# RATE STRUCTURE:
# PRICING OBJECTIVES AND OPTIONS
# IN NETWORK INDUSTRIES
# (Session 19)

**Developed by**
**Mark A. Jamison**
**University of Florida**

## TABLE OF CONTENTS

(Locations of definitions are in *italics*.)

# RATE STRUCTURE:
# PRICING OBJECTIVES AND OPTIONS
# IN NETWORK INDUSTRIES
# (Session 33)

**Mark A. Jamison**
**University of Florida**

Note: Unless otherwise indicated, all currency is in US dollars.

I. Introduction

A. Overview

1. This is the first of three sessions on regulating price or rate structures (also called rate design) in network industries. Rate structure is the relationships of various rates that the company charges. This session covers regulatory objectives, basic economic principles that affect pricing, cost concepts, and alternative price structures.

2. This outline defines terms and concepts in two ways: (1) as I find them used in practice; and (2) as professional accountants and economists would define them. The regulator must be aware of both. Understanding how terms are used in practice is important for discussing policy issues in public and for minimizing confusion. Understanding the professionals' use of the terms is important for separating truth from myth, and for assessing the validity of the claims of expert advisors.

II. What is a rate structure?

A. Definition

1. The term rate structure refers to the relationships between the rates that the company charges.

2. Setting rates is a two-step process:

a. Choosing a price level -- for example, through a rate of return procedure or a price cap index

b. Designing individual prices

B. The role of regulatory objectives

1. Whether a particular rate structure is good or bad, efficient or inefficient, depends upon how well it achieves regulatory objectives.

C. When to regulate or deregulate a rate structure

1. There is no need to regulate rate structure if:

   a. All rate structures are equally good at achieving regulatory objectives

   b. The company's objectives are the same as the regulator's objectives

   c. In practice (because of imperfect information, etc.), an unregulated rate structure is just as likely to achieve regulatory objectives as a regulated rate structure

2. Rate structure should be regulated if the above are not true.

III. Overview of Determining Whether a Rate Structure is Efficient

A. It is generally accepted that an effective rate design will:

***Revenue-related attributes***

1. Provide adequate revenues for investment and quality services
2. Allow stable and predictable revenues
3. Allow stable and predictable rates

***Cost-related attributes***

4. Send price signals that encourage efficient use of the services
5. Recognize positive and negative externalities
6. Fairly apportion the total cost of service
7. Avoid undue discrimination
8. Encourage innovation and respond to changes in supply and demand patterns

***Practical-related attributes***

9. Be simple to understand, facilitate convenience of payment and collection, and be acceptable to customers
10. Be free from controversy as to proper interpretation

B. These are generally accepted criteria. You may have other criteria, and regulators vary in how much importance they place some criteria relative to others.

IV. Basic Approaches for Relating Prices and Costs

A. Choosing the basis for measuring money

1. Defining what is meant by total cost

   a. *total cost* -- Generally refers to the value of all the inputs consumed by the company, but is sometimes used to refer to only an enterprise, service, or

increment of output for the company.

(1) When the term is used for something less than the whole company, there should be a modifier attached, such as "the total cost of producing an additional megawatt of electricity."

b. When speaking of something less than the whole company, people may or may not include some common and/or joint costs when they refer to total cost. Common and/or joint costs would not be included in total cost when it applies to something less than the total firm.

c. Total cost may be defined in accounting terms or economic terms. This is explained next.

2. *embedded cost* -- the money actually expended by the company; also called original cost, historical cost, or accounting cost in some contexts.

a. Embedded costs are generally found in the company's accounting records.

b. Embedded costs are the foundation of the accounting approach to costing.

(1) This is the basis chosen if RORR defines total cost, or if RORR is used as a foundation for price levels in price caps.

3. *current or forward looking cost* -- the money that would be expended if the inputs were purchased in the current time period, or some future time period. This is also often referred to as economic cost. Economic cost is the foundation for the economic approach to costing.

a. Economic costs are *opportunity costs.* Opportunity costs are money that a company or person gives up, whether they ever physically had the money or not. Opportunity costs include explicit costs plus, for example, money a company could have made by producing services that have higher value.

b. This is the basis chosen if price caps define total cost and the productivity offset takes the company to a zero level of economic profits, or if proxy costs are used (although embedded costs could be used as proxies).

4. *profit*

a. There are multiple uses of the term profit.

b. *Accountant definition* -- In normal business usage, profit is revenues minus explicit costs. Explicit costs are out-of-pocket costs such as wages, utility expenses, interest, and rent.

c. *Economist definition* -- Profits over and above a normal earnings level. Also called economic rents.

(1) In economics, a normal level of earnings is considered a cost of obtaining money from shareholders. Normal earnings are an opportunity cost to shareholders because shareholders give up getting normal earnings somewhere else in order to invest in this company. When shareholders provide capital to a company, they give up the opportunity to earn normal earnings from investing in other businesses. Economics considers these foregone normal earnings to be a shareholder cost.

B. Basic approaches to pricing

1. *fully distributed cost* (FDC) -- The allocation and assignment of costs by account to service categories.

a. Assignments are generally restricted to direct costs. Allocations are based on allocators that are believed to be related to cost causation, or are reasonable. Generally, usage (volumes of demand) are the primary allocators.

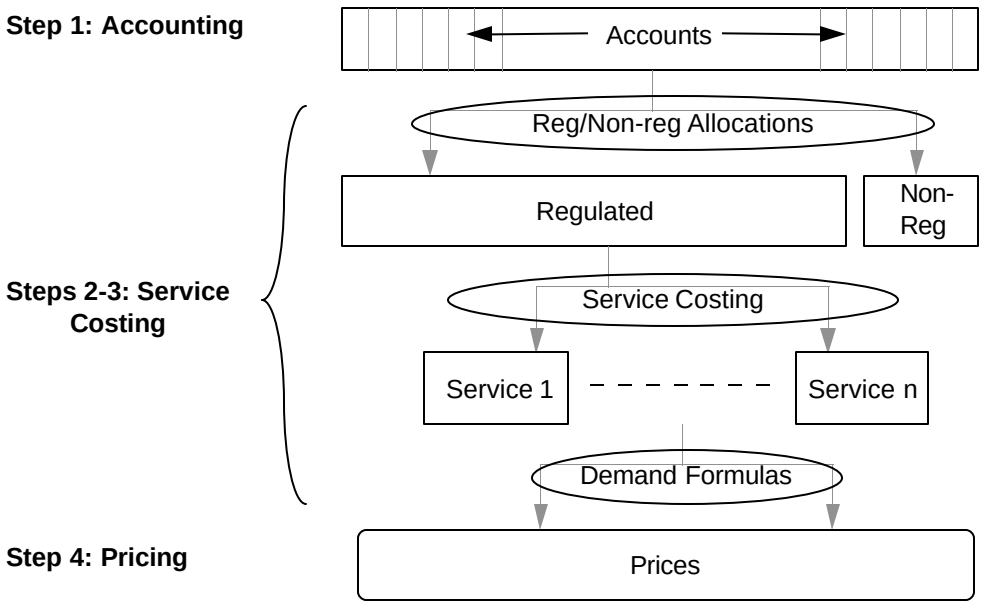
(1) *direct cost* -- Generally used in the context of accounting costs, but some people are starting to use this term when referring to economic costs. Refers to the cost of inputs that are only needed to provide a specific service or set of services. Generally is limited to resources that have their own identity for accounting purposes; i.e., their own account or subaccount.

b. FDC allocates all accounting costs -- both direct and common. FDC is NOT simply the allocation of common costs. This is contrary to how FDC is described in economics literature, but it is how FDC is done in practice.

(1) Box 1 illustrates the FDC process. Step 1 shows that accounting records provide the basis for FDC. The next steps show how the accounts are allocated to service categories. There may be 1 or more of these steps. Box 1 shows this occurring in two steps. The first of these two steps allocates costs to non-regulated services. The second of these two steps allocates the regulated costs among the regulated service categories.

Step 4 illustrates how service categories costs are finally divided by demand estimates (historical or projected) to develop prices. These demand data may or may not include estimates of demand stimulation or repression based on price changes.

## Box 1. Illustration of Fully Distributed Cost




(2) *common costs*

(a) accounting definition -- the cost of inputs that are shared by more than one output; e.g., a telecommunications central office switch

(b) economic definition -- costs that are not avoided by some difference[1] in output; does not include joint costs

(3) *joint costs* -- The cost of inputs that, once placed into production, necessarily produce more than one product in fixed proportions. There are very few joint costs.

(4) *shared costs* -- joint and common costs. There are two major types:

[1]The term "difference" is used rather than "change" to ensure that the focus is on the burden an increment places on the resources of the firm. If a cost could be avoided, it is part of the incremental cost for purposes of regulatory costing.

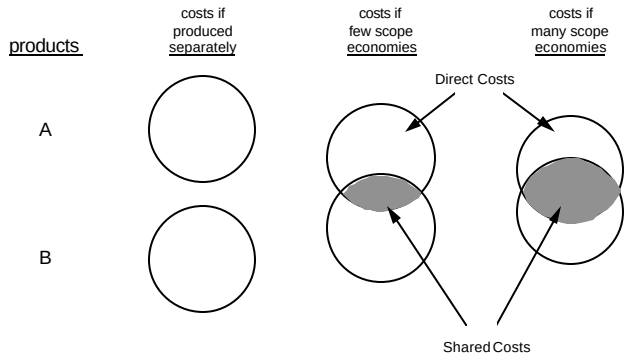
(a) *shared incremental costs* -- shared costs that are specific to only some services. For example, some consumer services may have shared costs in consumer billing, but these costs are not shared with business services.

(b) *overhead shared costs* -- shared costs that are shared by all services. These are costs that do not change or go away unless the company goes out of business. The classic example is the president's desk, but it's not a perfect example because the desk's cost tends to grow with the company.

(c) Box 2 illustrates shared and direct costs. The circles represent costs of providing services. The two circles on the left illustrate costs of producing two services (A and B) separately. The two circles in the middle illustrate costs if A and B are produced jointly. The shading represents costs that they are able to share so that the total cost of producing A and B together is less than the cost of producing them separately. This cost sharing creates economies of scope. The white areas in these circles represent direct costs of services -- costs that would be avoided if either of the services are no longer produced.

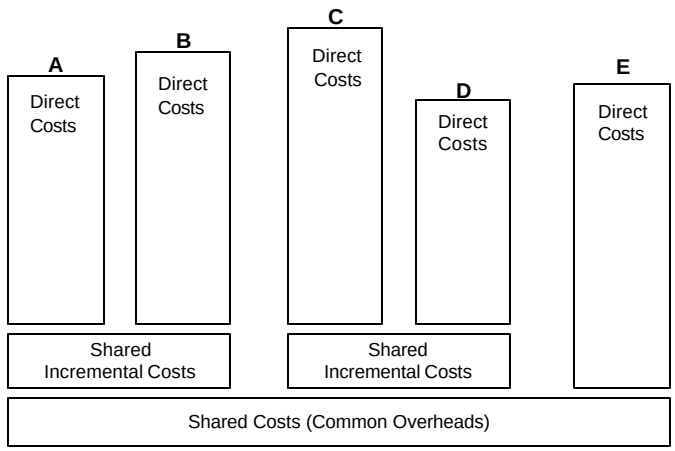
The two circles on the right also illustrate costs with joint production. These circles illustrate how higher economies of scope result in both higher shared costs and lower direct costs.

