

ANNOTATED READING LIST FOR A BODY OF KNOWLEDGE ON INFRASTRUCTURE REGULATION

Developed for The World Bank by:

Mark A. Jamison
Sanford V. Berg
Public Utility Research Center
University of Florida

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.



Chapter V. Tariff Design

Introduction

Tariff design or rate design refers to the relationships among the individual prices the operator charges.¹ Tariff design is different from most other regulatory issues in that it is one topic area where the interests of the operator and the interests of the government often coincide. This chapter describes situations where this is likely to hold so that the government can do no better than to permit the operator to choose its own tariff design. Also noted are situations where regulation of tariff design might be desirable. Various tariff design options and their properties are then examined, followed by pricing for the poor,² pricing in competitive situations,³ and demand forecasting.⁴ Following this chapter's narrative is a list of references, organized by topic.

Economics of Tariff Design

1. Government and Operator Objectives

Before identifying situations in which tariff design should be left to the operator, it is important to examine the objectives of the operator and the objectives of the government. Here, it is assumed that the operator wants to maximize profit⁵ and that the government's interest in tariff design is to maximize welfare and provide affordable service to the poor. Welfare is the difference between the value that customers place on the service and what it costs to provide the service.⁶ The operator and the government also have an interest in maintaining a stable political environment, but they may disagree on the role of regulation in that environment. As a result, the operator and government may disagree on issues such as service to the poor, which are generally viewed more as social policies than as economic policies. The operator and the government may also disagree on price discrimination, the situation where different customers pay different prices even though the costs of serving these customers are the same. The operator may find that some forms of price discrimination increase profit. However, customers generally do not like price discrimination on grounds of fairness, so the government may want to limit what is generally called undue price discrimination.

¹ Chapter IV examines how to set the overall price level.

² Chapter VI Section C also covers issues of service to the poor.

³ Chapter II Section B examines other issues related to competition in the market.

⁴ Chapter III Section C also examines issues related to demand forecasting.

⁵ Chapter III Sections C and F describe how to measure profits.

⁶ Welfare includes both the net benefits to customers and the net benefit to the operator that come from the service being provided and used. The net benefit to customers is called net consumer surplus and is the difference between the value that customers place on the service – more specifically, the area under the customer demand curve – and what customers pay for the service. The net benefit to the operator is called profit and is the difference between the revenue the operator receives and the costs the operator incurs. Sometimes the government may value net consumer surplus more or less than it values profits, in which case welfare is a weighted sum of net consumer surplus and profit. Welfare is generally maximized when prices equal their respective marginal costs. Marginal cost includes the all of the extra costs that the operator incurs when it increases output by one unit. If the system is capacity constrained, meaning that capacity cannot be increased, marginal cost would also include the marginal congestion cost.

To maximize profit, the operator seeks prices that equate marginal revenue and marginal cost, which, properly estimated, consider the need for a politically sustainable business and regulatory environment.⁷ Marginal revenue is the extra revenue the operator receives when it increases output by one unit. Once marginal revenue and marginal cost are equal, any change in output decreases profit, so the operator is making as much profit as it can on the service in question.

When markets are perfectly competitive, marginal revenue is equal to the market price. As a result, the profit-maximizing operator in a competitive environment will charge prices that are equal to marginal cost. Marginal cost pricing also maximizes welfare, so the interests of the operator and the interests of the government coincide when markets are highly competitive.

2. Deviations from Marginal Cost Pricing: Ramsey Pricing⁸

When the operator has market power,⁹ its profit-maximizing prices will exceed their marginal costs in most situations.¹⁰ This causes a loss in welfare relative to the perfectly competitive situation, so the government has an interest in lowering prices to their respective marginal costs. However, as noted in Chapter II on Market Structure and Competition, marginal-cost pricing may not be financially feasible for the operator because of scale economies, fixed costs, or joint and common costs.¹¹ When this is the case, the profit maximizing price structure for the monopoly operator is one that causes the quantities that customers want to purchase to deviate as little as possible from what customers would purchase with marginal-cost pricing. This system of pricing, called Ramsey Pricing or the inverse elasticity rule, raises individual prices above marginal cost in according to each service's price elasticity of demand.¹² Mark-ups above marginal cost are lower for services with more elastic demand, and conversely mark-ups are greater for services with more inelastic demand.¹³

Ramsey pricing is sometimes consistent with the government's objectives because Ramsey pricing is economically efficient in the sense that can maximize welfare under certain circumstances. There are, however, problems with Ramsey pricing. A profit-maximizing operator

⁷ Sections A and B provide information on economics of pricing.

⁸ See Sections A and B.

⁹ Chapter II Section A provides information on market power.

¹⁰ Exceptions might include situations where the sales of one product stimulate the sales of another product. For example, shortly after the development of telephone service in the U.S., AT&T chose to price residential service below marginal cost in order to stimulate sales of business service, which could be priced above marginal cost.

¹¹ Joint costs are costs that, once incurred, produce two or more services in fixed proportions. Joint costs are efficiently recovered by using Ramsey pricing. Common costs are costs that are incurred to produce one service and that do not have to be incurred again to produce one or more additional services. Most regulators use some form of cost distribution to deal with common costs. Ramsey prices are also efficient for recovering common costs. Section D provides further information on this topic.

¹² See Sections A and B.

¹³ The greater the elasticity of demand, expressed as a positive number, the more customers change the quantities they purchase in response to a change in price. If customers change the quantities they purchase by more than 1 percent in response to a 1 percent change in price, then demand is elastic and the elasticity of demand is greater than 1 when expressed as a positive number. Demand is inelastic if customers change their purchases by less than 1 percent in response to a 1 percent change in price and the elasticity of demand is less than 1 when expressed as a positive number. An elasticity of demand equal to 1 is called *unitary elasticity of demand*.

will choose Ramsey prices only if all markets are equally monopolistic or equally competitive. If markets are not equally monopolistic or competitive, then the regulator has an interest in taking steps to ensure that the extent to which the operator can use Ramsey pricing is limited to groups of services that are subject to similar degrees of competition. Regulators typically do this by forming baskets of services that are subject to similar degrees of competition and allowing the operator price flexibility within each service basket. Chapter IV on Regulating the Overall Price Level describes how service baskets are used in incentive regulation.

