# Telecommunications Regulation Handbook

Module 4

## Price Regulation

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infoDev

# Telecommunications Regulation Handbook

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# Telecommunications Regulation Handbook


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# MODULE 4

# PRICE REGULATION

## 4.1 Introduction

This Module discusses price regulation in the telecommunications sector. Before reading the Module, readers may want to review the section on the economic rationale for price regulation in the telecommunications sector that is found in Appendix B of the Handbook. As indicated in Section 1.1 of Appendix B, price regulation is normally justified when telecommunications markets fail to produce competitive prices.

In this Module, we look more closely at the specific objectives of price regulation and at the regulatory approaches used to achieve those objectives. The basic approaches to price regulation have evolved with the transformation of the telecommunications sector from monopoly to competition. As regulators have increasingly recognized the benefits of competition, they have adapted price regulation to take advantage of those benefits.

Today, price cap regulation is the most widely accepted form of price regulation in the sector. Because of its pre-eminence, a substantial part of this Module is devoted to price cap regulation. Before dealing with it, however, we discuss the objectives of price regulation and review other approaches to price regulation, particularly Rate of Return (ROR) regulation and its variations.

### 4.1.1 Objectives of Price Regulation

Good price regulation mimics the results of efficient competition. However, price regulation may have additional objectives. The objectives of price regulation may be grouped into three broad categories:

- Financing objectives;
- Efficiency objectives; and
- Equity objectives.

***Financing Objectives***

An important objective of price regulation is to ensure that regulated operators are permitted to earn sufficient revenue to finance on-going operations and future investments. The minimum amount of revenue associated with the financial objective is often referred to as the operator's "revenue requirement". To mimic the effect of a competitive market, the revenue requirement should ideally match the amount required by an efficient operator to finance its operations and investments. This aspect of the financial objective may be considered as setting a revenue "floor" for efficient operators.

Some traditional forms of price regulation, including Rate of Return regulation, do not allow operators to earn revenues in excess of their revenue requirements. This aspect of the financial objective is associated with preventing excessive revenues associated with monopoly or dominant market positions. It is discussed in greater detail in Sections 1.1 and 1.2 of Appendix B of the Handbook. This aspect of the financing objective, which may be considered a revenue "ceiling", has been relaxed under some specific conditions in other forms of price regulation, particularly price cap regulation.

***Efficiency Objectives***

It is generally accepted that price regulation should promote efficiency in the supply of telecommunications services. However, efficiency can be measured in different ways. Three main aspects of efficiency are discussed below.

**Allocative efficiency** is achieved when the prices of services reflect their relative scarcity. In an efficient market, prices will equal the marginal cost of producing each service. In the telecommunications sector, prices of international and long-distance services have traditionally been set significantly above their costs while local calls are priced below theirs. This is viewed as an example of allocative inefficiency. The above-cost pricing of international services discourages consumption of such services. On the other hand, pricing local calls below cost encourages consumption beyond the level at which local calls can be economically provided. A more detailed discussion of allocative efficiency is presented in Section 1.2 of Appendix B of the Handbook.

**Productive efficiency** has two related aspects. One aspect relates to the most efficient mix of inputs (capital, labour, etc.) for a given level of output. Some forms of price regulation can reduce productive efficiency. Rate of Return (ROR) regulation, for example, is generally viewed as encouraging operators to use an inefficiently high level of capital for its level of output. A second aspect of productive efficiency requires that the services be produced as efficiently as possible, that is by minimizing all inputs. The related concept of x-efficiency describes a situation in which an operator's costs are not minimized because the actual output from the given inputs is less than what could be achieved.

**Dynamic efficiency** is achieved when resources move over time to their highest value uses. Such uses include efficient investment, improved productivity, research and development, and the diffusion of new ideas and technologies. Dynamic efficiency involves the movement from one type of efficient use of resources to another type of efficient use of resources.

***Equity Objectives***

Equity objectives motivate many regulatory decisions on telecommunications prices. Equity objectives generally relate to the fair distribution of welfare benefits among members of society. Telecommunications regulators are primarily concerned with two different aspects of equity in the regulation of prices:

**Operator-consumer equity** relates to the distribution of benefits between consumers and the regulated operator. For instance, many people would not consider it equitable that monopoly operators be allowed to earn high profits for an extended period of time without improving or extending service. In this regard, the aim of many regulators is to ensure that the savings that result from improved technological innovations are shared equitably between the operator and consumers. Price cap regulation includes a mechanism for consumers to share in these productivity gains.

**Consumer-consumer equity** relates to the distribution of benefits between different classes of telecommunications consumers. For example, in Colombia, consumers in lower socio-economic brackets pay less for the same local telephone subscription services than consumers in higher brackets. This approach implements a government policy aimed at improving consumer-consumer equity.