Box 2. Illustration of Shared Costs



(d) Box 3 also illustrates shared and direct costs. The bars represent the costs of a company producing five services -- A, B, C, D, and E. The sum of all of the bars equals the total cost of the company. The bar across the bottom illustrates shared costs that are common overhead. These costs do not go away unless the company goes out of business. The two horizontal bars that are immediately above the common overheads represent shared incremental costs. The bar on the left shows shared incremental costs that are shared only by services A and B. The vertical bars illustrate direct costs for individual services.

Box 3. Another Illustration of Shared and Direct Costs




(5) Shared costs result from *economies of scope*. Economies of scope is one of four forms of production economies.

(a) A company has *economies of scope* if it is less expensive for a single company to produce two or more products than for 2 or more companies to produce them.

(b) A company has *economies of scale* if increases in production create decreases in average cost.

(c) A company has *economies of vertical integration* if it is less expensive for

the company to produce both the input and the final product than to produce either: (1) the input only and sell the input to another company; or (2) the final product only, purchasing the input from another source.

i) Economies of scope and economies of vertical integration are two forms of *economies of joint production*.

(6) *economies of density* exist when customers are sufficiently close to each other (such as in the case of urban customers) to make their marginal costs lower than the marginal cost of the average customer.

(7) Understanding these economies of production is important for regulating prices that affect which companies will be in which markets and each company's market share.

c. Benefits of FDC for pricing

(1) FDC-based prices add up to the total revenue requirement under RORR. Some people refer to FDC as a revenue requirement distribution.

(2) Can be simple to implement and understand, although the minutia can create bureaucratic inertia. Has the appearance of being fair.

(3) If costs can be traced, may encourage company to be responsible for service-specific investments.

d. Benefits of using FDC for ring fencing

(1) Establishes an accounting-based cost for non-competitive services to cover. This may be required for assessing earnings in price cap reviews or with RORR.

(2) Can be simple to implement and understand (although the minutia can create bureaucratic inertia). Has the appearance of being fair.

(3) If costs can be traced, may encourage company to be responsible for service-specific investments. For example with appropriate accounting, market research for competitive services can be identified and excluded from the revenue requirements for non-competitive services.

e. Problems with FDC for pricing

(1) May actually be unfair

(a) Because volumes drive the cost allocations: (1) customers in non-competitive markets have to carry the full cost of the company if it has

problems in competitive markets; and (2) the company's competitive operations have to bear increasing loads of cost if the company is successful

(2) What constitutes a "reasonable" allocation is in the eye of the beholder, so widely varying results can be justified.

(3) Is historical rather than forward looking.

(4) Can assign overhead costs to new services that have not yet established a market.

f. Problems with using FDC for ring fencing

(1) Applies only if RORR tools are being used.

(2) FDC's underlying theory is that regulators can use accounting records to determine the costs caused by particular services. Unfortunately, FDC allocates costs by account. These accounts show amounts spent on facilities, supplies, etc., but not costs caused by particular services. This is because the facilities, etc., are generally shared by multiple services. Rather than try to identify costs caused by services, FDC allocates accounts to services, generally based on measures of relative use. As a result, the costs allocated to a service may be less than costs that the service actually caused.

(3) FDC formulas shift costs to non-competitive markets. This happens for two reasons. First, the accounting records on which FDC is based do not show why costs were incurred. So it is at best difficult for regulators to prevent companies from acting on the incentive to shift costs incurred for competitive services into prices for non-competitive services. Second, FDC's heavy reliance on usage-based allocators shifts costs to non-competitive markets when companies lose market share in competitive markets. This shifts the risk of cost recovery from shareholders to captive customers.

(4) FDC restricts regulated companies' abilities to innovate and respond to competition in four ways.

(a) First, regulatory processes sometimes required to approve investments and new services cause delays. In the US, local exchange carrier (LEC) video dialtone services are a recent example. Prior to passage of the Telecommunications Act of 1996, LECs had to get approval of the FCC before constructing facilities for video dialtone. This prior approval was required to prevent cost shifting through the accounting process.

(b) The second reason FDC limits innovation is that it creates rigid structures and procedures. For example, FCC rules contain artificial distinctions

between switched and non-switched services. The FCC also requires uniformity across LECs in how they provide and measure costs for some non-regulated services.

(c) The third way that FDC limits innovation is that it constrains management thinking about services and markets. Service development, introduction, and marketing follow this framework because companies must conform their businesses to the regulatory structure.

(d) FDC limits how regulated companies respond to competition by sending false cost signals to management. When a regulated company gains or loses customers in a competitive market, it is changes in FDCs that affect this company's bottom line, not the costs caused by the gain or loss of customers. This sends false signals to management because change in FDC may be greater or less than the costs actually caused by the change. If the FDC change is too large, management will be discouraged from pursuing customers. If the FDC change is too small, management will be encouraged to over invest in the market. Both actions cause a loss of economic efficiency and could harm the long term financial interests of the company.

(5) Can result in cross-subsidy

(a) When two or more services are responsible for the costs in an account, the account is allocated among them based on relative use. The actual costs they cause may be greater than their relative use of the account. For example, if capacity drives costs for central office switching, and a large business customer has primarily peak demand (20% of the total) and very little off-peak demand (only 1% of the total), FDC could allocate only 1% of the central office costs to this customer even though this customer caused 20% of costs.

(b) *cross-subsidy* -- using revenues from non-competitive markets to protect profits while pricing aggressively in competitive markets. This concept is given more thorough treatment in the session on competitive pricing issues.

(c) It is often assumed that the allocation problems with FDC are limited to allocations of shared costs. This is incorrect. FDC is an allocation of all costs, including direct costs that are recorded in accounts that are used by more than one service. As a result, the allocation problems apply to many direct costs as well as shared costs.

g. Keys to effective use of FDC

(1) Minimize accounts that contain costs for multiple services

(a) hard because contrary to nature of network industry

(2) Use cost causation rather than relative use (directly assign, indirectly attribute, allocate)

(3) Control cost reallocation to non-competitive services

(a) Create facility pools for competitive services (for example, a minimum number of local lines for telecommunications) that:

i) do not shift to non-competitive services without permission

ii) are the maximum the competitive service can use without an increase in the pool

2. *incremental cost pricing* -- prices that are equal to incremental cost. When prices are equal to short-run marginal cost, also called *first-best pricing* or *marginal cost pricing*.

a. The terms marginal cost and incremental cost are often used interchangeably. However, marginal cost is a special case of incremental cost.

(1) *incremental costs* -- Costs that can be avoided with some difference in output. That is to say, the extra cost of doing something versus not doing it. The term has little meaning without a modifier saying what that something is. Generally it is meant to describe the extra cost of providing a service versus not providing it.

(a) Size depends upon the increment chosen and the amount of run considered. The term marginal cost is applied when the increment is a small change in the volume of production.

(b) When compared to incremental revenues, tells the firm whether it should be doing the activity; i.e., whether the activity is profitable. If the increment is the total service, it tells the firm whether that service is carrying its weight.

(2) A related concept is *avoided cost* -- the costs that are avoided, or can be avoided, by changing the business in some way. Avoided cost is generally applied to a change in the service -- for example, for estimating the costs avoided because of IPP power. Avoided cost is often used to establish differences between wholesale and retail prices, establish USO costs, and set prices for IPP power.

b. Long run versus short run

(1) Economists differentiate between cost measures by differentiating between long-run costs and short-run costs.

(a) *long run* means that everything about the company can be changed. For example, in the long run, new fiber optic cables and all associated facilities can be added in response to increased sales of local loops. So a cost measure that assumes that the company can optimize all of these facilities is a long-run cost.

(b) *short run* means that something about the company is fixed -- i.e., it cannot be changed by the company to lower its costs. What this something is must be defined for the term short run to have a precise meaning.

(c) Example of a short run.

i) A company may not be able to retrain employees for a new technology. So to answer an increase in demand, the company must do one of the following: (1) use the older technology; (2) use the new technology, but with inadequately trained employees; (3) use the new technology and hire contractors to install and manage it; or (4) use the new technology and hire new, already trained employees.

a) The short run constraint may keep the company from being as efficient as it will be in the long run.

b) If all of these options cost more than what the company would have spent if it had been able to retrain its employees, then the company is not able to optimize its costs because of the short run constraint.

c. Marginal-cost pricing is often applied to *peak and off-peak pricing*

(1) Prices for peak demand reflect marginal cost of peak demand.

(2) The case of electricity pricing in France, 1989-1992.

The French state-owned electric utility, Electricité de France (EDF), has a long experience in peakload pricing. It has recently experimented with an optional, real-time tariff for residential customers.

French household demand for electricity has shown three general trends over the past decade: (1) steady increase in total consumption; (2) smoothing of daily consumption; and (3) growingly unpredictable winter peak demands. The smoothing of daily consumption results from application, since 1965, of a tariff based on two daily fixed periods. This encourages customers to move consumption to the off-peak period. As a result, the load factor is now about

90% on winter weekdays. The development of electric space heating has caused the unpredictable winter peaks, especially on the coldest days.

EDF meets off-peak demand with baseload generating sources, primarily nuclear power plants with very low marginal costs of usage. Winter peak demands are met with fuel oil plants which have high fuel costs. The availability of thermal and hydraulic generating facilities further accentuates the variability in costs.

Real-time tariffs send appropriate price signals to customers. However, customers must have the capacity to respond to these price signals for the tariffs to be effective. EDF experimented with 6 rates during 1989-1992. The year is divided into three types of days and each day has two periods. The three groups of days are marked by colors -- blue, white, and red -- which are defined by three levels of long-run marginal cost. Red and white correspond to the colder periods.

The number of each types of days per year is known to the customer in advance (22 reds, 43 whites, and 300 blues), but the type of any particular day is only announced at the end of the preceding day.

Evaluation of this pricing scheme showed that the real-time tariff made the majority of consumers better off (consumer welfare increased). Customers in temperate areas benefitted most because they were better able to shift demand than customers in colder areas. However, approximately 50% of customers in colder areas benefitted.

Also, the customer's type of heating system did not affect whether the customer benefitted. Even though electric heating customers had less ability to shift demand by switching fuels, they probably had a higher motivation to manage their electricity consumption.

(Source: Christophe Aubin, Denis Fougère, Emmanuel Husson, and Marc Ivaldi, "Real-time Pricing of Electricity for Residential Customers: Econometric Analysis of an Experiment," *Journal of Applied Econometrics*, 10(1995): 171-191.)

d. Incremental cost is often applied to price floors for competitive services when prices in these markets are not allowed to fall below incremental cost. Prices below incremental cost are often referred to as being non-compensatory.

(1) Generally, the incremental cost used for price floors is *total service long run incremental cost* (TSLRIC) -- the costs that would not be incurred were the firm not offering the service or services in question. TSLRIC is the same as

the economist definition of direct cost.