Even though Ramsey pricing can be economically efficient, it may not be consistent with the government's goal of providing affordable service to the poor and the rate by which prices change to achieve Ramsey-efficient prices may not be consistent with political sustainability. As a result of these two concerns, the regulator sometimes limits the operator's ability to pursue Ramsey pricing within a service basket. In the case of services to the poor, the regulator may place upper limits on the prices. In the case of services where traditional prices were different from Ramsey prices, there are equity issues in changing from the traditional pricing structure to a new structure, even if the new structure would be more efficient in an aggregate sense. In such situations, the regulator may impose pricing restrictions that prevent Ramsey pricing or that impose a slower transition to Ramsey pricing than the operator would choose left to its own devices.¹⁴

Lastly, regulators often note that Ramsey pricing is a form of price discrimination -- although not necessarily a bad form of price discrimination -- and customers sometimes object to it on that basis. The public sometimes believes that it is unfair to cause one type of customer to pay a higher mark-up above marginal cost than another type of customer. In such situations regulators may further limit an operator's ability to adopt Ramsey prices.

3. Deviations from Marginal Cost Pricing: Multipart Prices¹⁵

In addition to Ramsey pricing, the operator also generally finds that multi-part tariffs are more profitable than linear tariffs. A multi-part tariff is one in which the operator charges separate prices for different elements of the service. A linear tariff is one in which the operator charges a single price for the service. A common multi-part tariff is the two-part tariff in electricity, under which the customer pays a monthly fee for access and a usage fee for consumption of electricity. With this two-part tariff, the operator is able to charge a price equal to marginal cost for electricity, which is profit maximizing, and deviate from marginal cost pricing in the fee for access. A common linear tariff is flat-rate telephone service, under which the customer pays a single monthly price that includes both access and usage.

¹⁴ Chapter IV Section B provides further information on price constraints within service baskets.

¹⁵ See Sections A and B.

4. Price Discrimination¹⁶

Ramsey pricing is an example of price discrimination. In many situations, price discrimination is efficient in that the differences in prices allow customers to buy more of the service. It does, however, appear unfair to some customers, which can make price discrimination difficult politically. This is a situation where the interests of the government and the operator may be different. As a result, it is often the regulator's job to understand when some amount of efficiency must be traded for political stability or other considerations. There is a danger, though, that the government may go too far in this tradeoff. In telecommunications, for example, many governments put off the political pain of price rebalancing so long that sector development was delayed and difficult transitions had to be made quickly. Price rebalancing is the process of aligning prices closer to their underlying costs. This topic is described in more detail in Section D.

5. Optional Tariffs¹⁷

The optional tariff is closely related to the multi-part tariff. Under optional tariffs, the operator offers the customer a menu of pricing plans.¹⁸ The customer chooses the pricing plan that best fits the customer's consumption preferences and pays according to that plan. If properly designed, the optional tariff scheme is profit maximizing for the operator and makes customers better off. Most optional tariffs include multi-part pricing.

Fortunately, multipart tariffs and optional tariffs are situations where the operator's interests and the government's interest often coincide. Multipart tariffs provide greater welfare than linear tariffs when the linear price does not equal marginal cost. Optional tariffs make customers better off than single tariffs because customers can choose the tariff that best meets their needs.

6. Non-linear Prices¹⁹

Another approach to economic pricing is non-linear pricing. Non-linear prices are prices that vary depending on the amount of consumption by the customer. An example might be a water tariff, which has higher per gallon or per liter prices for higher levels of consumption than for lower levels of consumption. Non-linear prices are like multipart prices in that they allow the operator to charge prices at the margin that reflect marginal cost, while using the inframarginal prices to manage earnings. Inframarginal prices are the prices charged for units that are not at the margin. For example, if a consumer purchases 1000 liters of water, the price paid for the 1000th unit is the marginal price and the prices charged for the other 999 liters are the inframarginal prices. Non-linear prices may be used in conjunction with multipart tariffs. Non-linear prices

¹⁶ See Sections A, B and E.

¹⁷ See Sections A and B.

¹⁸ The economics of offering a customer a menu of tariffs is related to the economics of offering an operator a menu of incentive regulation plans. Readers interested in the underlying economics could read more technical economics texts on these issues, such as Laffont, Jean-Jacques, and Jean Tirole, A Theory of Incentives in Procurement and Regulation, Cambridge, Massachusetts: The MIT Press, 1993.

¹⁹ See Sections A and B.

represent another situation where the interest of the operator and the interest of the government coincide.

7. Peak-load Pricing²⁰

Peak-load pricing is another pricing variation where the operator and government interests coincide. Peak-load pricing is useful when marginal costs vary depending on when the service is used. For example, the telecommunications operator builds his network with the capacity to serve the peak demand, which generally occurs during business hours. As a result, network costs are caused by peak demand and not demand during off-peak hours. To facilitate marginal cost pricing, the operator would maximize profit by charging higher prices during peak hours and lower prices during off-peak hours. The prices at the peak reflect the marginal costs of capacity and the lower-off peak prices reflect only the marginal costs of off-peak usage, which are generally close to zero in telecommunications.

Peak-load pricing requires sophisticated measurement of customer usage. This is rarely a problem in telecommunications, but requires advanced metering technologies in energy and water. As a result, the cost of implementing these advanced measurement technologies must be weighed against the welfare gains of metering. This is a situation where the operator and government may disagree. The operator benefits from advanced metering only to the extent that the metering increases profits. The government is also interested in how the metering benefits customers, so the government may have a stronger desire for advanced metering than does the operator.