***Balancing the Objectives of Price Regulation***

The main challenges of price regulation involve the design and implementation of low-cost and effective regulatory approaches that induce the regulated operator to achieve the socially desirable objectives discussed above. Regulation imposes a burden on the economy in the form of direct costs to telecommunications operators for enforcement and compliance. It may also place indirect burdens on consumers in the form of loss of choice of operators and/or services. A practical objective in the design of price regulation approaches should be to impose the least burden necessary to achieve their purposes. At a minimum, benefits of price regulation should justify its costs.

In practice, there is often disagreement over telecommunications price regulation because the three broad regulatory objectives, financial, efficiency and equity, can conflict with one another. Some people will place more importance on one objective than others. This means that the regulator will often have to make trade-offs between these objectives in the course of implementing price regulation.

### *4.1.2 Rate Rebalancing*

This Section contains a brief discussion of price rebalancing, or rate rebalancing, as it is more frequently called. This important topic is dealt with in greater detail in Appendix 4-1 of this Module.

The term "rebalancing" refers to moving the prices for different telecommunications services more closely in line with the costs of providing each service. Currently, telecommunications price structures in many countries are highly unbalanced, with some services priced well above costs and others below costs. Telecommunications costing is discussed in detail in Section 1.4 of Appendix B of the Handbook

Prices of telephone connections, monthly subscriptions, and local calls have traditionally been set below costs in many countries. Resulting deficits have been subsidized by higher-than-cost long distance and international calling prices. Some of the historical reasons for these traditional pricing structures are discussed in Section 4.2.2.

Unbalanced price structures are not sustainable in a competitive environment. New competitors will generally enter those market segments where profit margins are highest, such as long distance and international calling. Incumbent operators will therefore be under pressure to reduce subsidies or risk losing customers in the more profitable market segments. Traditional unbalanced price structures are also inefficient in that higher-than-cost prices encourage uneconomic entry by high-cost operators. Lower-than-cost prices discourage economic entry, even by low-cost operators.

Costs of different telecommunications services have been decreasing at different rates as a result of technological developments. This has further unbalanced telecommunications prices. Where telecommunication markets are open to competition, prices of different services will tend to move towards their costs. However, in monopoly or non-competitive environments they may not, and the regulator may be required to take steps to ensure that prices are more closely aligned with costs. Efficient monopoly pricing, and related matters, such as Ramsey Pricing, are discussed in Sections 1.1 and 1.2 of Appendix B of the Handbook.

A significant amount of rate rebalancing has occurred in many industrialized countries in recent years. Comprehensive price comparisons have been conducted by the OECD for its 29 member countries since 1990. The effects of rebalancing calls in member countries is presented in Figure 4-1. As this figure illustrates, since 1990, the average price of local calls in OECD countries has risen by more than 30%. In contrast, the average price of long distance calls (110 km and 490 km calls) has decreased by about 30% over the same period.

Figure 4-2 shows the effect of rebalancing on prices for business services. Over the 1990-1998 period, fixed charges (connection and subscription) increased by over 20% and usage charges decreased by over 20%, for an overall weighted reduction of about 12%. Note that overall teledensity in the OECD countries has increased steadily, despite rebalancing. The relationship between rebalancing and consumer welfare is discussed further in Module 6.

These two figures and those contained in Appendix 4-1 indicate that rate rebalancing has produced lower overall prices for most consumers in a majority of the countries surveyed. However, this is not the only benefit of rebalancing. Rate rebalancing will also increase social welfare by moving prices closer

**Figure 4-1: Index of OECD Tariff Rebalancing by Distance, including Local Calling**

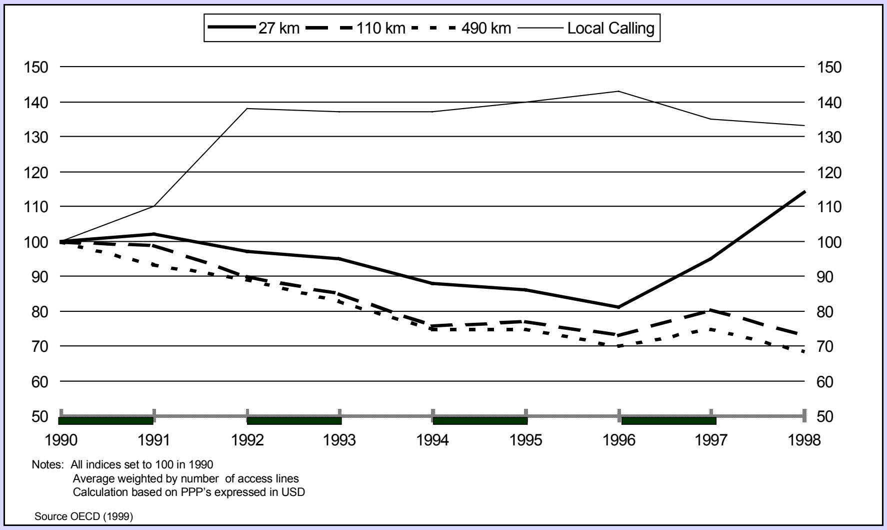
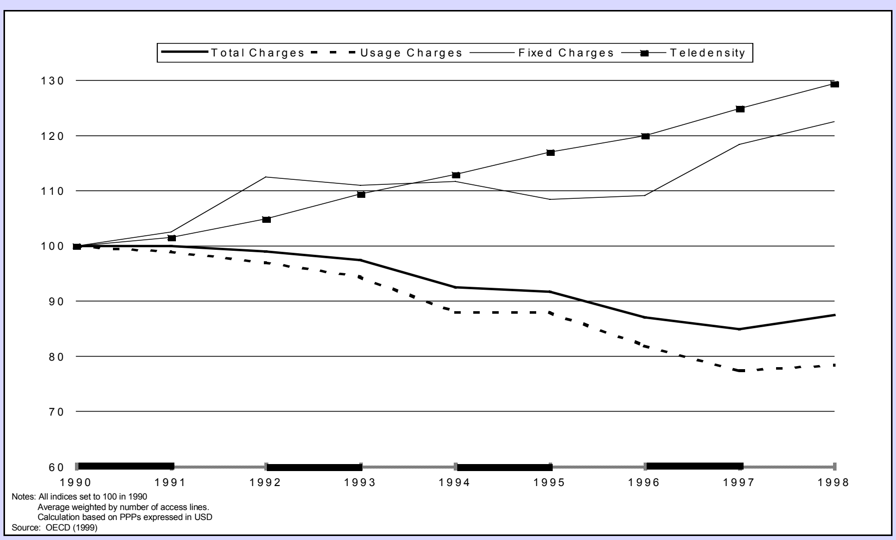