(a) TSLRIC is the sum of the usage sensitive costs caused by the service and service-specific fixed costs. This is also called long run service incremental cost (LRSIC), total service incremental cost (TSIC), long run incremental cost-total service (LRIC-TS) or direct incremental cost.

i) *volume sensitive costs or usage costs* -- costs that vary with output.

ii) *fixed costs* -- costs that do not vary with output. Fixed costs are higher in the short run than in the long run because more costs can be varied in the short run. Long-run fixed costs are sometimes called getting started costs or first unit costs. Service-specific fixed costs are fixed costs that are caused by only one service.

a) *sunk costs* -- costs that cannot be avoided. Sometimes used to describe embedded costs because these are monies already spent. Other times used to describe monies that have not been spent, but that will be even if the company goes out of business. An example would be termination clauses on contracts.

iii) *service-specific fixed costs* -- fixed costs are costs that do not vary with output. Service-specific fixed costs are fixed costs that are caused by only one service.

(b) The FCC in the USA has developed the term *total element long run incremental cost* (TELRIC) to describe the TSLRIC of a network component.

(2) the TSLRIC of each service, summed over all services, is less than the total cost of the firm because shared costs are left out

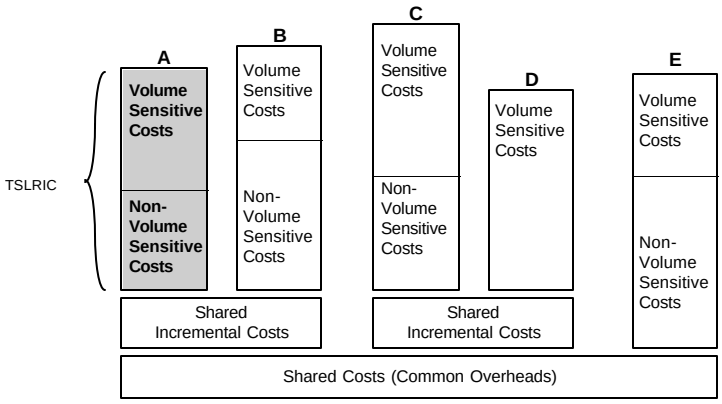
(3) incremental revenues in excess of TSLRIC provide "contribution," although the "contribution to what?" is generally unclear

(4) the sum of TSLRICs and shared costs is equal to the total cost (economic definition) for the company

(5) Box 4 illustrates TSLRIC for a single service. This box also illustrates how TSLRIC is the sum of the service's volume sensitive costs and service-specific fixed costs. The diagram in the box is the same diagram that was in Box 3.

(6) Box 5 illustrates TSLRIC for a group of services. The TSLRIC for the group including A and B includes the TSLRICs of both, plus the shared incremental costs that are common to A and B, but no other services. The diagram is the same as the diagrams in Boxes 3 and 4.

Box 4. TSLRIC of a Single Service




e. Benefits of incremental cost pricing

(1) Prices ensure that customer payments cover the costs that they cause

(2) prices equal to short run marginal cost achieve allocative efficiency

(3) Forward looking

f. Problems with incremental cost pricing

(1) May not equal total cost.

(a) Sheet 2 in Appendix A provides an example. The first set shows prices, demand, and revenues if prices were set at marginal cost. This illustrates that prices equal to marginal cost rarely cover the company's total cost. This is because fixed costs are ignored and marginal costs may actually be declining with increases in output.

(b) If prices are equal to marginal cost and marginal costs are increasing with output, monopoly profits may result.

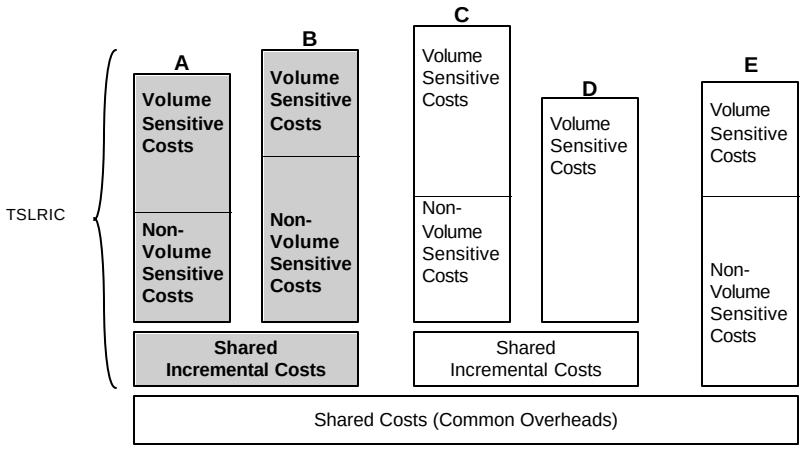
(2) Marginal costs are difficult to determine, so approximations such as long run

incremental cost are used.

(3) Can potentially shift all overheads to non-competitive markets.

(4) May allow cross subsidies

Box 5. TSLRIC of a Group of Services




g. Using incremental cost for ring fencing

(1) There are several approaches (discussed below)

(a) Assign regulated portion its stand-alone costs

(b) Assign non-regulated portion its incremental costs

(c) Use imputation and the Efficient Component Pricing Rule

(2) Maximum prices based on stand-alone cost

(a) *stand-alone cost* -- The total cost of a specialized company producing only the service or services in question.

i) For example, the stand-alone cost of providing water to residential

customers would be the total cost of a company that provided only sufficient pumping, processing, distribution, etc., to serve residential customers and produced nothing else.

ii) Stand-alone costs include all of the usage costs and service-specific fixed costs for the service or services in question, the shared costs that are needed only by the service or services in question, and the shared costs that are needed by the service or services in question plus those that may be shared with other services not included in the stand-alone cost estimate. In other words, if we were estimating the stand-alone cost of services A and B, and companies also tend to offer service C, then the stand-alone cost of A and B is:

Usage costs of A
Usage costs of B
Fixed costs of A
Fixed costs of B
Costs shared by A & B, but not C
+ Costs shared by A or B with C
Stand-alone cost of A & B

(b) Usefulness is questionable because it generally assigns all common costs to captive customers.

(c) Fails to protect against cross subsidy except in the special case where: (1) specialized self provision is the only economic alternative to captive customers; and (2) contributions to shared costs are not considered to affect cross-subsidy concerns.

(d) Applications

i) The US Interstate Commerce Commission used stand-alone cost tests to determine if captive rail shippers were paying too high prices.

ii) The Independent Pricing and Regulatory Tribunal of New South Wales is considering using stand-alone costs as the standard for maximum prices for contract services in gas. The method under consideration shares overhead costs among customers, so the effective price ceiling is below stand-alone cost.

(3) TSLRIC-based price floors.

(a) *price floors* -- lower bounds on prices in competitive markets. Generally

intended to keep incumbent from exploiting dominant position by driving out more efficient competitors.

i) Common form of cross-subsidy control

ii) TSLRIC is the most common form of price floor.

(b) Benefits of using TSLRIC price floors

i) Practice is well established

ii) Properly implemented, ensures that captive customers do not cover costs that this firm incurs only to produce the competitive services.

(c) Problems with using TSLRIC price floors

i) TSLRIC fails to protect against cross subsidy. This happens for two reasons:

a) TSLRIC ignores strategic pricing. Through strategic pricing, a dominant firm can drive more efficient, non-dominant competitors from markets without lowering prices below incremental cost in competitive markets.

b) TSLRIC is based on the Baumol-Faulhaber definition of cross subsidy which is overly narrow. Today's markets invalidate the TSLRIC price floor theories because the theories assume that rivalry is possible only from companies that are smaller and more specialized than the incumbent.

ii) TSLRIC fails to protect captive customers because it shifts costs to non-competitive markets. This happens in two ways. First, TSLRIC price floors place all of the responsibility of covering common costs on captive customers. In effect, customers in non-competitive markets ensure the company is financially viable because the only costs that put at risk are those that can be avoided by exiting the competitive market. Second, the incremental cost studies that form the bases for the price floors sometimes omit costs caused by a competitive service. For example, studies done after a service is developed would generally omit development costs. These development costs remain in the regulated company's overall cost and are potentially covered by other services.

iii) TSLRIC restricts regulated companies' abilities to innovate and respond to competition. This happens because the price floors can remove companies' abilities to price below incremental costs. This is

overkill because there are legitimate reasons, as well as anti-competitive reasons, to price below incremental costs. Examples of legitimate reasons include filling product and market gaps, maintaining stakes in strategic markets, expanding markets, and engaging in price wars.

(4) *Efficient component pricing rule* (ECPR), also called the *parity principle* or the *Baumol-Willig rule*.

(a) The ECPR is also sometimes used in setting interconnection prices. This is discussed later.

(b) The ECPR was developed by Baumol and Willig.[2] The formula is:

Retail price = Wholesale price + [Retail TSLRIC - Wholesale TSLRIC]

or

Wholesale price = Retail price - [Retail TSLRIC - Wholesale TSLRIC]

3. *Ramsey pricing* -- customers are charged different prices based on their responsiveness to price changes, and the business breaks even.

a. "Responsiveness" is measured in terms of how much customers change the amount they purchase. Customers who do not respond very much to price changes are said to have inelastic demand. Customers who respond a lot are said to have elastic demand. "Break even" means that the company's revenues equals its economic costs.

b. This is also called the *inverse elasticity rule* because prices are increased in inverse proportion to the customer's elasticity of demand.

c. The objective of Ramsey pricing is to deviate as little as possible from the consumption mix that would occur if prices were equal to marginal cost.

d. Sheet 2 in Appendix A provides an example. The fourth column shows prices, demand, and revenues if prices were set according to Ramsey pricing.

e. Benefits of Ramsey pricing

(1) Ramsey pricing allows prices to reflect (but not equal) marginal costs while also allowing the company to cover its total cost.

[2]Baumol, William, "Some Subtle Issues in Railroad Regulation," *International Journal of Transportation Economics* (1983):341; and Willig, Robert, "The Theory of Network Access Pricing," in *Issues in Public Utility Regulation* 109-52 (H. Trebing ed. 1979).

(2) Maximizes welfare subject to the constraint that total revenue must equal total cost

f. Problems with Ramsey pricing

(1) Difficult to implement because must know all marginal costs and all demand elasticities

(2) May not be subsidy free

(3) Customers and politicians often oppose Ramsey pricing because it gives the highest mark-ups over marginal cost to the customers who have the least ability to protect themselves

(4) Differences in levels of competition between markets distort elasticities

4. *linear (or uniform) prices* -- charging the same price for all units of the service.

a. Results in prices being equal to average cost if prices are cost covering.

(1) *average cost* -- Total cost divided by total output.

(a) Is a single-product firm concept. Is not well defined for firms that produce more than one product. My preference would be that the term would apply only to TSLRIC divided by output, but only a few people use it that way.