8. Summary

In summary, several situations have been identified where the operator's preferences and the government's preferences coincide with respect to tariff design. These include pricing in a competitive environment, Ramsey pricing for services that are subject to similar competitive pressures, multipart prices, optional tariffs, and non-linear tariffs. With respect to these if the interests of the government and the operator are in alignment, the government can do no better than to let the operator use its superior knowledge of its abilities and of the market to choose efficient pricing arrangements. Situations where it may be beneficial for the government to intervene in pricing also have been identified. These situations include pricing for the poor, controlling undue price discrimination, tariff design for services that are subject to different levels of competitive pressure, and the speed of transition to efficient pricing. Access prices charged to rivals are not noted in this chapter. Chapter II on Market Structure and Competition covers access prices.

Finally, it is important to review the cost basis for pricing. Most of the price issues noted above relate prices to marginal cost and demand. Marginal cost is an economic concept, so to the extent that regulators need cost information for efficiency purposes, the regulator needs information on economic costs.²¹ Another approach to measuring costs – called fully distributed

²⁰ See Sections A and B.

²¹ Regulators use current cost asset valuation when estimating economic costs. Chapter III Sections C and F review asset valuation.

costs – is also used in regulation, but primarily in situations where the regulator wants to limit the earnings of the operator for a specific set of services. This is called accounting separations and is described in Chapter III Section E.

Pricing for the Poor²²

Special pricing and service arrangements for the poor are frequently developed in countries where the poor cannot afford the services purchased by the general public. The keys to these arrangements appear to be to balance quality, price levels, and payment schemes so that the needs of the poor can be met. This section examines pricing and payment scheme issues. Quality issues for the poor are addressed in Chapter VI on Quality, Social, and Environment Issues.

Both price level and payment scheme are important for making services affordable for the poor. Sometimes customers can afford cost-based usage fees by managing their usage, but not cost-based initial connection fees. In these situations, it may be optimal for the operator to provide customers with the option of paying their connection fee over time, perhaps through usage fees. Customers may also prefer prepaid service, which allows customers to use only what they can afford and allows service for customers who cannot establish credit and who may be difficult to bill. Prepaid mobile service is an example of a situation where an innovative payment scheme made service affordable for the poor. The poor in many countries could not afford monthly fees for mobile service, could not establish credit for post-paid pricing schemes, and did not have mailing addresses where they could receive their bills. Operators developed prepaid cards, which made it easier for poor customers to obtain service and manage their bills. The ease of collecting from poor customers using prepaid cards actually lowered the cost of serving the poor, which made serving the poor profitable for operators.²³ In certain situations, it may also be possible to give customers a menu of options that provide various combinations of price and quality.

There are situations, however, where price level is a hurdle because overall costs of providing any level of service are high relative to what customers can afford. Consider for example the case of electricity distribution. The fixed costs that are currently inherent in the provision of the electricity grid are sufficiently high to make extension of the grid into poor, rural areas commercially infeasible. As a result, extensions of the grid to these people must be subsidized if the grid is to be commercially viable.²⁴ In these situations, it may be necessary to provide subsidies to ensure affordable prices for the poor.

There is growing consensus, however, that subsidies should be avoided if possible. Research has shown that the poor rarely benefit from broadly based subsidy schemes. For example, subsidies directed at public water companies have often benefited the middle class rather than the poor, who often receive their water from sources other than the formal water utility. Some regulators have attempted to solve this problem by developing targeted, direct

²² See Section E.

²³ The authors thank Vice Chairman/Chief Executive Officer of Teledom, Dr. Emmanuel Ekuwem, of the Nigerian Communications Commission for this insight.

²⁴ In some countries where grid expansion is prohibitively expensive, policy makers and regulators opt to have electricity provided off grid.

subsidies to customers, which have the advantages of being transparent and explicit, and minimize distortions in the behavior of water utilities and their customers. The main drawbacks are high administrative costs and the difficulty of designing suitable eligibility criteria.

It is also possible to make a case that subsidy schemes should have sunset provisions, be separately funded from the regulatory system, and be administered by an agency separate from the regulatory agency. Subsidy schemes can be difficult to bring to end, even after they have exhausted their usefulness, because interest groups can form to advocate the continuation of the subsidies and even find new uses for them, implying that subsidies might be subject to mission creep. Sunset provisions could decrease the influence of such interest groups by triggering a formal review of the subsidies. Furthermore management of the scheme by the infrastructure regulator might inappropriately lead the subsidy to focus on regulated services. For example electricity subsidies administered by a regulator have focused on grid electricity in some countries even though electricity by solar power might have been more cost effective for some customers.

Development of subsidies for service to the poor involves determining the amount of subsidy and funding the subsidy. Recently countries have had success with auctions to determine the amount of subsidy. One of the first successful examples of the use of auctions was with Chile, which auctioned subsidies for telecommunications projects in rural areas. Funding of below-cost prices can be done through concession bidding and external subsidies. Concession and licensing fees can provide funding for subsidies, or a requirement for internal funding of subsidized service can be built into the concession contract. In such situations, the operator either funds the subsidy by embedding cross subsidies in his price structure or he funds the subsidy by lowering what he is willing to pay for the concession contract. Sometimes regulators collect subsidy funds through percentage fees against operator turnover or revenue.

Experience has shown that subsidy schemes designed to benefit the poor can continue beyond their usefulness, perhaps because policy makers neglect to re-evaluate the schemes, the needs of the poor change, or non-poor stakeholders benefit from the subsidy process and so advocate its continuation. These possibilities point to the need to evaluate subsidy schemes on a regular basis. Evaluation criteria include how well the poor are reached, the share of the subsidy that goes to the poor, the predictability of the benefit for the poor, the extent and significance of unintended side effects, and administrative cost and difficulty.