**Figure 4-2: Index of OECD Business Charges and Teledensity**



to costs. This is illustrated in more detail in Appendix 4-1, and in other studies that have examined rebalancing in different countries. Rate rebalancing will provide benefits to the economy in addition to producing lower overall prices. Therefore, there is a strong case to be made for rate rebalancing, with our without the introduction of competition.

## *4.2 Approaches to Price Regulation*

### *4.2.1 Introduction*

Different approaches have been developed over the years to regulate telecommunications prices. Some, involving rules-based approaches, are designed to provide stability and certainty, as well as achieving regulatory objectives. Others have been more *ad hoc* and discretionary.

This Section begins with a discussion of two common pricing approaches: traditional discretionary price setting and Rate of Return regulation. This Section is followed by a discussion on incentive regulation. In our analysis we consider how well the three approaches achieve the broad objectives of price regulation: namely the financing, efficiency, and equity objectives.

### *4.2.2 Discretionary Price Setting*

Traditionally, in many countries, price regulation was focussed heavily on social objectives as well as financial or economic ones. This was particularly true where the government operated the telecommunications network. Under such circumstances, prices were usually set to promote consumer-to-consumer equity objectives. In many countries, there was little or no analysis of the economic impacts of such policies.

Where discretionary price regulation existed, or continues to exist, it is usually characterized by below-cost prices for connection, subscription and local calls. The shortfall is made up by higher-than-cost international call prices, and sometimes also high long-distance prices.

The frequently-stated objective of this type of pricing is to promote affordability of basic telephone services. This type of pricing may also incorporate the value of service principle. Simply stated, this principle assumes that a prospective buyer will pay a price that is related to the value derived from the service and that telephone services are more valuable to some classes of customers than to others. Accordingly, businesses are often charged more than residential customers for the same connection and subscription services. It is assumed that businesses are major users of international and long-distance services, and that they value such services highly. Accordingly, higher rates are charged for such services.

Discretionary price regulation approaches in many countries were interventionist. Often the government or the Minister in charge would micro-manage the PTT's pricing structure, severely reducing its ability to function as a normal business enterprise. In some cases, telephone prices were increased to make up government budget deficits, without extensive consideration of the economic or social impacts of such increases.

In some countries, traditional discretionary price regulation failed to generate enough revenue to pay the operating costs of the incumbent operator or to support network upgrades and expansion. As a result, the operator's revenue requirement and the financial objective of regulation were sometimes not met.

In some jurisdictions, telephone revenues of state-owned operators were treated as part of general government revenues. Expenditures of the state-owned operator, including those for investments, are included in the general government budget. Poor government fiscal management made it impossible to meet a PTT's revenue requirement. Such an arrangement deprives the operator of the capital required to upgrade its network. It can also reduce the incentive for the operator to innovate and reduce costs, which hurts the dynamic efficiency objective. In practice, such operators often have poor performance and over-staffing, which means that the productive efficiency objective is not met either.

Long-term capital investments should make up a large part of the costs of a telecommunications operator. However, cash-strapped governments sometimes extract cash from state-owned operators to finance other government priorities. This has been more common where there was no explicit rules-based regulatory regime that requires prices to be set to meet a revenue requirement calculated to include long-term capital investments. Enough cash may be left for the operator to meet its day-to-day operating requirements, but not enough to upgrade or expand the network.