(b) I have heard one economic consultant define average cost as fully distributed cost, but he is the only person I have heard use "average cost" that way. Average revenue (sometimes price) minus average cost equals profit per unit. Average cost is greater than marginal cost for most companies.

b. Sheet 2 in Appendix A provides illustrations of linear prices. The first two columns are both examples of linear prices.

c. Benefits of linear prices

(1) simple to implement because price is simply total cost divided by demand

(2) simple to understand because all prices are the same

d. Problems with linear prices

(1) They are rarely efficient

(a) Linear prices are rarely able to both equal short-run marginal cost and be

cost-covering in total

(b) They may encourage uneconomic competition if marginal costs are far below average cost. Companies may resort to cross-subsidization in this situation in order to protect market share.

5. *linear (or non-uniform) prices* -- charging different units of the same service to the same customer at different prices.

a. incremental and decremental tariffs are two forms of non-linear tariffs

b. *incremental (or rising block) tariffs* -- the price of successive units rise as consumption increases

c. *decremental (or declining block) tariffs* -- the price of successive units decreases as consumption increases

(1) Electricity example:

| | |
|---|---|
| Monthly fixed fee | $2.00 |
| Usage fee 0-100 kWh | $0.042 |
| Usage fee > 100 kWh | $0.031 |

Box 6 illustrates this tariff.

d. Benefits of non-linear tariffs

(1) Prices at margin of consumption can equal marginal cost while average revenue continues to equal average cost

(a) Declining block encourages consumption where marginal costs are declining

(b) Rising block encourages conservation where marginal costs are rising

(2) With rising block, low income households may find low levels of consumption affordable

(3) Revenue from a service can cover fixed costs and shares of common costs

e. Problems with non-linear tariffs

(1) Customers may arbitrage

(a) Large customer in declining block may resale to small customers

(b) Large customer may disguise consumption in rising block to look like

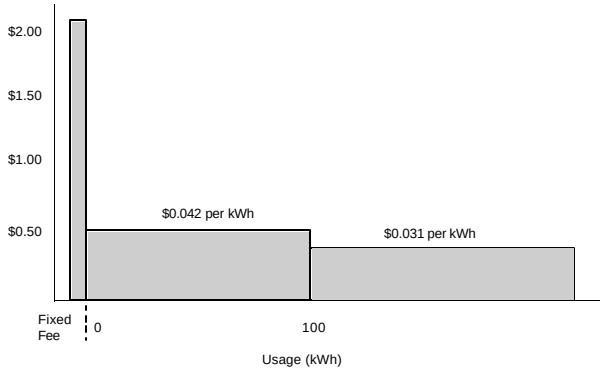
multiple small customers

(2) May not be efficient

(a) Prices at margin may equal marginal cost for only customers of certain size

(b) Access-related costs may be recovered in usage prices

Box 6. Declining Block Tariff




6. *multi-part prices* -- customers pay separate prices for different parts of the service.

a. Multi-part prices allow regulators and companies to have customers self-select the price structure that maximizes welfare.

b. The simplest form is a two-part tariff where customers pay an access fee plus a usage fee. Sheet 2 in Appendix A illustrates this fee structure. The last three columns all illustrate fee structures that have both an access component and a usage component.

c. Optional multi-part tariffs allow customers to choose among price structures; for

example, to buy under the multi-part tariff or under a flat-rated tariff.

V. Assessing Revenue-related Attributes of a Rate Structure

A. Provide adequate revenues for investment and quality services

1. Taken together, the various prices must be cost covering -- they must provide adequate revenues to allow new investment and to maintain service quality. The formula for testing revenue adequacy is:

| | Prices, Demand, Revenues, and Costs | | | | |
|---|---|---|---|---|---|
| Item | Service 1 | Service 2 | Service *I* | Service *n* | All Services |
| Price | $P_1$ | $P_2$ | $P_i$ | $P_n$ | |
| Demand | $Q_1$ | $Q_2$ | $Q_i$ | $Q_n$ | |
| Service Revenue | $P_1 \times Q_1$ | $P_2 \times Q_2$ | $P_i \times Q_i$ | $P_n \times Q_n$ | $3_{I=1}^{n}(P_i \times Q_i)$ |
| Bad Debt | | | | | D |
| Expected Revenues | | | | | $3_{I=1}^{n}(P_i \times Q_i) - D$ |
| Total Cost | | | | | C(Q) |
| Revenue Surplus (Deficiency) | | | | | $3_{I=1}^{n}(P_i \times Q_i)-D-C(Q)$ |

a. The most typical ways to determine to total cost are through RORR, price caps, or some combination.

b. One non-traditional option in electricity generation is the *ascending tariff*.

(1) This is a tariff in which the purchaser accepts a constant per-kwh price for electricity, subject to annual adjustments for inflation, and subsequently for increases in later years to provide investors a return on equity. Both the purchaser and the provider face market risks over the term of the contract.

(2) This tariff defers return on equity payments to later years.

c. Some countries are beginning to experiment with proxy estimates of total cost.

(1) *proxy costs* are estimates of what it *should* cost a company to provide a service rather than what the company is actually spending. The estimates are

performed using engineering process models. Engineering process models are computer models that emulate the production processes to estimate costs.

(2) The Chilean Electricity Distribution Approach -- In Chile, prices are regulated for consumers of less than 2 MW and freely negotiated for the rest. The final price to regulated consumers has two components: (1) a node price at which distribution companies buy power from generators and from the transmission grid; and (2) the value added of distribution (VAD).

The node price is determined as the sum of the forecasted average of the short-run marginal costs of generation, given the investment program proposed by generators for the next 3 years, and of the marginal cost of transmission between the generating unit and the distribution node or point. The difference between the marginal cost and average cost of distribution is charged to generators who pass it on to the unregulated customers. The law provides that the node price must be within a 10% band around the average price in the unregulated market.

The VAD is calculated every 4 years. The procedure involves the calculation of the costs of an efficient firm and then setting prices to cover these costs, including a 10% return over replacement costs. These prices are then applied to existing firms. If an existing firm's realized return would exceed 14% or fall below 6% with these prices, the prices are adjusted to stay within this range. Both the industry and the regulator (CNE) calculate costs of an efficient firm. The industry's estimate is given a weight of 33% and the CNE=s estimate is given a weight of 67%.

Even though this approach is supposed to make cost studies relatively objective and technocratic, the fixed-weight averaging creates incentives for strategic behavior on the parts of the industry and CNE. Both have an incentive to bias their own estimate, subject to what they think the other will estimate, so that the weighted average achieves their objectives. As a result, discrepancies between the industry's and CNE's estimates have exceeded 50% in some cases.

Development of the models can be demanding. Chile's model took three full-time senior engineers two years to develop. (Likewise, Oftel's model of BT takes three full-time economists to maintain it.)

(Sources: E. Bitran and Pablo Serra, "Regulatory Issues in the Privatization of Public Utilities: The Chilean Experience," *The Quarterly Review of Economics and Finance* 34 (1994): 179-197; and Warrick Smith and Michael Klein, *Infrastructure Regulation: Issues & Options for East Asia*, The World Bank, December 1994.)

(3) Australian telecom universal service obligation (USO) funding -- Austel, the federal telecommunications regulator in Australia, has hired Bellcore to develop a cost model that will estimate Telstra's (the incumbent's) costs for USOs. This model will, in effect, determine the total cost to be recovered. There is some discussion of using a similar approach for setting other prices.

(4) USA telecom funding for USOs -- The US federal telecom regulator (Federal Communications Commission or FCC) has adopted a plan for funding USOs using proxy costs. The proxy cost becomes the total cost for the subsidized service. The FCC also plans to use proxy costs for interconnection.

2. Appendix A provides an example of assessing the revenue adequacy of a rate design.

   a. Page 1 shows the company's total costs broken into categories of short run and long run volume sensitive costs (i.e., energy costs), volume sensitive costs that are capacity driven, customer-specific costs, and shared costs. The total cost for the company is $199,114,000. This cost is determined using RORR.

   b. Page 1 also shows demand (peak and total), numbers of customers, bad debt, and energy demand elasticities.

   c. Page 2 shows five proposed sets of prices. Assumptions made in these prices are described at the bottom of page 2.

      (1) These simply illustrate different methods of designing rates, not a comprehensive cost study nor a complete proposal. Electricity sector sessions will show how to actually do electricity cost studies.

      (2) The first set shows prices, demand, and revenues if prices were set at short run marginal cost for energy. This assumes that short run marginal cost includes fuel costs only.

      (3) The second set shows prices, demand, and revenues if prices are set according to long run marginal cost for energy. This assumes that the difference between short run and long run is the energy related cost in generation.

      (4) The third set shows a two-part tariff where usage is set at short run marginal cost and the access fees cover the remainder of the costs.

         (a) *two-part tariff* -- customers pay an access fee and a usage fee. The residential customers in the example would pay an access fee of $809 per year and a usage fee of $0.035 per kWh.

      (5) The fourth set shows a two-part tariff based on Ramsey prices for usage.

(6) The fifth set shows tariffs based on fully distributed costs. The prices shown assume historical demand. This is a standard assumption in fully distributed cost. However, fully distributed cost prices can assume demand effects just as the other prices on this schedule assume.

(7) This example illustrates how to determine if prices are cost covering. Revenues are compared to costs and bad debt (uncollectible bills) on lines 39-42. Only the two-part tariffs are cost-covering.

3. Determinants of whether prices are cost-covering

a. Whether prices are cost-covering is affected by the price level, demand, and management issues such as collection rates and cost levels.

b. Stimulation and repression

(1) Sometimes regulators incorporate effects of stimulation or repression in assessing whether prices provide adequate revenues

(a) *stimulation* -- additional sales volumes caused by price decreases

(b) *repression* -- lower sales volumes caused by price increases

(2) Formula

(a) $\%\Delta R = \%\Delta P * (e * \%\Delta P + e + 1)$

i) where:

a) R = revenue
P = price
e = elasticity of demand (expressed as negative)
$\%\Delta X$ is expressed as a decimal

ii) Test various $\%\Delta P$'s until get target $\%\Delta R$

a) Example

e = -0.20
Target $\%\Delta R$ = 12.3%

Tests:
$\%\Delta P$ = 18% gives $\%\Delta R$ = 13.75%
$\%\Delta P$ = 15% gives $\%\Delta R$ = 11.55%
$\%\Delta P$ = 16% gives $\%\Delta R$ = 12.3%

c. The case of water in Buenos Aires, 1996

Before establishment of the Buenos Aires private sector water concession, the annual revenues of the public operator (OSN) barely covered operating costs. This left nothing for maintenance or for new investment. The government privatized the water operations through a bidding process. No cash payments were required as no assets were transferred. Instead, the winning bidder assumed responsibility for operating and maintaining the fixed assets, was obligated to expand coverage, guaranteed water quality, and developed sewage treatment. The winning bidder, Aguas Argentinas, began operations in 1993 and improved the commercial properties of the services by:

(1) improving the billing and collection system (numbers of meters increased by 460%)
(2) increasing the number of customers that were actually registered (30,000 customers had illegal connections)
(3) expanding the system (water connections increased 9%, sewer connections increased 7%, water production capacity increased 26%)
(4) decreasing prices 17% overall (prices were at first decreased 27% and then increased 13.6%)
(5) rehabilitating 550 kilometers of water pipes
(6) decreased the incidence of clogged drains 97%
(7) reduced staff by 47% initially (but is now adding staff to meet growing demand)

Revenues jumped by 76 percent in two years even though the price increase was only 13.6 percent. Combined with cost reduction strategies, Aguas Argentinas was able to turn a first year loss of $26 million in 1993 into a profit of $26 million in 1994 and a profit of $54 million in 1995.