Pricing in Competitive or Partially Competitive Environments²⁵

In most countries, utility service prices prior to market reforms were based on political considerations and not on underlying costs. Examples include subsidized electricity prices and high international telecommunications prices used to subsidize other services, fund the country's treasury, or provide hard currency to the government. Politically-based prices are unsustainable when competition is allowed because entrants target the subsidy-providing customers and subsidized markets are ignored. As a result, there is often a need to rebalance prices when markets are open to competition. Rebalancing means that prices are aligned closer to their

²⁵ See Section E. Chapter II reviews competition.

marginal costs. Rebalancing prices can adversely affect some customers, so regulators need to consider whether these effects make certain aspects of rebalancing unsustainable politically and whether certain aspects of the rebalancing conflict with regulatory objectives.

Price flexibility, forbearance, and deregulation are also important when there is competition. If market forces are to work, operators need the ability to respond to market changes, expect extra profits when they make good decisions in the marketplace, and experiment with ideas. If regulators are reluctant to deregulate prices in competitive markets but nonetheless want to allow the operator to respond to competitive pressure, they will sometimes use forms of price regulation for those markets to allow price flexibility. Examples of approaches include establishing a service basket²⁶ for nearly competitive services, establishing price floors based on incremental cost or imputation, and banded prices. Imputation is used in instances where the operator provides an essential facility²⁷ that its rivals need in order to compete in the nearly competitive market. Imputation is a process that in effect requires the operator to reflect in its competitive prices the price it charges its rivals for using the essential facility. Banded prices are simply upper and lower bounds, between which the operator can change prices as it wishes. The lower band is typically based on incremental cost.

Regulators or policy makers often adopt policies of forbearance or deregulation when competition is sufficient to constrain operators' abilities to raise prices enough to receive economic profits.²⁸ Forbearance is generally the situation where the regulatory has authority to regulate prices but chooses to not do so. Deregulation is generally the situation where the regulator lacks the authority to regulate prices.

The regulator might also be concerned about protecting customers of non-competitive services from providing cross-subsidies to the operator's competitive operations. The regulator might address this problem with ring fencing, the price floors described above, or with pure price cap regulation for the non-competitive services.²⁹

Demand Forecasting³⁰

Demand forecasts are used for setting price controls for energy and water and could be used in telecommunications. Several methods of demand forecasting are available. Trend analysis expresses demand largely as a function of time. There is general consensus that trend analysis is too simplistic for most countries. End-use method develops demand projects by examining the number of devices in households and businesses that use the utility service. For example, an energy demand forecast would consider the number of household appliances that use energy and the amount of energy that each appliance is expected to use. The econometric approach uses statistical analyses to forecast demand based on household income levels, use-intensive industries, and prices, to name a few of the possible variables. Time-series methods are similar to

²⁶ Chapter IV Section B describes service baskets.

²⁷ See Chapter II Section B for more information about essential facilities.

²⁸ Chapter II Section A notes assessing market power.

²⁹ Chapter IV Sections A and B describe pure price cap regulation.

³⁰ See Section F.

the econometric approach, but incorporate the effects that one time period has on subsequent time periods. Hybrid approaches are also used.

Concluding Observations

As explained above, tariff design is an area where the interests of the government and the interests of the operator may coincide. As a result, the government can effectively deregulate tariff design in many instances. This is also true, but to a lesser extent, for service quality and social issues. These topics are covered in Chapter VI.

Case Studies

Foster, V., A. Gómez-Lobo, and J. Halpern, “Designing Direct Subsidies for the Poor – A Water and Sanitation Case Study,” Note No. 211 in Public Policy for the Private Sector. Washington, D.C.: World Bank Group, June 2000.

Garg, A., M. Kabra, and R. Kacker, Regulatory Reforms in India: Effectiveness, Efficiency, and Impacts, The Energy and Resources Institute, New Delhi, India, 2003.

GeoEconomics Associates Inc., Economic Principles and Concepts as Applied to Municipal Water Utilities, Final Report to the Ontario Superbuild Corporation (project number SSB-018197), 2002.

IRG Regulatory Accounting Working Group, “Regulatory Accounting in Practice: A Report prepared by the IRG Regulatory Accounting Working Group,” April 2006.

Maryland Power Plant Research Program, “Maryland Power Plants and the Environment: A review of the impacts of power plants and transmission lines on Maryland’s natural resources,” December 2003, Appendix C: State-Wide Forecast of Electricity Consumption and Peak Demands in Maryland.

NERA, “Electricity Tariff Structure Review: Alternative Tariff Structures: A Consultation Paper,” CER/04/239, July 1, 2004.

NERA, “Marginal Cost of Electricity Service Study,” CER/04/240, July 1, 2004.

OFWAT Final Determinations. Future Water and Sewerage Charges 2000-05: Periodic Review 1999. November 1999.

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

Rohlf, Jeffrey H. and Arturo Briceño, “Rate Rebalancing and Competition in Peruvian Telecommunications,” Prepared for presentation at the International Telecommunications Society meetings held in Stockholm, Sweden, June 1998.

Romanian National Regulatory Authority for Communications, Decision for Approving the Regulation for the Realization of the Top-down Long Run Incremental Costing Model by Mobifon S.A., 18 December 2003.

Ros, A., and A. Banerjee, "Telecommunications Privatization and Tariff Rebalancing: Evidence from Latin America," *Telecommunications Policy* 24(3): 2000, pp. 233-52.

World Energy Council, "Pricing Energy in Developing Countries," June 2001.

Table 5. Chapter V Cases by Topic Area

	Cases												
	Foster, Gómez-Lobo, and Halpern, June 2000.	Garg, Kabra, and Kacker, 2003.	GeoEconomics Associates Inc., 2002.	IRG Regulatory Accounting Working Group, 2006	Maryland Power Plant Research Program, December 2003.	National Economic Research Associates, July 1, 2004(a).	National Economic Research Associates, July 1, 2004(b).	OFWAT, November 1999.	OFWAT, March 2003.	Rohlfs and Briceño, June 1998.	Romanian National Regulatory Authority for Communications, 18 December 2003.	Ros and Banerjee, 2000.	World Energy Council, June 2001.
Chapter V. Tariff Design													
A. Principles, Options, and Considerations in Rate Design		X	X			X	X	X	X		X		X
B. Economics of Alternative Price Structures			X			X	X	X	X	X			
C. Pricing for the Poor	X	X											X
D. Effects of Joint and Common Costs on Pricing			X			X	X	X	X		X		X
E. Effects of Competition		X		X						X		X	
F. Demand Forecasting			X		X								

References

A. Principles, options and considerations in rate design, including conditions for deciding when tariff design is a regulatory concern

Core References

Baldwin, Robert, and Martin Cave, Understanding Regulation: Theory, Strategy, and Practice, Oxford: Oxford University Press, 1999, Chapter 15.