Where this has happened, the result has been an undersupply of telecommunications services and waiting lists for service. In some countries, telecommunications prices have been increased solely to meet general government revenue requirements, without regard to the specific revenue requirement of the telecommunications operator. Instead of improving telecommunications service, the proceeds of telephone rate increases have sometimes been used to meet a wide range of other government priorities, from subsidizing postal services to paying the armed forces.

In some cases, it is said that local telephone rates are kept at low levels to maintain affordability of services for low-income subscribers (i.e. to meet consumer-consumer equity objectives). In reality, however, the initial telephone users in most emerging economies are not the poor. With low prices, the relatively privileged group of telephone users end up paying much less than it can afford. At the same time, the operator cannot expand the network to provide service to other users. This undermines the operator-consumer equity and consumer-consumer equity objectives. As a result, most of the poor households, especially in rural areas, receive no subsidy at all because they have no access. In summary, experience has shown that discretionary price setting approaches have seldom achieved their social or economic goals, at least on a long-term basis.

Traditional discretionary price setting approaches have usually resulted in inefficient price structures. Table 4-1 summarizes the main differences between prices that typically result from discretionary price setting and the types of cost-oriented prices that would result from competition.

A detailed discussion of telecommunications costs is provided in Section 1.4 of Appendix B.

### *4.2.3 Rate-of-Return Regulation*

Rate of Return (ROR) regulation is a rules-based form of price regulation. Unlike discretionary price setting, ROR regulation provides an operator with relative certainty that it can meet its revenue requirement on an ongoing basis. The essence of ROR regulation is simple. First, the regulated operator's revenue requirement is calculated. Then the operator's individual service prices are adjusted so that its aggregate service revenues cover its revenue requirement.

In calculating the revenue requirement, the regulator first reviews the operating costs and financing (e.g. debt service) costs. Typically there is some regulatory scrutiny to ensure that the costs were necessarily and prudently incurred in order to provide the regulated services. If not, they may be disallowed from the "rate base". The operator will not be entitled to increase its prices or rates to recover such disallowed costs.

The next step in calculating an operator's revenue requirement is to determine its rate of return. In order to allow the operator to remain financially viable, and to attract new capital for its operations, ROR regulation permits the operator to recover not only its direct operation and financing costs, but also a fair return on its rate base. The regulator determines an appropriate rate of return on capital for a given time period (typically one to three years). This return is generally based on a review of financial market conditions, plus any additional operator or industry-specific issues (industry or operator risk, operator specific taxation issues, etc.).

Based on the approved rate of return, a revenue requirement is calculated (i.e. total revenues that may be generated in a given period). The revenue requirement is to be recovered from the sum of all services provided. If an operator earns more than its allowable rate of return, the regulator will require price reductions to bring the operator's rate of return down to the allowable level. Conversely, if the operator does not meet its allowable rate of return, it will request price increases to raise its revenues.

**Table 4-1: Typical Result of Discretionary Price Setting**

| Service | Discretionary Price Setting | Efficient Cost-oriented Pricing |
|---|---|---|
| Connection | Very low price: typically below $50. Waiting list used to ration demand. | Related to the incremental costs of providing the line. |
| Subscription | Relatively low price: typically below $3/month. Network congestion used to ration demand. | Related to the incremental costs of local service, including the local exchange switch and the "local loop" portion of the network. Local service costs vary significantly across different service areas, based on density and other factors. Higher charges levied on businesses due to their higher demands for maintenance and service quality. |
| Local Calling | Very low, unmetered or non-existent local call charges. | Calls charged per minute and in some cases with additional call set-up surcharge. Discounts for off-peak calling and special promotions. |
| Domestic Long-distance Calling | High charges with multiple call zones. Longest distance typically charged at a multiple of 20 or more times local call rate. | Calls charged per minute with possible reductions for duration of call. Discounting during off-peak periods. Ratio between longest-distance call and local call in range of five to one or less. Tendency to distance-insensitive or "postalized" prices. |
| International Calling | Generally very high, especially to distant countries. Accounting rates kept high and number of outgoing circuits kept low to generate net settlement payments. | Calls charged per minute with possible reductions for duration of call. Discounting during off-peak periods. Ratio between international and national calls typically in excess of 3 to 1, but coming down due to accounting rate reform. |

Source: Adapted from ITU (1998a)

ROR regulation is designed to equate an operator's total revenues with its total costs. It is generally not designed to equate revenue for any particular service to the cost of that service. As a result, it does not specifically address the structure of prices. In practice, where ROR regulation is applied, the structure of prices generally tends to fall somewhere between cost-oriented prices and the prices that result from discretionary price setting.

***Weaknesses of ROR Regulation***

The weaknesses of ROR regulation are summarized in Box 4-1. The main weakness is that it does not provide operators with a strong incentive to operate efficiently by reducing their operating costs. They can usually recover most if not all of their costs through rate increases, and they are not permitted to retain additional profits earned by reducing their costs. As a result, ROR regulation does not promote the efficiency objectives of price regulation as well as other forms of regulation.