(Sources: Daniel Rivera, *Private Sector Participation in the Water Supply and Wastewater Sector: Lessons from Six Developing Countries*, The World Bank, 1996; Claude Crampes and Antonio Estache, "Regulating Water Concessions: Lessons from the Buenos Aires Concession", *Viewpoint* Note No. 91, The World Bank, September 1996; and Emanuel Idelovitch and Klas Ringskog, *Private Sector Participation in Water Supply and Sanitation in Latin America*, The World Bank, 1995.)

B. Allow stable and predictable revenues

1. Stable and predictable revenues are important because unexpected changes in revenues can affect the financial viability of the company and/or its ability to invest.

a. A company must have confidence that its prices will provide the revenues

predicted. A company can be expected to make fewer investment commitments if unstable and unpredictable revenues force the company to hold higher cash reserves.

C. Allow stable and predictable rates

1. Unexpected changes that are adverse to ratepayers should be avoided. Rates should have some historical continuity. In moving from current prices to more efficient prices, how do winners compensate losers?

2. This need sometimes results in extra restrictions on prices for services whose prices customers are particularly sensitive to.

a. The case of British Telecom (BT) in the UK, 1994

In the UK, Oftel does not allow a full scale rebalancing of prices. This is done to protect residential customers and to take into consideration public opinion. Oftel has used sub caps, restrictions on median residential bills, and bounds on a single price to limit price rebalancing.

During the first price cap period (1984-89), BT could not increase residential exchange line rentals more than RPI + 2% within an overall cap of RPI - 3%. During the second price period, Oftel introduced the concept of a median residential customer bill that was to represent a "typical" customer bill. Nether this median residential customer bill nor connections were allowed to increase in real terms. In other words, they had limits of RPI + 0%

During the third cap period (1991-93), residential lines and connections had caps of RPI + 2% in an overall cap of RPI - 6.25%. During the current cap period (1993-97), almost all service prices are under a RPI + 0% cap in an overall cap of RPI - 7.5%. The exceptions are exchange line rentals (RPI + 2%), rental lines supplied to other operators (RPI + 5%), and some international voice (RPI + 5%).

(Source: Michel Rogy, "Price Cap Regulation in European Telecommunications: The Chronicle of a Forecast Death?" *Communications & Strategies*, 3 (3rd Quarter 1994): 47-75.)

VI. Assessing Cost-related Attributes of Rate Structure

A Send price signals that encourage efficient use of the services

1. Static efficiency of the rate classes or rate blocks should discourage wasteful use of services by:

a. ensuring that the total amount of service supplied is worth the money

b. ensuring that there is an appropriate balance of the relative uses of the various types of services -- for example, a higher quality service versus a lower quality service

c. This is called allocative efficiency. Allocative efficiency is one of three types of economic efficiency:

(1) *allocative efficiency* -- for a particular amount of resource consumption, choosing the mix of outputs that gives society the most value. Also called first order economic efficiency.

(2) *productive efficiency* -- using the least amount of resources to provide a particular level and mix of outputs. This includes x-efficiency. It also includes production economies such as economies of scale and economies of joint production.

(a) X-efficient means a company operating at least cost. Said another way, x-efficient simply means that the company cannot produce the same output and quality at a lower cost.

(3) *dynamic efficiency* -- achieving an optimal rate of technological change and new product introduction.

B. Recognize positive and negative externalities

1. There are both private and social costs and benefits to services. Social costs and benefits are called externalities.

2. *externalities* exist when someone other than the producer and consumer is affected by a transaction.

a. Private costs and benefits are things that affect only the producer and consumer. For example, the purchase of a meal involves costs only the producer bears (supplies, labor, etc.) and benefits only the consumer receives (taste, satisfaction of hunger, etc.).

b. Social costs and benefits are things that affect persons other than the producer and consumer. For example, the purchase of electricity can affect persons living near the generating station even though they are neither producers nor consumers of this electricity. Likewise, the purchase of telephone service by an individual provides benefit to others who can now call or be called by this individual.

3. There are four types of externalities -- network, production, cost, and intertemporal.

a. Telecommunications networks often exhibit positive network externalities in that the value of a unit of service increases with the number of units sold.

b. Electricity generation often exhibits negative production externalities because of environmental pollution.

c. Cost externalities exist when the cost of adding a customer is different from the average cost of all customers. If the additional cost is less, there is a positive cost externality. If the average cost is more, there is a negative cost externality.

d. Intertemporal externalities exist when consumption in one time period affects customers in another time period. Natural resource depletion is an example.

C. Fairly apportion the total cost of service

1. "Fairness" is a subjective standard. In rate structure, it generally means to avoid being arbitrary (making decisions based on individual discretion) and capricious (being sudden or unpredictable).

2. Dimensions of fairness

a. horizontal -- equals are treated equally

(1) for example, all residential consumers in the same area pay the same prices

b. vertical -- unequals are treated unequally

(1) for example, rural customers with higher costs might pay higher prices than urban customers who have lower costs

(2) In many instances, rural customers may actually pay lower prices than urban customers because (in the case of telecommunications service) there are fewer customers that can be called with a local telephone call, or for social welfare reasons (if rural customers have lower incomes than urban customers).

c. anonymous -- the customer's demand should be satisfied by the lowest cost supplier

(1) for example, an IPP with a cost per kwh of $0.04 should not be handicapped so as to lose customers to an incumbent with a cost per kwh of $0.05.

(2) This one aspect of productive efficiency.

D. Avoid undue discrimination

1. One customer should not have to bear the financial burden of another customer's

service.

2. *price discrimination* -- Price discrimination was one of the main drivers of the development of commission-style regulation in the U.S. In general, price discrimination occurs when two or more prices are charged for the same product even though the costs are the same. Whether this is good or bad depends on the degree of discrimination and your regulatory objectives.

E. Encourage innovation and respond to changes in supply and demand patterns

1. There should be financial rewards for innovation

2. Positive response to changes in customer demand patterns and to changes in costs should be rewarded

3. The case of water in Buenos Aires, 1996

   The concession contract for Aguas Argentinas contained pricing provisions that encourage service improvements and expansion, but also contains provisions that discourage these.

   - *Water rates.* Water rates are to be reassessed every five years based on updated investment plans and estimates of expenditures. This forward looking perspective on prices is necessary because the contract contains many requirements for quality and system improvements.

   - *Metering.* The contract stipulated that if after two years, Aguas Argentinas had not installed meters to large customers and bulk water sales, the rate applied would be the fixed charge in consumption. This fixed charge would not be cost covering for water usage. In a sense, the usage prices gave Aguas Argentinas the incentive and opportunity to encourage efficient water use by installing meters.

     However, in some instances consumers decide whether to have a meter installed. Only customers with low consumption levels have an incentive to install a meter. Also, the fixed charge in the two-part tariffs for metered customers do not cover connection costs. As a result, connections for metered customers must be subsidized by usage charges and by non-metered customers.

     (Sources: Daniel Rivera, *Private Sector Participation in the Water Supply and Wastewater Sector: Lessons from Six Developing Countries*, The World Bank, 1996; Claude Crampes and Antonio Estache, "Regulating Water Concessions: Lessons from the Buenos Aires Concession", *Viewpoint* Note No. 91, The World Bank, September 1996; and Emanuel Idelovitch and Klas Ringskog, *Private Sector Participation in Water Supply and Sanitation in Latin America*, The World Bank, 1995.)

F. Efficiency Effects of Price Structures

1. In traditional economics, prices are said to be efficient if they lead to the highest possible level of welfare.

   a. There are two parts to this welfare:

      (1) Consumer surplus -- the difference between how much consumers would be willing to pay for something and how much they actually pay.

      (2) Producer surplus -- the difference between the economic cost of producing the unit of service (its marginal cost) and the price the producer receives.

2. The case of subscriber line charges in the USA, 1984-1990.

   Charges for local telephone service (or telephone line rentals) in the USA are rarely sufficient to cover line costs. Several factors have created this situation. One of the factors is the dual jurisdiction system of regulation -- a system in which a telephone company is regulated by both a federal regulator (the Federal Communications Commission or FCC) and a state regulator. The FCC regulates prices for telecommunications calls that cross state boundaries (called interstate). The state regulators regulate prices for local service and all calls that stay within state boundaries. Line costs are allocated between the federal and state jurisdictions. As a result, line costs show up in interstate calling prices. This helps allow state regulators to keep local service prices below line costs.

   In the mid-1980s, the FCC concluded that efficiency could be improved by decreasing the share of line costs covered in usage prices. It would have been politically difficult for the FCC to have moved line costs back to the state jurisdiction, so the FCC instituted subscriber line charges (SLCs). SLCs are just like local service charges in that they are per line charges that subscribers must pay to have a line. These charges were phased in and are now at $3.50 per line per month for residence and single-line businesses, and $6.00 per line per month for businesses with more than one line.

   Covering more line costs in per line prices allowed interstate usage prices to decrease. Studies have estimated the net gain that customers have enjoyed from this rate rebalancing. One recent study estimated that consumer surplus has increased a net of $7.5 billion annually, or $4.20 per subscriber per year (residence and business).

   Approximately 90% of this benefit was the result of lower prices for interstate calling. The remainder was the result of customers being able to afford more calling as a result of the decrease in price. Even though these benefits do not apply uniformly across all customers, it appears that most customers did benefit.

(Source: Thomas J. Makarewicz, "Efficient Telecom Pricing: Who Stands to Benefit?" *Public Utilities Fortnightly*, 134 (March 15, 1996):26-28, 32.)

## VII. Assessing Practical-related Attributes of a Rate Structure

### A. Qualities

1. Be simple to understand, facilitate convenience of payment and collection, and be acceptable to customers

2. Be free from controversy as to proper interpretation

### B. Understandability and Customer Acceptability

1. Sometimes, regulators must explain prices to the public. In these cases, a premium should be placed on being able to effectively communicate how the price structure works, how it was set, and how the public benefits.

2. Understandable price structures decrease the cost of answering customer questions and complaints.

3. Efficient price structures such as marginal cost-based peak prices, may not improve efficiency if customers do not understand the prices, or do not respond to the price signals because they are not known.

4. The case of long distance pricing in the U.S, 1994-1996.

   Currently, all of the major US-based interexchange carriers (IXCs) have introduced new domestic calling plans. Examples include AT&T's True Savings, MCI's Friends & Family, and Sprint's The Most. The pricing plans offered price discounts based on calling volumes and who was called. For example, MCI's the Friends & Family required customers to designate a circle of friends that would also be MCI customers. The customer would receive a special discount when calling people within this circle. Sprint's The Most offered larger discounts if the person called was also a Sprint customer.

   Some customers were skeptical of advertized price discounts because the calling plans were complicated. In 1994, Sprint introduced a postalized rate to try and capitalize on the customer demand for understandable prices. Sprint introduced Sprint Sense. This plan charged $0.10 per minute for domestic evening and weekend

calls regardless of who was called and calling distance. The daytime rate was also postalized, but somewhat higher.