Provides an overview of pricing issues for regulating monopolies. Considers multipart tariffs, Ramsey pricing, and problems of cost recovery.

Berg, S., “Basics of Rate Design – Pricing Principles and Self-Selecting Two-Part Tariffs,” in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 74-90.

Explains that two-part pricing and Ramsey pricing represent innovative ways to recover joint costs. Defines each and explains how Ramsey pricing improves efficiency.

Kahn, Alfred. The Economics of Regulation: Principles and Institutions. Cambridge, MA: MIT Press, 1988, Reissue Edition, vol. I, Chapters 2-7.

Describes pricing issues in utility regulation, giving practical examples and explaining the underlying economics. Considers asset valuation, marginal cost pricing, peak load pricing, short-run and long-run marginal costs, effects of scale economies, externalities, Ramsey pricing, fully distributed costs, and effects of competition.

Sectoral References

ELECTRICITY

Green, R., “Electricity Transmission Pricing: An International Comparison,” *Utilities Policy* 6: 1999, pp. 177-184.

Argues that in the case of electricity transmission, prices that closely reflect costs are constrained by the complexity of costs and hurdles to political implementation. Outlines six principles for transmission pricing to be short- and long-term efficient, and politically feasible. These criteria are reviewed using examples from eight studies of transmission pricing systems.

GAS

Okogu, B., "Issues in Global Natural Gas: A Primer and Analysis," International Monetary Fund Working Paper no. 02/40, 2002.

Gives an outlook of the natural gas industry and its evolution in the recent decades. Describes the structure of the industry and points to factors that may constrain its further development. Deals with the contracting process and its implications on the structure of the gas price. Both gas pricing and demand drivers are analyzed using evidence from the literature. Proposes a set of solutions to improve the efficiency of the pricing mechanisms in the natural gas industry.

TELECOMMUNICATIONS

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

Provides a practical overview of telecommunications pricing issues and regulatory approaches.

Mitomo, H., "The Political Economy of Pricing: Comparing the Efficiency Impacts of Flat Rate vs. Two-Part Tariffs," *Communications and Strategies* 44: 2001, pp. 55-70.

Following the popularity of flat rates, in particular, in Internet, this paper compares its efficiency to that of another pricing scheme, namely, two-part tariffs. Shows by means of simulations that a change from two-part tariffs to flat rates has negative implications for supplier's efficiency or profitability. Raises some questions about the economic principles lying behind the choice of flat rates.

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.

CPCS Transcom, Urban Bus Toolkit: Tools and Options for Reforming Urban Bus Systems Public-Private Infrastructure Advisory Facility, World Bank.

Provides guide to evaluating existing and alternative urban bus systems in developing and transitional countries. Offers practical advice to enact fundamental system reforms.

WATER

Dinar, A., ed. The Political Economy of Water Pricing Reforms. Oxford, U.K.: Oxford University Press for the World Bank, 2000.

Collects eighteen papers that seek to incorporate political economy concepts in the analysis of reforms in water-pricing schemes. The papers cover such important issues as the impact of market structure and property rights on pricing regimes, the difficulties in regulating the water industry through pricing, and the importance of involving the public in rate design. The collection also includes papers that give a wide empirical overview of price reforms in this sector.

GeoEconomics Associates Inc., Economic Principles and Concepts as Applied to Municipal Water Utilities, Final Report to the Ontario Superbuild Corporation (project number SSB-018197), 2002.

Presents some economic principles and concepts that are applicable to municipal water servicing. Sketches the essential aspects of markets for water services. Then outlines the theory of water pricing and suggests alternative organizational, ownership and management arrangements for municipal water utilities. Applies the above principles and concepts to the Ontario's water servicing market.

OFWAT Final Determinations. Future Water and Sewerage Charges 2000-05: Periodic Review 1999. November 1999.

Describes customer priorities in U.K., profiles customer bills, describes prices' affects on bills and profitability, and profiles charges.

Groom, Eric, Jonathan Halpern, and David Ehrhardt, [Explanatory Notes on Key Topics in the Regulation of Water and Sanitation Services](#) (1.06mb pdf). June 2006. *Water Supply and Sanitation Sector Board Discussion Paper Series*, Paper No. 6.

Provides an integrated view of regulatory functions and the principles and practice underlying the design of regulatory systems in the water supply and sanitation (WSS)sector. Additionally, it provides a brief analysis of consistent approaches to resetting tariffs for WSS services.

Other References

Berg, S., and J. Tschirhart, Natural Monopoly Regulation: Principles and Practice. Cambridge Surveys of Economic Literature Series, Cambridge University Press, 1988.

Provides a technical economic description of pricing issues.

Faruqui, A., and K. Eakin, eds. Pricing in Competitive Electricity Markets. Boston: Kluwer, 2000.

Provides technical analyses of various pricing issues in electricity, including consumer responses, effects of market design, risk management, and energy derivatives.

Key Words

Efficiency, Price structure, Rate structure, Marginal cost pricing, Marginal cost, Multi-part tariffs, Ramsey pricing, Two-part tariffs, Externalities, Class cost of service, Objectives

B. Economics of alternative price structures (linear and non-linear rates, peak-load pricing, multi-part tariff, price discrimination, etc.)

Core References

Berg, S., “Basics of Rate Design – Pricing Principles and Self-Selecting Two-Part Tariffs,” in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 74-90.