The perceived inefficiencies of ROR regulation must be put into perspective. The reality is that operators in some industrialized countries performed relatively well under ROR regulation for nearly a century, taking advantage of gains in technology and sharing the benefits with their customers in the form of lower prices. Nevertheless, because of the identified weaknesses, many regulators in industrialized countries have been introducing forms of incentive regulation instead of ROR regulation.

Concerns about the inefficiencies of ROR regulation arose in industrialized countries after extensive networks had been constructed. The most important objective in many developing countries is to build network infrastructure to meet unsatisfied demand.

**Box 4-1: Weaknesses of Rate of Return Regulation**

**Lack of Incentive to Minimize Costs**

- In ROR regulation, the operator's prices are set at a level sufficient to cover its costs. This is why ROR regulation is often referred to as "cost plus regulation". From a dynamic perspective, therefore, the operator has little incentive to reduce its rate base or its operating costs. In competitive markets, where the market determines price levels, an increase in costs will reduce profits. Therefore cost containment is a major objective of operators in a competitive market.

**Lack of Innovation/Productivity Improvement**

- Over time, ROR regulation of a monopoly operator will lead to a lower rate of productivity improvement than would occur under effective competition. ROR regulation does not provide the operator with a strong incentive to increase its productivity.

**Capital Bias – The Aversch-Johnson Effect**

- ROR regulation provides incentives to increase the amount of capital that the operator invests. The higher the capital expenditure, the higher the rate base, and the greater the total return the operator can earn. It therefore encourages the operator to use an inefficient input mix. The operator will have an incentive to use an inefficiently high capital/labour ratio for its level of output. This result is often referred to as the Aversch-Johnson effect, named after two economists who described it. The effect is an indication that productive efficiency is not being maximized.

**Cost of Regulation**

- ROR regulation requires the operator and the regulator to spend significant amounts of time and money. The rate base must be repeatedly calculated by the operator and reviewed by the regulator, the cost of capital must be recalculated, and so on. Rate reviews or hearings must be held on a regular basis, incurring costs to the regulator, the operator, and other participants in the process.

**Interventionist Nature of ROR Regulation**

- The regulator is required to review many aspects of the operation and management of the firm in a detailed manner. This includes scrutiny to prevent rate base "padding". Over time, this type of detailed regulation may place a regulatory burden on the firm that impedes its ability to function as a normal business enterprise.

**Inadequacy for Transition to Competition**

- ROR regulation operates relatively slowly, and generally does not allow operators the pricing flexibility they need to respond to competitors' actions.
- The introduction of competition in some parts of the telecommunications sector, combined with continuing ROR regulation in monopoly segments, means that vertically-integrated operators have an incentive to engage in anti-competitive practices (e.g. anti-competitive cross-subsidization).

This will typically require a very large capital investment. As a result, the concern about ROR regulation emphasizing capital investment is not as significant a concern in developing countries. The political and economic environment in many developing countries minimizes the differences between ROR and incentive regulation. In fact, any economically sustainable form of rules-based price regulation would be preferable to the *ad hoc* forms of discretionary price setting currently practised in some developing countries.

### 4.2.4 ROR-Incentive Regulation

The term ROR-incentive regulation is generally used to describe variations on ROR regulation that were developed in different US states to respond to perceived weaknesses in traditional ROR regulation. ROR-incentive regulation has enjoyed limited popularity in other parts of the world.

Incentive regulation provides inducements and penalties that encourage an operator to meet regulatory goals.

The different types of incentive regulation generally share the following elements:

- The operator often participates in setting goals or performance targets.
- The operator is given more flexibility than under traditional ROR regulation. The regulator typically does not prescribe specific management actions. For example, the operator may be rewarded for reducing its operating costs but not told exactly how to reduce these costs.
- The regulator restricts some activities of the operator.
- Rewards and penalties established by the regulator motivate the operator to perform efficiently.

### 4.2.5 Types of ROR-Incentive Regulation

In this Section, we summarize some of the incentive-based regulatory schemes that have been implemented in the US telecommunications industry. These forms of regulation typically replace traditional ROR regulation.

#### Banded Rate-of-Return

Under this form of incentive regulation, regulators establish a range (or band) of authorized earnings. Prices are set to generate earnings that fall within the authorized range. When only a narrow band of earnings is permitted, the operator's incentives are similar to those created by traditional ROR regulation. A broad band of earnings can create stronger incentives for the operator to reduce operating costs and improve operations. For instance, rather than set the rate of return at 12%, the operator might be allowed a return of between 10% and 14%.

#### Rate Case Moratoria

Rate case moratoria can be implemented by agreements between a regulator and an operator to suspend regulatory scrutiny of the operator's earnings for a fixed period. This form of incentive regulation is often used at the beginning of a transition to price cap regulation. It gives the regulated operator an incentive to lower operating costs, since it may retain higher earnings during the transition period.