Customers responded positively to Sprint Sense. In response, AT&T introduced a $0.15 per minute option that applied at all times to all calls. Sprint eventually expanded the scope of its $0.10 per minute rate. Postalized rates are now being applied to international calls, too. Postalized rates were not new for the IXCs, but Sprint's marketing of Sprint Sense increased customer awareness and customer demand.

Increased simplicity provided a competitive advantage and also encouraged more customers to sign up for calling plans. One of the consequences of this is that the IXCs had to raise other prices to make up for the lower prices they were now charging the new calling plan customers.

(Source: The Yankee Group, *Consumer Long Distance: The Battle for Simplicity and Differentiation*, May 1995.)

C. Payment and collection

1. Prices must be billable to be effective in creating revenues. Complex price structures may appear efficient on paper, but result in efficiency because they cannot be implemented.

D. Controversy in Interpretation

1. Regulators, companies, and customers must have a common understanding of how the price structure works.

VIII. Evaluating a Rate Structure

A. The form in Box 7 can be used to as a score sheet to for evaluating alternative rate structures.

1. The column on the left lists the regulatory objectives.

2. The middle column is used to record scores. A score of 1 means that the rate structure seriously harms achieving this objective. A score of 5 means that the rate structure achieves this goal perfectly.

3. The column on the right is used to record relative weights (importance) for the objectives. These weights may vary with the situation. For example, a country with a history of non-cost covering prices may place high importance on Objective 1. A country with very competitive markets may place high importance on Objectives 6 and 7.

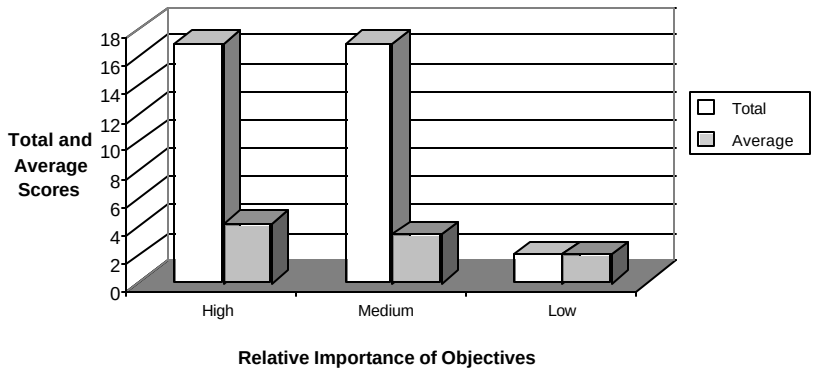
| *Box 7. Rate Structure Score Sheet* | | | | | |
|---|---|---|---|---|---|
| Objective | Score (1-5) | Importance (High, Medium, Low) | Average Score H | M | L |
| 1. Provides adequate revenues for investment and quality services | | | | | |
| 2. Allows stable and predictable revenues | | | | | |
| 3. Allows stable and predictable rates | | | | | |
| 4. Sends price signals that encourage efficient use of the services | | | | | |
| 5. Recognizes positive and negative externalities | | | | | |
| 6. Fairly apportions the total cost of service | | | | | |
| 7. Avoids undue discrimination | | | | | |
| 8. Encourages innovation and respond to changes in supply and demand patterns | | | | | |
| 9. Is simple to understand, facilitate convenience of payment and collection, and be acceptable to customers | | | | | |
| 10. Is free from controversy as to proper interpretation | | | | | |
| Average Score H, M, L | NA | NA | | | |

4. Example (Box 8)

| ***Box 8. Rate Structure Score Sheet (example)*** | | | | | |
|---|---|---|---|---|---|
| Objective | Score (1-5) | Importance (High, Medium, Low) | Average Score H | M | L |
| 1. Provides adequate revenues for investment and quality services | 5 | H | 5 | | |
| 2. Allows stable and predictable revenues | 4 | H | 4 | | |
| 3. Allows stable and predictable rates | 3 | M | | 3 | |
| 4. Sends price signals that encourage efficient use of the services | 4 | M | | 4 | |
| 5. Recognizes positive and negative externalities | 2 | L | | | 2 |
| 6. Fairly apportions the total cost of service | 4 | H | 4 | | |
| 7. Avoids undue discrimination | 3 | M | | 3 | |
| 8. Encourages innovation and respond to changes in supply and demand patterns | 4 | M | | 4 | |
| 9. Is simple to understand, facilitate convenience of payment and collection, and be acceptable to customers | 4 | H | 4 | | |
| 10. Is free from controversy as to proper interpretation | 3 | M | | 3 | |
| Scores H, M, L | NA | NA | 17 | 17 | 2 |

a. Box 9 provides an evaluation of the example in Box 8

Box 9. Score sheet example evaluation




B. Scoring may overly simplify evaluation of a rate structure, but it does provide a comprehensive format for analyzing the issues and comparing effects of alternative structures.

C. Evaluating how well a rate structure achieves objectives involves comparing the prices to costs.

1. This may be done implicitly by establishing incentives for the company to implement rate structures that achieve regulatory objectives.

2. Or it may be done explicitly by reviewing company rate structures and costs.

3. With either method, the measure of cost chosen affects the efficiency of the price.

## IX. Should Tariffs Be Required?

A. Definition

1. A tariff contains the schedule of prices charged by the company and the terms and conditions for service.

B. Tariffing requirements will often be covered by law or by concession agreements. In these cases, regulators may have no discretion on this issue.

C. When tariffs are useful

1. Protecting against price discrimination

2. Ensuring that prices in non-competitive markets are within the bounds allowed

3. Protecting against cross-subsidies

4. Ensuring that services are generally available under the approved terms and conditions

5. Providing public information on utility services and prices

D. When tariffs can be detrimental

1. Competitors use them as an opportunity for umbrella pricing

2. Markets are highly competitive and service prices are negotiated

3. They create opportunities for collusion

E. Tariff Approval Processes

1. Some regulators must review and approve the tariffs of service providers.

a. For example, in the case of Jamacian telecommunications, NTC has a monopoly over all domestic telecommunications and JAMINTEL has a monopoly over all international communications. If either company wants to adjust its tariffs, it proposes the new tariff to the Minister of Public Utilities and Transport. If the Minister accepts, the tariff goes into effect. If the Minister does not accept and the Minister's offer is not accepted by the company, then there is an arbitration procedure with the arbitrator having to set prices that provide after-tax earnings between 17.5% and 20%. The government cannot disallow investments.

b. In general in the US, companies propose tariffs to regulators. If the regulator accepts the tariff, it goes into effect. If the regulator rejects the tariff, the company may appeal to a court.

X. Other Issues: Cross-subsidization

A. Why it occurs

1. Promotion of industry -- Some countries have subsidized utility industries in the belief that this would lead to a competitive edge

2. Social reasons -- Services may be subsidized to make them more affordable to particular customer classes

3. Political reasons -- Subsidies may be designed to benefit some politically important group

4. Anti-competitive reasons -- Cross-subsidies may be used to protect markets from competition

   a. Companies have an incentive to cross-subsidize if it protects markets from competition. This may or may not be profitable. It is profitable if the cross-subsidy has to be repeated only infrequently because of reputation and/or if it keeps demand in core markets more inelastic than it would be otherwise.

   b. In general, these cross-subsidies are a regulatory issue only if they decrease competitive pressure and involve the leveraging of an incumbent, monopoly position.

B. Meaning of cross-subsidy

There has been some debate over what is meant by cross subsidy:

1. *The Public Policy View*. From a public policy perspective, anti-competitive cross-subsidization occurs in a regulated industry when the regulated firm is able to use revenues from non-competitive markets to hinder competition in other markets. Social cross-subsidization occurs when the regulatory pricing rules (or voluntary company actions) create cash flows between markets that would not occur absent the government policy and/or if markets were competitive.

2. *Everyday Use of the Terms.* In more general usage, cross-subsidization can mean several things. For example, if a service's prices do not make a reasonable contribution to overhead costs, it could be argued that the service is not carrying a fair share of the overheads and is therefore being subsidized. Another view is that companies with captive markets may be extracting subsidies from their competitors by charging competitors prices that greatly exceed their direct costs.

3. *The Baumol-Faulhaber View.* Baumol and Faulhaber have taken the view that cross-subsidization occurs when prices for a service do not cover the service's incremental cost and the company still earns a normal profit (i.e., zero economic profit) overall.

This implies a maximum price of stand-alone cost. This is a popular view among economists.

4. *A More Comprehensive Economic View*. More recent economic studies have shown that cross-subsidization occurs when prices for a service are higher than would be charged by the next most efficient competitor and the company still earns a normal profit. In other words, mark-ups (price minus total service incremental cost) for non-competitive services should be restricted to something comparable to the "mark-ups" competitive services would need if the firm were to cover all of its costs. Appendix B explains this concept and contrasts it with the Baumol-Faulhaber view.

XI. Other Issues: Universal Service Obligations and Stranded Costs

A. What is a USO?

1. USOs are outcomes that the government requires, and that would not occur in a fully competitive, non-regulated market. These outcomes generally take the form of regulatory or concession obligations to charge subcompetitive, non-cost covering prices in certain markets to further some social objective, or obligations to provide a level of service quality that customers are not willing to pay for.

B. The case of telephone rate rebalancing in the U.S.

The US has used a complex system of accounting cost allocations to keep local exchange telephone service prices (the US term for line rental) low while keeping telephone companies financially whole. This system contains several accounting practices, allocations, and prices that are generally referred to as subsidies:

- *Recording accounting costs on state-wide and/or company-wide bases rather than on a cost-center or market basis.* This causes accounting costs to be averaged across geographic areas and across customer classes.

- *Recording accounting costs on facility and function bases rather than on a product basis.* This causes accounting costs to be averaged across products and markets.

- *Allocating accounting costs for loops across services and jurisdictions.* This has resulted in charges such as the carrier common line charge that cause long distance services to subsidize local service.

- *Using targeted subsidies to small and/or rural LECs, to low income customers, and for calls with the hearing impaired.*

The traditional view in the US is that these subsidies are necessary for universal service and benefit small, rural, and residential customers. However, several studies have shown that the subsidies are, at best, too large or, at worst, counter productive. These studies examined a partial rate rebalancing that occurred in the US in the late 1980s and early 1990s. Most of the rate rebalancing resulted from the FCC shifting costs from long distance services to local services via a subscriber line charge. Some customers that were supposed to benefit from the old subsidies found the rebalanced prices more attractive than previous prices.

Hausman-Tardiff-Belinfante (1993) studied the effects of rebalancing local service and long distance prices from 1984 through 1990.[3] They concluded that decreases in long distance prices had a positive effect on household penetration that was three times the slight negative effect of increasing local rates.

Albery (1995) concluded that 38% of the increase in household penetration rates from 1985 through 1992 was caused by decreases in toll prices.[4] Stated another way, this decrease in toll prices accounted for 816,870 more households having telephone service.