Explains that multipart pricing enables the supplier to create win-win options — bringing the marginal price down to incremental cost, while recovering current capacity costs via fixed monthly fees. Further explains that incremental cost pricing promotes the efficient use of society’s resources, and price options enable the supplier to extract more consumer surplus than under uniform pricing. Further explains Ramsey pricing and its efficiency aspects.

Kahn, Alfred. The Economics of Regulation: Principles and Institutions. Cambridge, MA: MIT Press, 1988, Reissue Edition, vol. I, Chapters 3-7, vol. II, Chapter 5.

Describes pricing issues in utility regulation, giving practical examples and explaining the underlying economics. Explains economic efficiency in the context of pricing. Considers marginal cost pricing, peak load pricing, short-run

and long-run marginal costs, effects of scale economies, externalities, Ramsey pricing, fully distributed costs, effects of competition, cream-skimming, and price discrimination.

Sectoral References

ELECTRICITY

Borenstein, S., M. Jaske, and A. Rosenfeld, “Dynamic Pricing, Advanced Metering, and Demand Response in Electricity Markets,” CSEM Working Papers, CSEMWP-105, University of California at Berkeley, 2002.

Discusses the possibility of enhancing the participation of the demand side in electricity markets through dynamic pricing, which could help balance supply and demand. Provides an overview of the theory and practice of the different approaches used to achieve such an objective and concludes by suggesting a wider use of dynamic retail pricing. Argues that this measure would allow end-user prices to reflect changes in wholesale prices and the gap between supply and demand.

Viscusi, W. Kip, John M. Vernon, and Joseph E. Harrington, Jr., Economics of Regulation and Antitrust. Cambridge, MA: MIT Press, 2000, Chapter 12.

Discusses the economics of price structures, including fully distributed cost, price discrimination, and peak-load pricing.

World Energy Council, “Pricing Energy in Developing Countries,” June 2001.

Examines historical cost recovery, marginal costs, opportunity costs, market-based pricing, subsidies, pricing for industrial customers, and special problems in a developing country context.

GAS

OECD/IEA, Natural Gas Pricing in Competitive Markets. Washington, D.C.: Organization for Economic Cooperation and Development, 1998.

Describes the process of introducing competition in the natural gas industry. Analyzes the main economic principles that apply to contracting and pricing mechanisms in a competitive framework. Surveys the reform experiences in the U.S., Canada, and the U.K., and discusses their applicability to other countries, particularly in continental Europe.

TELECOMMUNICATIONS

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

Provides a practical overview of telecommunications pricing issues and regulatory approaches.

Romanian National Regulatory Authority for Communications, Decision for Approving the Regulation for the Realization of the Top-down Long Run Incremental Costing Model by Mobifon S.A., 18 December 2003.

Describes the economics of estimating incremental costs in telecommunications in compliance with European Union directives.

Romanian National Regulatory Authority for Communications, Decision for Approving the Regulation for the Realization of the Top-down Long Run Incremental Costing Model by Romtelecom S.A., 18 December 2003.

Describes the economics of estimating incremental costs in telecommunications in compliance with European Union directives.

TRANSPORTATION

Button, Kenneth J. *Transport Economics*. 2nd Edition. Brookfield, Vermont: Edward Elgar Publishing Company, 1993.

Provides an extensive discussion on the pricing of transport services, including peak-load pricing, Ramsey pricing and price discrimination and backhaul pricing in transportation.

WATER

Hall, D., ed., Marginal Cost Rate Design and Wholesale Water Markets: Advances in the Economics of Environmental Resources, vol. 1. Greenwich, CT: JAI Press, 1996.

Collects eleven papers analyzing the political economy of water and evaluating the success of emerging wholesale water markets and retail marginal cost pricing. Provides a methodology for the calculation of marginal cost for water rates, and applies it to the design of urban water rates. Surveys various case studies in which such policies have been implemented and discusses the importance of water markets as a mechanism to address water scarcity.

Komives, Kristin, and Penelope J. Brook Cowen, “Expanding Water and Sanitation Services to Low-Income Households.” Note no. 178 in Public Policy for the Private Sector. Washington, D.C.: World Bank Group, 1998.

Explains that if service expansion is to be sustainable, a concessionaire must be able to recover its costs. Three potential disconnects between the tariff structure and the regulatory objectives include water usage being below costs for low-consumption customers, a household with a water connection but no sewer connection, and the maximum connection fees not reflecting the true cost of connection.

Key Words

Price structure, Peak-load pricing, Efficiency, Marginal cost pricing, Marginal cost, Multi-part tariffs, Ramsey pricing, Two-part tariffs, Fairness, Social policy, Distributional justice, Externalities, Contract regulation, Franchising, Service continuity, Service availability, Performance standards, Objectives

C. Pricing for the poor

[NOTE: Readers should cross-reference this section with Chapter VI Section C.]

Core References

Ehrhardt, David, “Impact of Market Structure on Service Options for the Poor,” Presented at Infrastructure for Development: Private Solutions and the Poor, 31 May - 2 June 2000 | London, UK.

Discusses market structure options for utility reforms, with special attention to impacts on the poor. Considers entrants versus formal providers, price and quality options, payment mechanisms, subsidies, and regulatory process.

Foster, V., A. Gómez-Lobo, and J. Halpern, “Designing Direct Subsidies for the Poor – A Water and Sanitation Case Study,” Note No. 211 in Public Policy for the Private Sector. Washington, D.C.: World Bank Group, June 2000.

Describes direct subsidies for making infrastructure services more affordable to the poor. Considers how governments pay part of the water bill of poor households that meet certain eligibility criteria. Describes case of Chile and illustrates how simulation techniques can be used to improve the effectiveness of such programs.

The World Bank, New Designs for Water and Sanitation Transactions Making Private Sector Participation Work for the Poor, Washington, D.C.: The World Bank (undated).

Discusses the importance of considering the poor in water reforms. Examines various elements of water reforms, including tariff reform, governance, and management changes. Discusses legal issues for helping the poor, including the regulatory framework, using competition, private sector involvement, and methods for addressing legal issues.