#### Earnings-Sharing

Under an earnings-sharing plan, the operator may retain higher earnings. However, earnings in a specified range are shared with consumers. Typically, these plans are set up with different sharing ranges based on a prescribed ROR. These sharing ranges can differ substantially from plan to plan. In one example of this type of plan, the regulated operator keeps 100% of the earnings up to 10%, the operator and consumers split earnings between 10% and 14%. The operator's earnings are capped at 14%.

## 4.3 Price Cap Regulation

### 4.3.1 Overview

This Section provides an overview of price cap regulation, which is the preferred form of rules-based price regulation around the world today.

Price cap regulation uses a formula to determine the maximum allowable price increases for a regulated operator's services for a specified number of years. The formula is designed to permit an operator to recover its unavoidable cost increases (e.g. inflation, tax increases, etc.) through price increases. However, unlike ROR regulation, the formula does not permit the operator to increase rates to recover all costs. The formula also requires the operator to lower its prices regularly to reflect productivity increases that an efficient operator would be expected to experience.

Price cap regulation has several advantages over ROR regulation:

- It provides incentives for greater efficiency;
- It streamlines the regulatory process;
- It provides greater pricing flexibility;
- It reduces the possibility of regulatory intervention and micro-management;
- It allows consumers and operators to share in expected productivity gains;
- It protects consumers and competitors by limiting price increases; and
- It limits the opportunity for cross-subsidization.

For these advantages to materialize, price cap regulation must be implemented in an effective and internally consistent manner. We discuss some of these implementation challenges in the Sections below.

Price cap regulation is meant to provide incentives that are similar to competitive market forces. Competitive forces require operators to improve productivity and, after accounting for unavoidable increases in their input costs, pass these gains on to their customers in the form of lower prices. The price cap formula has a similar effect.

Price cap regulation is a means to regulate prices over time. The price cap formula determines the rate of change in prices from an initial level. The initial level of prices may be set by the regulator (see Section 4.1.2). Alternatively, the regulator may establish a transition period at the end of which the regulated operator must reach target price levels or ranges (see Section 4.4.5). Future financial performance for a price cap regulated operator formulae is highly dependent on the initial price levels. Therefore, it is critical for the regulator to ensure that the initial level of prices are consistent with the operator's revenue requirement.

### *4.3.2 The Basic Price Cap Formula*

There are a number of ways to express the price cap formula. In its simplest form, a price cap formula allows an operator to increase its rates annually by an amount equal to an inflation measure, less an amount equal to the assumed rate of productivity increase. A simplified very basic price cap formula is set out in Box 4-2.

It can be seen from this simple example that operators may increase their prices to include the effects of inflation, but no more. Inflationary cost increases of 5% may be passed on because it is assumed that the operator cannot control them. However, the example also assumes that telecommunications industry productivity will increase by 3%. Such productivity increases result from technological improvements, lower switching and transmission costs, and many other factors. Therefore, in the above example, the operator must pass on a productivity benefit to its customers by lowering its year 2001 prices by 3%.

In this example, the operator may reap the benefits of any measures it takes to reduce its costs below 3%. If the operator has been very efficient, it may

**Box 4-2: Simplified Basic Price Cap Formula**

Allowable price increase for a year = Starting Price + I – X

Notes:

(1) I = Inflation Factor for the year

(2) X = Productivity Factor

(3) These factors are discussed in greater detail in later Sections of this Module

Example:

In year 2000, the price is 100

I = 5

X = 3

Therefore, the allowable price increase for 2001 equals 100 + 5 – 3 = 102 have reduced its actual costs by 10%. In such a case, the operator may retain the benefits of lowering its costs from the assumed 3% productivity factor to 10%. The additional earnings which result from such efficient operations may be retained as profits to shareholders or used for other purposes, such as new investment. The earnings could also be used to reduce prices further, for example to meet competition. However, such additional reductions will not be required by the regulator. The price cap formula determines the maximum required price decreases.

#### *4.3.2.1 Price Indices and Weights*

The sample price cap formula in Box 4-2 is highly simplified. In practice, telecommunications operators do not offer a single service at a single price. They offer a range of different services at different prices. A typical price cap formula will, therefore, generally use an index of the prices charged by an operator and not a single price. In such cases, the operator will be required to keep its actual prices below a Price Cap Index (PCI).

In developing indices for a price cap formula, prices of different services are weighted so that the prices for major services receive a proportionately greater weight. Consider a simple example, where an operator provides only two services, local service and international service. An index of the operator's actual prices (Actual Price Index or API) can be developed for this operator using service revenues as weights. For example, assume that local service accounts for 75% of the operator's revenues, and international service accounts for 25%. The same proportions ("weights") will be used to determine whether the operator's API exceeded the price cap, or PCI.

Let us use the same price increase assumptions as described in Box 4-2. In the year 2001, prices will be allowed to increase from 100 to 102. Therefore, let us assume that 102 is the PCI. To determine whether the operator's actual prices in 2001 exceed the PCI of 102, we must compare that PCI to the API. Box 4-3 contains examples comparing the operator's API for 2001 to its PCI of 102.