Larson-Makarewicz-Monson (1989) showed that when the FCC rebalanced rates: (1) the average residential telephone bill went down $3.88 per month; (2) 44% of low income customers experienced a decrease in their total telephone bill; (3) of the 56% of low income customers that experienced an increase in their total telephone bill, the average increase was only about 5%; and (4) the average senior citizen's total telephone bill decreased $1.75 per month.[5]

C. Traditional funding is generally inconsistent with liberalization and technology changes

1. Cost-covering USO funding is required in order to prevent: (1) market distortion; and (2) undue financial harm to the provider with USOs.

2. The costs of USOs have traditionally been a non-issue. Governments imposed obligations on service providers and the funding of the obligations was implicit rather than explicit. That is to say, costs of these obligations were simply part of the overall cost of service and were covered by the overall revenues of the provider.

[3] Hausman, Tardiff & Belinfante, *The Effects of the Breakup of AT&T on Telephone Penetration in the United States*, 83 AM. ECON. ASSOC. PAPERS & PROCEEDINGS 178, 182-3 (1993).

[4] Albery, *What Level of Dialtone Penetration Constitutes "Universal Service"?*, 19 TELECOMMUNICATIONS POL'Y 365, 373-4 (1995).

[5] Larson, Makarewicz, and Monson, *The Effect of Subscriber Line Charges on Residential Telephone Bills*, TELECOMMUNICATIONS POL'Y 337-53 (1989).

3. This implicit funding of USOs created subsidies among customers. These subsidies flow along as many as four dimensions depending on the sector and country: (1) from large customers (primarily business) to small customers (primarily residential); (2) from premium services (such as long distance and international telephony) to basic services (such as local rentals and access lines); (3) from urban areas to rural areas; and (4) from future customers to present customers. The primary mechanisms to accomplish these subsidies have been charging higher prices for business services than residence services, allocating costs across services and geographic areas, and (in the case of RORR) slowing plant depreciation rates to postpone price increases.

    a. These subsidies may be used to benefit geographic areas, low-consumption customers, customers that fit particular consumption profiles (such as customers that drive peak demand or, in the case of telephone, customers that make international calls), system expansion, customers that have trouble paying bills on time, or particular consumer groups (such as elderly).

    b. Implicit funding of USOs has been possible primarily because the service providers (and in some instances their regulators) controlled all of the money and had all of the customers. Everyone that could affect the system was in agreement on how the monies should flow.

    c. Market liberalization and technology changes are now making implicit funding problematic if not impossible. Liberalization thwarts implicit USO funding because the associated competition, interconnection, and price regulation allow customers and competitors to bypass the traditional cost allocations and revenue sharing mechanisms. For example, a basic feature of competition is that companies target profitable customers. But with an implicit subsidy system, these "profits" that competitors pursue may actually be cash flows that the incumbent needs to cover USO costs.

3. Stranded Costs -- Market liberalization may result in some USO costs being stranded. Regulators may need to take steps to allow service providers an opportunity to recover these costs. This is covered in more detail below.

4. The case of electric industry restructuring.

    Hunt and Shuttleworth (1996) identified four models of electric industry restructuring.[6] Box 4 summarizes these models and shows where traditional subsidies may be retained and where new subsidy systems are needed.

[6] S. Hunt and G. Shuttleworth, *Competition and Choice in Electricity*, John Wiley & Sons: Chichester, 1996.

**Box 4. Effects of Electric Industry Restructuring on Traditional Subsidies**

| Model | Description | Effects on Subsidy System | |
|---|---|---|---|
| | | **Where Traditional Subsidies Can Be Kept** | **Where Traditional Subsidies Cannot Work** |
| *Model 1 - Monopoly* | Monopoly at all levels. | All levels | NA |
| *Model 2 - Purchasing Agency* | Competition in generation. Single buyer. | All levels as long as buyer specifies USOs to generators | NA |
| *Model 3 - Wholesale Competition* | Competition in generation. Choice for Distcos. | At all levels except generation as long as customers cannot resell power | Generation |
| *Model 4 - Retail Competition* | Competition in generation. Choice for final consumers. | Generally not possible except for collecting limited amounts of funding from monopoly wires. | Generation, competitive wires, and in monopoly wires at amounts that would make self generation economical. |

D. Historic versus Ongoing USOs

1. Historical USOs are USOs that have been fulfilled in the past. Examples include past requirements to charge unprofitable prices for some services, obligations to place facilities even though demand never materialized or was insufficient to cover costs, requirements to use depreciation rates that were slower than economic depreciation rates, and requirements to place technology before it was economical to do so. Past USOs are important if service providers have not had a reasonable opportunity to cover these costs. These costs are called sunk costs.

2. Ongoing USOs are USOs that involve special pricing and infrastructure deployment obligations either on an ongoing basis or at some future time. Examples include ongoing requirements to price some services at unprofitable levels, to maintain an uneconomic level of infrastructure in order to stand ready to serve, and to place an unremunerative technology in order to facilitate community or economic development. Ongoing USOs are important because service providers will need funds to cover the ongoing costs of these USOs.

E. Paying for Stranded Costs

1. What are *stranded costs*?

a. Stranded costs are costs that the company has incurred for historic USOs and that the company does not have a reasonable opportunity to recover given the introduction of competition.

2. The first question to answer is whether stranded costs, if they exist, should be paid by someone other than the shareholders (including taxpayers in the case of publicly owned enterprises). If the answer is "no," there is no issue to analyze.

a. One view is that having someone other than shareholders pay for stranded costs is unfair and inefficient

(1) Customers and competitors should not have to compensate incumbents for being less efficient than a competitive market.

(a) This argument assumes that all stranded costs are the incumbent's fault.

(2) Compensation discourages customers from choosing more efficient competitors.

(a) This problem can be remedied by applying a competitively neutral recovery mechanism. (See below.)

(3) Compensation discourages consumption of the service.

(a) This is true if the comparison is between a competitive market price and the price that includes compensation.

i) This effect can be minimized by putting the recovery rate on an a price inelastic component of the service; for example, on an access fee rather than a usage fee.

(b) This is untrue if the comparison is between the price with compensation and the price that would be charged under normal monopoly regulation.

(4) Compensation may create intertemporal subsidies

(a) The customers that pay for the recovery may not have been customers when the stranded costs were incurred.

(b) The shareholders that are compensated may have considered the stranded costs to have been lost when they purchased stock in the incumbent

(5) Incumbents benefit by receiving revenues in excess of economic costs.

(a) This is true. It is a market efficiency issue only if it protects the incumbent's financial position while either pricing aggressively or investing aggressively.

b. Another view is that having shareholders pay for stranded costs is unfair and inefficient

(1) Not paying for stranded costs will encourage inefficient competition

(a) This assumes that the incumbent is willing to lose customers rather than charge prices that do not include stranded costs. It is more likely that the incumbent will price to retain customers, subject to economic costs.

(2) Not paying for stranded costs discourages investment.

(a) This is true if investors view this as a credibility issue for the government and/or the regulator.

(3) Shareholders were not compensated for taking this kind of risk

(a) This is easier to assess if the company was recently privatized. What investors knew at the time of privatization can be determined. Asset valuation from the privatization can be compared to competitive market outcomes.

(b) Some analyze this issue by comparing cost of capital estimates before competition with actual earnings over the no-competition and competition periods (without stranded cost recovery). This is not valid. Cost of capital is affected by expectations of the future. These expectations included ranges of possible outcomes and the probabilities of these outcomes. Using actual earnings post liberalization assigns 100% certainty to the stranded cost outcome.

(4) Not paying for stranded costs confiscates shareholder property

(a) This is an issue primarily in countries with laws protecting private property from government confiscation

(b) Estimating stranded costs when the basic question is whether shareholder property is being confiscated involves answering five basic questions

i) How much of the cost of the historic USO has the company actually recovered?

ii) How much of this unrecovered cost was the fault of the government?

iii) How much of this unrecovered cost (that was the government's fault) does the company not have an opportunity to recover in the future absent some special action by the government?

iv) How much of this unrecoverable historic USO cost has been made unrecoverable by the government?

v) Who should have the burden of funding the amount that has been determined?

3. The formula for estimating stranded cost is:

Stranded cost = Sunk costs - Operating earnings from sunk assets

Operating earnings from sunk costs = Revenues from sunk-cost assets - avoidable costs

4. Estimating sunk costs

a. There are three views of how to determine this:

(1) Accounting process view

(a) This view says that the government's obligation was to allow accounting processes that result in accounting costs equaling economic cost. Any excess of accounting cost over economic cost is a historic USO cost that should be funded.

(b) This appears to be the dominant view.

(c) Simple to calculate if accounting records exist because it can be measured directly from the company's books. It includes:

i) Book value of plant net of book depreciation

a) This includes any deferred taxes, premiums paid on acquired debt, and deferred labor charges (such as retirement benefits)

b) It also includes nuclear decommissioning expenses and environmental cleanup costs associated with past activities which are more difficult to estimate

ii) Contracts (such as purchased power contracts) that the utility was required to enter into

(d) Ignores what the company or shareholders actually received

(2) Specific asset view

(a) This view identifies assets whose costs are not fully recovered, and which are now stranded

(3) Another alternative is to obtain an estimate of the market value of the assets. Privatization of assets may do this automatically.

(4) Under a confiscation framework, the regulator would have to ask how much of the sunk cost is the government's fault.

5. Estimating revenues from sunk assets

a. Present value of revenues that these assets will make possible

(1) Electricity generating facilities: electricity sales from these facilities

(2) Telecommunications local loops: revenues from customers using these loops

(3) Telecommunications switching: switching revenues from these switches

b. There is an estimation risk if this is a one-time calculation. This can be solved by using an ongoing calculation that cannot be manipulated by the company.

6. Estimating avoidable costs

a. Present value of the marginal costs of using the sunk assets

b. If avoidable costs exceed revenues from sunk assets, shareholders should bear the excess amount. This keeps stranded costs from exceeding sunk costs. It also gives the company incentives to not incur operating losses.

7. Recovering stranded costs

a. Who should have the burden of funding the stranded costs?

(1) Even if the regulator takes no action, the amount determined will be funded by someone. Even though funding USOs is not a zero sum game, it does distribute wealth and affects shareholders, customers, and competition.

(2) Potential funders include shareholders, taxpayers, customers of this company, customers of competitors, and competitors.

(a) Shareholders pay be default if no one else pays. It may be appropriate to charge shareholders if the historic cost of capital included payment for this risk. However, charging shareholders may affect the company's ability to attract financial capital for system upgrades and expansion.

(b) Taxpayers pay any amounts that are financed by government funds.

(c) Customers of this company pay if:

i) there is a general assessment against all customers, or

ii) competition is sufficiently weak to allow for super-competitive prices and the regulator also allows super-competitive prices

(d) Competitors and/or their customers pay if:

i) There is a general assessment against all companies/customers

ii) Competitors pay super-competitive interconnection prices

b. Standards for efficiency of recovery mechanisms[7]

(1) Mechanism should not affect customer choice of suppliers relative to the choices that would be made if there were no stranded costs to be recovered

(2) Mechanism should not encourage high-cost generators to operate instead of low-cost units

(3) Mechanism should not make it profitable for incumbents to underprice a new entrant that has lower costs

(4) Mechanism should encourage incumbents to lower stranded costs as much as possible

(5) Mechanism should be simple to administer

[7] Baxter, Hirst, and Hadley, *Who Should Pay Transition Costs?*, THE ELECTRICITY J. 68, 74 (June 1997).