Sectoral References

TRANSPORTATION

Arnott, Richard, 1996. "Taxi Travel Should Be Subsidized" *Journal of Urban Economics*, Elsevier, vol. 40(3), pages 316-333.

In a first-best environment, taxi travel should be subsidized. The result derives from economies of density—doubling trips and taxis reduces waiting time. The subsidy should cover the shadow cost of taxis' idle time, evaluated at the optimum. The paper provides a proof of the result for dispatch taxis and then discusses the practicality of its implementation.

World Bank Cities on the Move: A World Bank Urban Transport Strategy Review China Financial and Economic Publishing House, Beijing, China, 2002.

Connects the urban and transport strategies with a focus on poverty. Concentrates on the problems of the very poor, not only in relation to income, but also in terms of the broader dimensions of social exclusion. Seeks to offer a better common understanding of urban transportation problems in developing and transitional economies and to identify an urban transport strategy framework for national and city governments.

World Bank, Sustainable Transport: Priorities for Policy Reform World Bank, Washington, D.C., 1996.

Describes how strategies and programs in the transport sector can be designed to make more efficient use of public resources, facilitate trade and other economic activity, foster competitive markets, and better serve users' needs—in particular, expanding poor people's access to services and opportunities. The discussion is organized around the concepts of economic and financial sustainability, environmental and ecological sustainability, and social sustainability.

D. Effect of joint and common costs associated with network industries on pricing rules

Core References

Ergas, H., "Valuation and Costing Issues in Access Pricing with Specific Applications to Telecommunications, in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 91-112.

Explains that common costs are likely to account for a substantial part of the total resources deployed in a telecommunications network. Argues that efficient recovery of these costs will require a mark-up over the attributable long-run costs of each service, including access and that the contribution sought for these costs from access services should reflect regulatory price distortions, notably so as to avoid inefficient entry. Further holds that to minimize the resulting economic costs, access prices should be structured in such a way as to secure the greatest contribution from infra-marginal traffic.

Kahn, Alfred. The Economics of Regulation: Principles and Institutions. Cambridge, MA: MIT Press, 1988, Reissue Edition, vol. I, Chapters 3-5, 7.

Describes pricing issues in utility regulation, giving practical examples and explaining the underlying economics. Explains economic efficiency in the context of pricing. Considers marginal cost pricing, peak load pricing, short-run and long-run marginal costs, effects of scale economies, externalities, Ramsey pricing, fully distributed costs, and price discrimination.

Sectoral References

TELECOMMUNICATIONS

Gasmi, F., Kennet, D., Laffont, J.J., and W. Sharkey, Cost Proxy Models and Telecommunications Policy: A New Empirical Approach to Regulation, Cambridge, MA: MIT Press, 2002, Chapter 9.

Uses the cost function of a representative local exchange regulated telecommunications firm obtained from an engineering cost proxy model to assess the typical size of joint and common costs. Evaluates the extent of accounting and strategic cross-subsidizes that can be associated with vertical integration and their impact on pricing of the firm in the competitive segment.

Romanian National Regulatory Authority for Communications, Decision for Approving the Regulation for the Realization of the Top-down Long Run Incremental Costing Model by Mobifon S.A., 18 December 2003.

Describes the economics of estimating incremental costs in telecommunications and its use in pricing in a competitive environment.

Romanian National Regulatory Authority for Communications, Decision for Approving the Regulation for the Realization of the Top-down Long Run Incremental Costing Model by Romtelecom S.A., 18 December 2003.

Describes the economics of estimating incremental costs in telecommunications and its use in pricing in a competitive environment.

TRANSPORTATION

Quinet, Emile and Roger Vickerman, *Principles of Transport Economics*. North Hampton, Massachusetts: Edward Elgar Publishing Company, 2004.

Provide a discussion on Ramsey pricing and multipart tariffs that lead to various degrees of price discrimination in transportation.

Key Words

Efficiency, Price structure, Marginal cost pricing, Marginal cost, Multi-part tariffs, Ramsey pricing, Two-part tariffs, Joint costs, Common costs

E. Effect of competition on decisions regarding tariff rebalancing, cross-subsidization, and funding of social obligations

[NOTE: Readers should cross-reference this section with Chapter VI Section C.]

Core References

Armstrong, Mark, "Regulation and Inefficient Entry," Nuffield College, Oxford, February 2000.

Explores regulation can promote inefficient entry. Considers protection of entrants, universal service obligations, asymmetric regulation, deregulation, access to essential facilities, price averaging, and regulation of price structures.

Cremer, H., F. Gasmi, A. Grimaud, and J.J. Laffont, "Universal Service: An Economic Perspective," *Annals of Public and Cooperative Economics* 72(1): 2001, pp. 5-43.

Gives a detailed account of the issues related to the definition, the economic justification, the cost, and the financing of universal service. Provides a systematic analysis of the tradeoffs raised by the implementation of universal

service in both a regulated and a deregulated market. Surveys some universal service experiences in the telecommunications and postal services.

Irwin, Timothy, “Price Structures, Cross-Subsidies, and Competition in Infrastructure.” Note no. 107 in Public Policy for the Private Sector. Washington, D.C.: World Bank Group, 1997.

States that price discrimination designed to favor one group over another generally does not withstand competition, but rebalancing the price structure has costs for some groups that may exceed the benefits they receive from increased competition. Options are discussed. Finds that most schemes in which one firm supplies services at low prices and is compensated by its competitors are in telecommunications. Also finds that the reform of the Chilean water supply industry replaced cross-subsidies with a price subsidy targeted at low-income households. Describes how New Zealand eliminated subsidies and relied on existing social safety nets.

Kahn, Alfred. The Economics of Regulation: Principles and Institutions. Cambridge, MA: MIT Press, 1988, Reissue Edition, vol. I, Chapter 6.

Examines issues of pricing in the presence of competition. Discusses issues of cross subsidy and price flexibility.

