water – Case Study," in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 68-74.

Describes the steps Ofwat took in its early price reviews.

Note: Green (1997) and the Green and Pardina (1999) are substitutable for each other.

Green, R., "Utility Regulation – A Critical Path for Revising Price Controls." Note no. 133 in Public Policy for the Private Sector. Washington, D.C.: World Bank Group, Nov. 1997.

States that the regulatory process needs to begin two years before the new control is due to come into effect. Explains that the review process includes: (1) Gathering and analyzing information on costs, investment plans, and demand forecasts; (2) Forecasting revenue requirements; (3) Choosing whether to use price caps or revenue caps; (4) Projecting revenue and cash flows using different price control parameters (such as the service baskets and the anticipated efficiency gains) to find a set of parameters that result in the appropriate cash flows; and (5) Making the announcement. Holds that the regulator should release information at several stages of the review process so that interested parties are kept informed. Suggests the following time table: (1) Request information (2 years ahead); (2) assess and amend information (18 months ahead); (3) determine form of control and rate of return (15 months ahead); (4) calculate revenue needs (1 year ahead); (5) select candidate price control and predict revenues, iterating until match revenue needs (1 year to 9 months ahead); (6) Propose price control (9 months ahead); (7) complete appeal process (3-9 months ahead); (8) implement price control (1 month ahead).

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999.

Identifies four stages a regulator should follow in resetting a price control, namely information gathering, analysis and decision-making, announcement (and possible appeal), and implementation. In this framework, the regulator would: (1) collect information from the firm, focusing on the future; (2) gather information and views from other interested parties; and (3) communicate with the firm and all interested parties throughout the process to increase the likelihood of acceptance of the final outcome of the review. Describes processes for analyzing financial information: (1) Firm projections about the future are compared

against independent evidence when possible, and the reported costs and investment plan should be evaluated to see if they are reasonable; (2) The amount of revenue necessary to cover costs is calculated and transformed into a price control given demand forecasts; (3) announce the new price control as soon as possible to allow the firm time to react and possibly appeal. Possible outcomes may be discussed during the review process, to hear reactions and allow the parties to become used to the proposals before they are finalized. The new price control may be integrated into the company's concession contract and enforced by the regulator. Examples of each of these stages are described for Argentina and the U.K.

Sectoral References

WATER

OFWAT, Ofwat Annual Report 2003-2004, 2004.

Outlines how Ofwat regulates prices and sets out plans for upcoming price review.

Key Words

Incentive regulation, Information, Regulation, Price, Price cap regulation, Benchmarking, Revenue caps, Price basket controls, RPI-X, Price review, Yardstick regulation, Service quality, Rate base

7. Establishing the duration of the price control

Core References

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 4.

Explains that in setting the duration of the price controls, a regulator must trade off the productive efficiency that increases with duration against allocative efficiency, which decreases with duration if prices become significantly higher than costs over time. That is to say, the regulator must weigh the increased incentives of long intervals against the risks that prices will get out of line with costs. Holds that during privatization, longer intervals may be beneficial since there may be considerable scope for efficiency gains. Suggests that including a provision in the price control that specifies when an early price review could take place might also be beneficial.

Sappington, David E.M., and Dennis L. Weisman, Designing Incentive Regulation for the Telecommunications Industry. Cambridge, MA: MIT Press, 1996, Chapter 3.

Examines the features and economic effects of various forms of regulation, including rate of return regulation, earnings-sharing plans, revenue-sharing plans, and price cap regulation. Considers how to establish the length of time for a price cap plan.

Key Words

Incentive regulation, Information, Price cap regulation, Benchmarking, Revenue caps, Price basket controls, RPI-X, Price review, Yardstick regulation, Service quality, Rate base

B. Price Regulation – main building blocks and process

1. Choice of price escalation indices

Core References

Bernstein, Jeffrey I. and David E. M. Sappington, “How to Determine the X in RPI - X Regulation: A User's Guide,” *Telecommunications Policy* 24(1): February 2000, pp. 63-68.

Explains that price cap regulation is intended to replicate the discipline of competitive market forces. Competitive forces compel firms to realize productivity gains and to pass these gains on to their customers in the form of lower prices, after accounting for unavoidable increases in input prices. Therefore, if all industries in an economy were competitive, output prices in the economy would grow at a rate equal to the difference between the growth rate of input prices and the rate of productivity growth.

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 4.

Explains that a regulator may choose to use a general consumer price index for familiarity purposes, although a producer price index may be a better proxy for prices faced by the firm. Further explains that the choice of a price index affects how one sets the X-factor. Using price inflation from the previous time period (preferably short in duration) in the

RPI – X formula has the advantage of not forcing the company to forecast inflation and thus reduces correction terms.