# Appendix A

Sample Electric Company
Cost Structure and Other Data

| Line | Cost Measure | Annual Costs | (Note: These costs are based on demand levels shown below.) |
|---|---|---|---|
| 1 | Short Run Volume Sensitive Costs | $ 52,500,000 | |
| 2 | Long Run Volume Sensitive Costs | $ 51,453,359 | |
| 3 | Volume Sensitive Capacity Costs | $ 23,933,899 | |
| 4 | Industrial Customer-Specific Costs | $ 1,612,760 | |
| 5 | Other Customer Costs | $ 21,459,214 | |
| 6 | Shared Costs | $ 48,154,769 | |
| 7 | | ========== | |
| 8 | Total | $ 199,114,000 | |
| 9 | | | |
| 10 | | | |
| 11 | | System | |
| 12 | Other Data | Units | Residential | Commercial | Industrial |
| 13 | Peak Demand | 300,000 | 105,000 | 110,000 | 85,000 |
| 14 | Percent | 100.0% | 35.0% | 36.7% | 28.3% |
| 15 | Energy -- kWh | 1,500,000,000 | 640,000,000 | 500,000,000 | 360,000,000 |
| 16 | Percent | 100% | 42.70% | 33.30% | 24% |
| 17 | Numbers of Customers | 111,000 | 100,000 | 10,000 | 1,000 |
| 18 | Percent | 100.0% | 90.1% | 9.0% | 0.9% |
| 19 | Bad Debt | $ 4,000,000 | $ 3,600,000 | $ 400,000 | - |
| 20 | Percent | 100.0% | 90.0% | 10.0% | 0.0% |
| 21 | Energy Demand Elasticities | | -0.27 | -0.22 | -0.20 |
| 22 | Access Demand Elasticities | | 0 | 0 | 0 |

Illustrative Price Schedules

| Line | Item | Customer Type | Prices, Units, and Revenues: Uniform Tariffs — Short Run Marginal Cost Pricing | Uniform Tariffs — Long Run Marginal Cost Pricing | Two Part Tariffs — Short Run Marginal Cost Pricing | Two Part Tariffs — Ramsey Based | Two Part Tariffs — Fully Distributed Cost |
|---|---|---|---|---|---|---|---|
| 1 | *Consumption Charge* | | | | | | |
| 2 | | Residential | $ 0.035 | $ 0.069 | $ 0.035 | $ 0.131 | $ 0.141 |
| 3 | | Commercial | $ 0.035 | $ 0.069 | $ 0.035 | $ 0.164 | $ 0.110 |
| 4 | | Industrial | $ 0.035 | $ 0.069 | $ 0.035 | $ 0.190 | $ 0.099 |
| 5 | | | | | | | |
| 6 | *Sales* | | | | | | |
| 7 | | Residential | 640,000,000 | 470,644,945 | 640,000,000 | 166,121,366 | 640,000,000 |
| 8 | | Commercial | 500,000,000 | 392,192,963 | 500,000,000 | 93,958,014 | 500,000,000 |
| 9 | | Industrial | 360,000,000 | 289,435,394 | 360,000,000 | 40,639,557 | 360,000,000 |
| 10 | | **Total** | **1,500,000,000** | **1,152,273,302** | **1,500,000,000** | **300,718,937** | **1,500,000,000** |
| 11 | | | | | | | |
| 12 | *Consumption Revenue* | | | | | | |
| 13 | | Residential | $ 22,400,000 | $ 32,616,749 | $ 22,400,000 | $ 21,758,969 | $ 90,540,000 |
| 14 | | Commercial | $ 17,500,000 | $ 27,179,850 | $ 17,500,000 | $ 15,427,453 | $ 55,005,000 |
| 15 | | Industrial | $ 12,600,000 | $ 20,058,521 | $ 12,600,000 | $ 7,731,459 | $ 35,569,000 |
| 16 | | **Total** | **$ 52,500,000** | **$ 79,855,120** | **$ 52,500,000** | **$ 44,917,880** | **$ 181,114,000** |
| 17 | | | | | | | |
| 18 | *Access Fee* | | | | | | |
| 19 | | Residential | $ - | $ - | $ 809 | $ 530 | $ 96 |
| 20 | | Commercial | $ - | $ - | $ 4,830 | $ 1,329 | $ 640 |
| 21 | | Industrial | $ - | $ - | $ 21,364 | $ 8,796 | $ 6,000 |
| 22 | | | | | | | |
| 23 | *Access Numbers* | | | | | | |
| 24 | | Residential | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 |
| 25 | | Commercial | 10,000 | 10,000 | 10,000 | 10,000 | 10,000 |
| 26 | | Industrial | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| 27 | | **Total** | **111,000** | **111,000** | **111,000** | **111,000** | **111,000** |
| 28 | | | | | | | |
| 29 | *Access Revenues* | | | | | | |
| 30 | | Residential | $ - | $ - | $ 80,947,543 | $ 53,000,827 | $ 9,600,000 |
| 31 | | Commercial | $ - | $ - | $ 48,302,698 | $ 13,286,137 | $ 6,400,000 |
| 32 | | Industrial | $ - | $ - | $ 21,363,759 | $ 8,796,293 | $ 6,000,000 |
| 33 | | **Total** | **$ -** | **$ -** | **$ 150,614,000** | **$ 75,083,257** | **$ 22,000,000** |
| 34 | | | | | | | |
| 35 | *Total Revenue* | | | | | | |
| 36 | | Residential | $ 22,400,000 | $ 32,616,749 | $ 103,347,543 | $ 74,759,796 | $ 100,140,000 |
| 37 | | Commercial | $ 17,500,000 | $ 27,179,850 | $ 65,802,698 | $ 28,713,590 | $ 61,405,000 |
| 38 | | Industrial | $ 12,600,000 | $ 20,058,521 | $ 33,963,759 | $ 16,527,751 | $ 41,569,000 |
| 39 | | **Total** | **$ 52,500,000** | **$ 79,855,120** | **$ 203,114,000** | **$ 120,001,137** | **$ 203,114,000** |
| 40 | | Bad Debt | $ 4,000,000 | $ 4,000,000 | $ 4,000,000 | $ 4,000,000 | $ 4,000,000 |
| 41 | **Total Cost** | | **$ 199,114,000** | **$ 175,015,761** | **$ 199,114,000** | **$ 116,001,137** | **$ 199,114,000** |
| 42 | *Cost Covering?* | | *No* | *no* | *yes* | *yes* | *yes* |

Notes:

1 In this example, Short Run Marginal Cost Pricing covers energy costs only because tariff is uniform.
2 In this example, Long Run Marginal Cost for consumption covers energy and energy-related investment only.
3 In this example, the Short Run Marginal Cost Two-part Tariff places all but energy costs in access. Access prices are calculated as customer costs spread uniformly across all customers; industrial access prices assigned to access customers; 50% of shared and capacity costs assigned to residential, 40% to commercial, and 10% to industrial; and energy-related investment assigned based on total usage.
4 The Ramsey Based Two-part Tariff in this example allocates 50% of shared costs across usage based on long run marginal cost and demand elasticities. All other costs are in access.
5 Bad debt is covered in access fees in this example.

6 For FDC, this example shows no demand response because demand is based on historical units.

## Appendix B: Economic Definitions of Cross-Subsidy

### *Background*

Traditional economics has said that TSLRIC is an economically efficient price floor. This is too simplistic because it assumes that competitors are only able to reasonably produce subsets of the products provided (or potentially provided) by the company with captive customers.

This assumption is not appropriate for network industries. For example in telecommunications, it is technically feasible and reasonable for companies that look significantly different from the incumbent serve markets the incumbent wishes to be in or is in.

This appendix demonstrates that the conclusions of the traditional analysis are incorrect. This will be done through use of numerical examples.

### *The Traditional View*

The traditional view states that a company's prices are subsidy free as long as they are above TSLRIC and below stand-alone cost for all subsets of the company's products. For example, if company providing only local exchange telephone service has costs of $50 million, and by also providing cellular telephone service the company's costs are increased to $60 million, the TSLRIC of the company's cellular telephone service is $10 million ($60 million minus $50 million). "Stand-alone cost" is the total cost of producing a product by itself, or a group of products by themselves. In the example, the $50 million would be the stand-alone cost of local exchange telephone service. If the stand-alone cost of cellular service was $20 million, then prices for this company would be considered subsidy free as long as:

1. The revenues from cellular service are no greater than $20 million and no less than $10 million; and
2. The revenues from local exchange service are no greater than $50 million and no less than $40 million.

The "all subsets" provision in this definition means that, for example, if a company produces three products, its prices are subsidy free as long as: (1) each product covers its TSLRIC; (2) each product covers less than its stand-alone cost; (3) every group of two products covers the group's TSLRIC; (4) every group of two products covers the group's stand-alone cost; and (5) the company breaks even.

At a conceptual level, this view considers prices to be subsidy free as long as no set of customers was made worse off by the monopoly's prices than the customers would be if they received service from a smaller, more specialized company. One conclusion of this definition is that the assignment of joint and common costs has nothing to do with cross-subsidy. Another way of saying this is that the contribution that a product's revenues make to covering joint and common costs is irrelevant to determining whether a cross-subsidy is occurring.

This rule would change if the product purchases were linked -- i.e., if the sale for one product (e.g., access services sold to long distance companies) were dependent on sales of another product (e.g., local exchange service). In this case, incremental *revenues* -- not price -- would be compared to incremental costs.

### *More Comprehensive View*

More recent analyses have concluded that contributions to joint and common costs are important to defining cross-subsidy. These analyses have shown that the traditional view doesn't apply if it is possible for other companies to produce some portion of the monopoly's output in conjunction with other products that the monopoly does not produce. From this view, prices are not generally subsidy free unless all products and groups of products are making contributions to joint and common costs.

To illustrate, assume in the previous example that a long distance company could produce the cellular service for an incremental cost of $16 million or the local exchange telephone services for an incremental cost of $48 million. As a result of this, cellular prices from the local exchange company to be too high if they collected more than $16 million, and the local exchange telephone service prices to be too high if they exceeded $48 million. These ceilings are lower than the traditional ceilings of $20 million and $50 million respectively.

These new ceilings mean that the local exchange company's services price floors will include overhead costs. This is illustrated with the following calculations:

Price floor for cellular services:

| | |
|---|---|
| $60,000,000 | Total company cost |
| - $48,000,000 | Price ceiling for local services |
| $12,000,000 | Price floor for cellular |
| - $10,000,000 | TSLRIC for cellular |
| $2,000,000 | Cellular contribution to joint and common costs |

Price floor for local exchange services:

| | |
|---|---|
| $60,000,000 | Total company cost |
| - $16,000,000 | Price ceiling for cellular services |
| $44,000,000 | Price floor for local services |
| - $40,000,000 | Incremental cost for local services |
| $4,000,000 | Local exchange service contribution to joint and common costs |