These simple examples illustrate the following basic features of price cap formulae that are based on indices:

- ➢ The actual prices of the operator (as measured by the API) may not exceed the price cap for the year (as measured by the PCI).
- ➢ The operator has pricing flexibility; some prices may be increased above the weighted average of the change in prices, as long as others are not.
- ➢ Prices for services with heavier weightings in an index will affect the index more. Therefore, prices for major services (measured by revenues) may not be increased as much as prices for less significant services.

#### *4.3.2.2 Basic Indexed Price Cap Formula*

Box 4-4 restates the basic price cap formula using the concept of price indices described above. The formula assumes that prices will be calculated for each year. The symbol "t" is used in the formula to represent the appropriate time period (e.g. a year). In practice, different time periods can be used instead of years.

The factors I and X which are used in the formula set out in Box 4-4 are discussed in greater detail in later Sections of this Module.

#### *4.3.2.3 Service Baskets*

Under price cap regulation, services are usually grouped into one or more service baskets. Different service baskets may be subject to different price cap indices.

For example, a residential service basket might be developed to limit price increases affecting residential consumers. This basket might include local residential connection charges, monthly subscription fees, and local and international usage charges. A separate basket might include services used by typical business customers.

**Box 4-3: Using Price Indices - Simplified Calculation of API**

Basic Price Cap Rule: API ≤ PCI

i.e. the Actual Price Index (API) for the year 2001 must be equal to or less than the Price Cap Index (PCI) for 2001. The objective of this example is to calculate the API for year 2001 and determine whether the proposed price changes comply with the Basic Price Cap Rule. The API for year 2001 is the product of the API for year 2000 and the weighted average of the change in prices from 2000 to 2001.

Notes:

(1) Set the API, the PCI and all prices equal to 100 in year 2000

(2) Year 2001 PCI = 102 (i.e. a 2% increase over year 2000)

(3) Indices are weighted by revenues

(4) The operator provides only 2 services:

(a) Local Services = 75% of revenues

(b) International Services = 25% of revenues

(5) The weighted average of the change in prices is the sum of the following calculation for each service: the change in prices (expressed as the division of year 2001 price by year 2000 price) multiplied by the respective revenue weight (expressed as the division of service revenue by total revenue).

Example A:

| | | |
|---|---|---|
| Proposed price changes: | Local price increases by 1% from year 2000 to 2001 (100 to 101) | |
| | International price increases by 4% from year 2000 to 2001 (100 to 104) | |
| Weighted average of the change in prices: | Local service: 1.01 x 0.75 | = 0.7575 |
| | International service: 1.04 x 0.25 | = 0.2600 |
| | Total: | = 1.0175 |

Since the API for 2000 was 100, the API for 2001 is the product of 100 and the weighted average of the change in prices, i.e. 100 x 1.0175 = 101.75. Therefore API < PCI (i.e. 101.75 is less than 102). Since the proposed year 2001 prices are less than the PCI, no additional price reductions would be required by the regulator.

Example B:

| | | |
|---|---|---|
| Proposed price changes: | Local price increases by 4% from year 2000 to 2001 (100 to 104) | |
| | International price increases by 1% from year 2000 to 2001 (100 to 101) | |
| Weighted average of the change in prices: | Local service: 1.04 x 0.75 | = 0.7800 |
| | International service: 1.01 x 0.25 | = 0.2525 |
| | Total: | = 1.0325 |

Since the API for 2000 was 100, the API for 2001 is the product of 100 and the weighted average of the change in prices, i.e. 100 x 1.0325 = 103.25. Therefore API > PCI (i.e. 103.25 is greater than 102). Since the proposed year 2001 prices are higher than the PCI, the proposed prices would not be approved by the regulator. The regulator would require that prices must be reduced further.

**Box 4-4: Basic Price Cap Formula Using Indices**

Price cap regulation requires:

$$API^t \leq PCI^t \text{ for all } t$$

That is, the API for a particular time period must always be less than or equal to the PCI for that period. From year to year, the PCI is adjusted according to the following formula:

$$PCI^t = PCI^{t-1} \times (1 + I^t - X)$$

i.e. the PCI for a given year (*t*) will be equal to the PCI for the previous year (*t*-1) multiplied by 1 plus the Inflation Factor for year *t* ($I^t$) minus the Productivity Factor (X).

Notes:

(1) $API^t$ means the Actual Price Index at year *t*. The API is a weighted average of the change in prices actually charged by the operator.

(2) $PCI^t$ means the price cap index at year *t*. The PCI is a weighted average of the change in the maximum allowable prices of the operator.

(3) $I^t$ is the inflation factor at time *t*.

(4) X is the productivity factor.

(5) It is common to express $I^t$ and X in percentage terms especially when referring to them outside the context of actual price cap calculations. Note, however, that in the price cap formulae these variables are expressed in decimal, not percentage terms.