Sectoral References

TELECOMMUNICATIONS

ICT Regulation Toolkit. Washington, D.C.: infoDev and the International Telecommunications Union, 2007, Module 2.

State that frequently used criteria for choosing an inflation index include: a) reflectiveness of changes in the operator's costs; b) availability from a credible, published, independent source; c) availability on a timely basis; d) understandability; e) stability; and f) consistency with total factor productivity of the economy. Further state that potentially useful inflation measures include Gross Domestic Product (GDP) indices and Consumer Price Index (CPI) or the Retail Price Index (RPI) indices.

TRANSPORTATION

World Bank and Sub-Saharan Africa Transportation Project Africa Infrastructure Country Diagnostic: Stuck in Traffic: Urban Transport in Africa Working Paper number 44980, World Bank, Washington, D.C., 2008.

Summarizes recent research on urban transport in 14 large African cities. Provides a comprehensive overview of the state of urban transport in Africa, with a view to drawing out the main challenges facing the sector and illustrating the different ways in which these have been addressed

Key Words

Inflation, Price cap regulation, Incentives, Productivity, RPI-X regulation, Price index

2. Basics of financial modeling for price regulation

Core References

Armstrong, Mark, Simon Cowan, and John Vickers, Regulatory Reform: Economic Analysis and British Experience, Cambridge, MA: The MIT Press, 1999, Chapter 6.

Describes financial modeling for RPI-X regulation.

Estache, Antonio, Martín Rodríguez Pardina, José María Rodríguez, and Germán Sember, “An Introduction to Financial and Economic Modeling for Utility Regulators,” World Bank Policy Research Working Paper 3001, March 2003.

Describes basics of financial modeling for a price review. Considers regulatory objectives, regulatory instruments, cost of capital, inflation, and exchange rates. Describes how to perform net present value analysis.

Farrier Swier Consulting, “Comparison of Building Block and Index-based Approaches,” paper prepared for the Utility Regulators Forum, Australian Competition and Consumer Commission, 2002.

Examines price cap and revenue cap regulation in Australia, focusing on efficiency incentives, risk, robustness, transparency, simplicity, administration, and cost and availability of information required. Describes financial modeling in Australia and makes recommendations.

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapters 5, 8, and 9.

Describe the present value calculations used in U.K.-style price cap regulation to determine the amount of revenue required for cover the operator’s required cash flow and return on investment. States that present values can be estimated using a cost-based approach or an economic approach. Operating costs are forecasted for each year, as are revenues.

3. **Principles for determining the X-factor, including total factor productivity approach and earnings forecasting approach**
 - (a) **Demand and revenue forecasting**
 - (b) **Estimation and forecasting of costs**
 - (c) **Present value calculations: cost based versus value based**

Core References

Bernstein, Jeffrey I. and David E. M. Sappington, “How to Determine the X in RPI - X Regulation: A User's Guide,” *Telecommunications Policy* 24(1): February 2000, pp. 63-68.

Explains that if the regulated firm were just like the typical firm in a competitive economy, competition would limit the rate of growth of the firm's prices to the economy-wide rate of price inflation. As a result, the X-factor should reflect the extent to which: (1) the regulated firm is capable of increasing its productivity more rapidly than are other firms in

the economy; and (2) the prices of inputs employed by the regulated firm grow less rapidly than do the input prices faced by other firms in the economy.

Coelli, T. A. Estache, S. Perelman, and L. Trujillo, A Primer on Efficiency Measurement for Utilities and Transport Regulators. Washington, D.C.: World Bank Group, 2003.

Describes the tools used for measuring efficiency. Considers total factor productivity measures, frontier analysis, and data concerns. Describes how these measures are incorporated into X-factors.

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapters 5-8.

Holds that the regulator should construct a model to predict the company's revenues given a price control, using price elasticities of demand to predict how price changes will affect quantity demanded. Describes how the regulator can then transform a revenue requirement into a price control. Considers sales predictions, past and future projected operating costs, ongoing controllable costs, ongoing uncontrollable costs, one-off costs, role of benchmarking or yardstick competition, cost- and value-based approaches to present value calculations, cash-flow-based formula for present value calculations, and the timing of payments and receipts.

OFWAT, "Assessing Capital Values at the Periodic Review. A consultation paper on the framework for reflecting reasonable returns on capital in price limits." November 1992.

Describes how asset values affect price cap parameters.

Key Words

Price cap regulation, RPI-X regulation, Forecasting, Price review, Revenue, Pricing, Costs, Benchmarking

C. Revenue Caps

Core References

Alexander, Ian and Chris Shugart, "Risk, Volatility and Smoothing: Regulatory Options for Controlling Prices," 1999.