Sectoral References

ELECTRICITY

Berg, S., “Basics of Rate Design – Pricing Principles and Self-Selecting Two-Part Tariffs,” in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 74-90.

Explains that cost allocation manuals are becoming increasingly irrelevant as the electricity industry becomes more competitive. Argues that: (1) Evidence from other industries suggests that competition will force marginal price towards incremental cost; (2) Electric utilities are going to have to generate value for customers by devising new rate designs, which create win-win opportunities; and (3) Incremental cost pricing promotes the efficient use of society’s resources, and price options enable the supplier to extract more consumer surplus than under uniform pricing — which enhances the financial viability of a firm under competitive pressure.

Hunt, Sally, Making Competition Work in Electricity. New York: Wiley & Sons, 2002, Chapters 16-18.

Examines transmission pricing and the functions of the Independent System Operator and the transmission operators. Discusses issues of market power and the roles regulators can play to control or disperse market power. Also discusses retail pricing with stranded costs.

GAS

Gomez-Lobo, A., "The Welfare Consequences of Tariff Rebalancing in the Domestic Gas Market," *Fiscal Studies* 17(4): 1996, pp. 49-65.

Asserts that competitive reforms in U.K. energy markets will make tariffs more cost-reflective, threatening cross-subsidies between consumer groups. Focuses on the welfare impact of competition on the traditional cross-subsidy, namely, the fact that the "standing charge," a charge that is independent of the amount consumed, is set smaller than the fixed cost while the unit price exceeds the marginal cost.

TELECOMMUNICATIONS

Jamison, M., "Regulatory Techniques for Addressing Interconnection, Access, and Cross-Subsidy in Telecommunications," in Infrastructure Regulation and Market Reform: Principles and Practice, edited by Margaret Arblaster and Mark Jamison. Canberra, Australia: ACCC and PURC, 1998, pp. 113-129.

Describes approaches that regulators use for controlling cross subsidization.

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

Explains that the term "rebalancing" refers to moving the prices for different telecommunications services more closely in line with the costs of providing each service. Further states that: (1) Prices of telephone connections, monthly subscriptions, and local calls have traditionally been set below costs in many countries; (2) Unbalanced price structures are not sustainable in a competitive environment; and (3) Traditional unbalanced price structures are also inefficient in that higher-than-cost prices encourage uneconomic entry by high-cost operators, and lower-than-cost prices discourage economic entry, even by low-cost operators.

Ros, A., and A. Banerjee, "Telecommunications Privatization and Tariff Rebalancing: Evidence from Latin America," *Telecommunications Policy* 24(3): 2000, pp. 233-52.

Addresses the relationship between network expansion and tariff rebalancing under privatization of telecommunication services. Using cross-sectional information on privatization programs in Latin American countries, shows how privatization is a policy that gives incentives for network expansion. Finds that tariff rebalancing, understood as an increase in residential service prices to reflect costs, also leads to network expansion and efficiency improvement.

TRANSPORTATION

Boyer, Kenneth D. Principles of Transportation Economics. Reading, Massachusetts: Addison-Wesley, 1997.

Explains that regulation is sometimes seen as a program for consumer protection, rather than a system to guarantee fairness to all parties including producers. Economic regulation has all but disappeared from North American transportation. The railways were severely disadvantaged by regulation. The motor carriers took advantage of regulatory curbs on competition as did the airlines. In both cases, the unions extracted much of the benefits.

Key Words

Efficiency, Price structure, Marginal cost pricing, Multi-part tariffs, Ramsey pricing, Two-part tariffs, Competition, Cross-subsidy, Universal service

F. Demand forecasting

[NOTE: Readers should cross-reference this section with Chapter IV Section B]

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 5-8.

Describes forecasting of costs, investment, and revenue in a price review setting. Further describes how these forecasts are incorporated into present value calculations.

Whittington, Dale, “The Challenge of Demand Forecasting in Pro-poor Infrastructure Projects” Departments of Environmental Science and Engineering, University of North Carolina Chapel Hill, 2002.

Examines approaches to demand forecasting, with particular attention to projects targeted for the poor.

Sectoral References

ELECTRICITY

Maryland Power Plant Research Program, “Maryland Power Plants and the Environment: A review of the impacts of power plants and transmission lines on Maryland’s natural resources,” December 2003, Appendix B: Determinants of Electricity Demand Growth in Maryland and Appendix C: State-Wide Forecast of Electricity Consumption and Peak Demands in Maryland.

Describes determinants of electricity growth, the principles of econometric forecasting of electricity demand, the effects of demographic features. Provides case study of a demand forecast for Maryland.

Mehra M and A. Bharadwaj, “Demand Forecasting for Electricity,” New Delhi, India: Tata Energy Research Institute, 2000.

Considers the need for good forecasting and summarizes existing methods, including trend analysis, end-use method, the econometric approach, and time series methods. Discusses hybrid approaches. Also considers load curves, effects of new technologies, and data needs.

TRANSPORTATION

MacQuarie Corporate Finance, Limited Project Finance: The Guide to Financing Transport Projects Euromoney Books, 2000.

Provides an overview of project financing for transport projects. Among topics covered are: demand forecasting, the role of capital markets, debt and equity funding, risk identification and management, role of government and specialized agents. Special focus is given to developing nations and case studies are provided.

Lourdes, Trujillo, Emile Quinet, and Antonio Estache Forecasting the Demand for Privatized Transport: What Economic Regulators Should Know and Why Policy, Research Working Paper 2446, World Bank, Washington, D.C., 2000.

Privatization brings new needs for demand forecasting. More attention is paid to risk under privatization, than when investments are publicly financed. And regulators must be able to judge traffic studies done by operators, and to learn what strategic behavior influenced these studies. Forecasting has long been a challenge, and will remain so for the foreseeable future. But the analytical instruments and data processing capabilities available through the latest technology, and software, allow much better forecasting than transport ministries, or regulatory agencies typically observe.

WATER

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

Describes the process that Ofwat planned for its 2004 price review.

Key Words

Demand, Price, Price review, Forecast