Examines price caps, revenue caps, and hybrids. Considers advantages and disadvantages, with particular attention to price volatility. Discusses options for addressing price volatility.

Green, R., "Has Price Cap Regulation of U.K. Utilities Been a Success?" Note no. 132 in Public Policy for the Private Sector. Washington, D.C.: World Bank Group, Nov. 1997.

Compares regulatory schemes for British Telecom, British Gas, U.K. water operators, and U.S. utilities. Examines regulatory discretion and adjustments.

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapter 4.

Discusses how regulators review price control methods in the context of a price review. Describes features and practices in revenue cap regulation.

Sectoral References

ELECTRICITY

Australian Competition and Consumer Commission, Decision: Statement of principles for the regulation of transmission revenues: Information requirements guidelines, 5 June 2002.

Details information filing requirements for electricity transmission operators. Describes information needs for revenue caps. Describes policies for information disclosure and future information policy issues.

Key Words

Revenue cap regulation, Inflation, Revenue, Costs

- D. Principles of using efficiency measures for yardstick regulation**
- 1. Performance measures for benchmarking, including efficiency, theft, and loss**
 - 2. Techniques for measuring efficiency and their properties, including frontier analysis, regression analysis, and virtual company approach**
 - 3. Issues in estimating benchmarks, including controlling for exchange rates and data quality and needs**
 - 4. Incorporation of efficiency parameters into price control formulas**
 - 5. Publication of benchmarking information**

Core References

Baldwin, Robert, and Martin Cave, Understanding Regulation: Theory, Strategy, and Practice, Oxford: Oxford University Press, 1999, Chapter 18.

Outlines how to assess operator efficiency using benchmarking and yardsticking. Provides examples from the U.K.

CEPA, “Background to Work on Assessing Efficiency for the 2005 Distribution Price Control Review: Scoping Study Final Report for Ofgem,” Cambridge Economic Policy Associates, September 2003.

Examines approaches for analyzing benchmarking data. Considers regression analysis, data envelope analysis, and corrected ordinary least squares, stochastic frontier analysis. Examines scale variables, cost drivers, the benchmark variable, and quality.

Coelli, Tim, Antonio Estache, Sergio Perelman, and Lourdes Trujillo, “A Primer on Efficiency Measurement for Utilities and Transport Regulators,” Washington, D.C.: The World Bank, 2003.

Describes the tools used for measuring efficiency. Considers total factor productivity measures, frontier analysis, and data concerns. Describes how these measures are incorporated into X-factors.

Coelli, Tim, and Denis Lawrence (ed.) Performance Measurement and Regulation of Network Utilities, Northampton, MA: Elgar, 2007.

Describes the tools used for measuring efficiency. Considers total factor productivity measures, frontier analysis, and data concerns. Describes how these measures are incorporated into X-factors.

Farrier Swier Consulting, “Comparison of Building Block and Index-based Approaches,” paper prepared for the Utility Regulators Forum, Australian Competition and Consumer Commission, 2002.

Examines price cap and revenue cap regulation in Australia, focusing on efficiency incentives, risk, robustness, transparency, simplicity, administration, and cost and availability of information required. Considers various methods for benchmarking utilities, including total factor productivity and data envelopment analysis.

Kingdom, Bill, Vijay Jagannathan, “Utility Benchmarking,” Note no. 229 in Viewpoint. Washington, D.C.: World Bank Group, March 2001.

Describes how some regulators routinely publish indicators of utility service performance in the local media and how this provides incentives for poorly performing operators to provide better services. Holds that this also shields regulators from political interference. Reviews requirements for effective benchmarking in the choice of indicators.

Sectoral References

ELECTRICITY

Domah, Preetum, “Technical Efficiency in Electricity Generation – The Impact of Smallness and Isolation of Island Economies,” Working Paper 0232 (CM14), Department of Applied Economics, University of Cambridge, U.K.

Conducts a comparative technical efficiency analysis of electricity generators in small island economies. Does not find significant differences between islands and non-islands electric utilities. Suggests that “benchmarking of small islands, using non-island generating utilities as comparators, is both feasible and desirable given the lack of historical generation data for most small islands.”

Estache, Antonio, Martin A. Rossi, and Christian A. Ruzzier, “The Case for International Coordination of Electricity Regulation: Evidence from the Measurement of Efficiency in South America.” World Bank Policy Research Working Paper 2907, Washington, D.C., October 2002.

States that monitoring performance of public and private monopolies in South America is difficult because operators control most of the needed information and do not provide it to regulators. Argues that Latin America’s electricity regulators should use benchmarking based on performance rankings using comparative efficiency measures. This approach has modest data requirements. Demonstrates how this could be done.

Meyrick Consulting, “Regulation of Electricity Lines Businesses: Analysis of Lines Business Performance – 1996–2003,” Report prepared for Commerce Commission, Wellington, New Zealand, 19 December 2003.

Examines use of benchmarking in establishing *X*-factor for electricity distribution company.

TELECOMMUNICATIONS

Sappington, David E.M., and Dennis L. Weisman, Designing Incentive Regulation for the Telecommunications Industry. Cambridge, MA: MIT Press, 1996, Chapter 5.

Examines how to structure and establish performance goals and incentives. Considers broad versus targeted benchmarks, determining the appropriate performance level, and four basic principles for performance incentives.

WATER

Gómez-Ibáñez, José, Regulating Infrastructure: Monopoly, Contracts, and Discretion. Cambridge, MA: Harvard University Press, 2003, Chapter 9.

Discusses price cap regulation for British water sector. Considers historical context, the design of the price capping system, privatization, the 1994 and 1999 price reviews, effects of weather, and appeals. Assesses strengths and weaknesses of the system.

Shirley, Mary M., and Claude Ménard. “Cities Awash: A Synthesis of the Country Cases,” in Thirsting for Efficiency, edited by Mary M. Shirley. Washington, D.C.: The World Bank, 2002, pp.1-41.

Discusses yardstick competition, monitoring, performance targets, assignment of risks and rewards, incentives in tariff policies, and the roles of regulatory, judicial, and political institutions.

Van den Berg, C., “Water Privatization and Regulation in England and Wales.” Note no. 115 in Public Policy for the Private Sector Washington, D.C.: World Bank Group, May 1997.

Examines England and Wales water sector privatizations. Discusses cost structures and how regulator uses yardstick regulation.

Other References

Estache, Antonio, and Eugene Kouassi, “Sector Organization, Governance, and the Inefficiency of African Water Utilities.” World Bank Policy Research Working Paper 2890, Washington, D.C., September 2002.

Using a benchmarking approach, analyzes the determinants of the efficiency levels of African water utilities.

Jamasb, Tooraj. Paul Nillesen, and Michael Pollitt, “Strategic Behaviour under Regulation Benchmarking.” Working Paper WP 0312, 2003, Department of Applied Economics, University of Cambridge, U.K.

Examines how electricity distribution companies regulated by benchmarking can engage in strategic behavior to increase profits without improving efficiency.

Key Words

Price cap regulation, Incentive regulation, Productivity, RPI-X regulation, Benchmarking, Costs, Competition, Comparative competition, Yardstick

E. Earnings and revenue sharing techniques

Core References

Green, Richard, and Martin Rodriguez Pardina, Resetting Price Controls for Privatized Utilities: A Manual for Regulators. Washington, D.C.: World Bank, 1999, Chapters 2 and 4.

Summarizes profit sharing regulation. Further discusses how regulators choose forms of incentive regulation in the context of a price review and provides an overview of the options.

Mayer, Colin and John Vickers, "Profit Sharing Regulation: An Economic Appraisal," Fiscal Studies, 17(2): 83-101, 1996.

Examines profit sharing regulation. Considers regulatory instability, regulatory lag, incentive power, measurement problems, and using cash- flow or cost rather than profit measures of performance.

Sappington, David E.M., and Dennis L. Weisman, Designing Incentive Regulation for the Telecommunications Industry. Cambridge, MA: MIT Press, 1996, Chapters 1 and 3.

Defines and explains the basics of incentive regulation. Examines the features and economic effects of various forms of regulation, including rate of return regulation, earnings-sharing plans, revenue-sharing plans, and price cap regulation.

World Bank, India Financing Highways Other Infrastructure Study, report number 30363, World Bank, Washington, D.C., 2004.

Report designed to provide information and advice to the Indian Union and States Governments on the principles and practicalities for establishing a sound and sustainable system of highway financing. Reviews the potential contribution of private sector finance to the sector and assesses the present use of

private finance and the alternative possibilities for utilizing the private sector in the financing and management of the network.

Other References

Sappington, David E.M., "Price Regulation," in Handbook of Telecommunications Economics, vol. 1, edited by Martin E. Cave, Sumit K. Majumdar, and Ingo Vogelsang. Amsterdam: North-Holland, 2002, pp. 227-293.

Describes and gives examples of banded rate of return regulation, earnings sharing regulation, and revenue sharing regulation. Charts illustrate the sharing options and the incentive properties.

Key Words

Incentive regulation, Information, Earnings, Revenue, Sharing