Example

Using the same PCI assumptions as described in Box 4-2 and Box 4-3, in a period where the inflation factor is 5% and the productivity factor is 3%, the maximum amount that the weighted average of the change in prices would be permitted to increase would be by 2%.

i.e. The formula $PCI^t = PCI^{t-1} \times (1 + I^t - X)$ produces the following result: 102 = 100 x (1+.05 -.03)

There may also be restrictions on the absolute or relative movement of prices for services subject to price cap regulation. Operators may change prices for individual services within the baskets as long as the API for the services in the basket complies with the price cap formula, and as long as no individual service pricing restrictions are breached.

An example of an individual service pricing restriction is a rule that no price for an individual service may increase by more than 10% per year. Such restrictions may be applied, for example, to limit the impact on residential consumers of rate rebalancing. The concepts of service baskets and individual restrictions are discussed further in Sections 4.3.7 and 4.3.8 of this Module. Service baskets may also be used to restrict or prevent the cross-subsidization of service open to competition (e.g. domestic and international long distance) by monopoly services (e.g. access and local calling).

### *4.3.3 Calculating Price Cap Variables: Looking Ahead or Back*

The basic price cap formula contains a number of variables that must be calculated. To mimic the workings of competitive markets, the price cap formula should ideally be forward-looking. Variables such as the inflation (I) and productivity (X) factors, and the weights used to calculate the indices should ideally be determined based on expected future values.

In practice, however, the majority of regulators only set the productivity factor based on future values. The inflation factor and index weights are determined based on the most recent available historical data.

There are a number of practical reasons for setting the inflation factor and index weights based on historical data:

- In many economies, past inflation performance is a good predictor of future inflation.
- The process of forecasting inflation and the demand and revenue variables needed to forecast weights is complex, time consuming, and subject to controversy and possibly manipulation.
- A forecasting approach may necessitate corrections to offset the effect of forecasting errors, thus adding complexity and regulatory uncertainty.

Basing the inflation factor and weights on historical data also has disadvantages. For instance, future inflation may vary significantly from past inflation. This disadvantage may be mitigated by increasing the frequency of adjustments to the inflation factor, or by establishing trigger mechanisms as discussed below.

In principle, index weights may be based on costs or revenues. Cost weights are generally considered to be the more theoretically correct choice, but reliable forward-looking costing data is often not available. In practice, therefore, most regulators have chosen revenue weights to calculate the aggregate indices in the price cap formula. Regulators should be especially vigilant in the choice of weights when prices are not balanced and heavy cross-subsidization exists. In this type of scenario there may be significant differences in the cost and revenue weights and use of the latter may bias the calculation of the API.

Another approach is to set fixed weights that do not vary from period to period. This approach is administratively simpler and limits any possibility for the operator to manipulate the price cap formula by setting prices strategically. Setting weights based on forward-looking cost benchmarks is one possible alternative under this approach.

### *4.3.4 The Inflation Factor*

The price cap formula includes an inflation factor to account for changes in input costs of the operator. For example, holding all the other variables constant, a 5% inflation factor would allow a regulated operator to increase its average prices by 5%.

#### *4.3.4.1 Selection Criteria*

In most economies, a number of different indices are used to measure inflation. For example, a consumer price index or retail price index (CPI or RPI) measures changes in the prices of goods and services purchased by typical consumers (e.g. food, passenger transportation, residential electrical power, etc.). A Producer Price Index (PPI) measures changes in the prices of goods and services purchased by different types of production industries (e.g. prices for labour, freight transport, industrial electrical power, etc.).

In developing a price cap formula, regulators must select an appropriate inflation factor (I). A choice may be made from among existing inflation indices, or a new inflation factor may be calculated. Regulators that have implemented price cap regulation have identified a number of criteria for selecting an inflation index to be used as the inflation factor. Frequently used criteria are set out in Box 4-5.

Particular national circumstances may dictate that other criteria should be considered. It is unlikely that any one potential inflation measure will rank highest in all of the selection criteria. Ultimately, the selection must be based on the informed judgment of the regulator.

**Box 4-5: Selection Criteria for an Inflation Factor**

**Reflective of changes in the operator's costs**

➢ For the inflation factor to be a useful variable, it must reflect changes in the operator's input costs. This is particularly critical in situations of economic instability, when the inflation factor will have to capture sudden and large changes in the country's exchange rate. This is particularly important for operators that typically purchase a large proportion of their equipment in foreign currency.

**Availability from a credible, published, independent source**

➢ This is important if price cap regulation is to have credibility with all parties involved. Private sector participants as well as international investors in the sector must be able to trust the source of the data.

**Availability on a timely basis**

➢ In order for the price cap formula to respond quickly to any changes in input costs, the inflation factor should ideally be available with a lag of less than 6 months and preferably 2 to 4 months.

**Understandability**

➢ There is significant benefit in including an inflation factor that is easily understood not only by all the players in the telecommunications sector, but by the public at large.

**Stability**

➢ The values of some statistical indices are subject to revision after their initial release. For example, in March 2001, the January 2001 CPI may be announced at 123.47; however, that value may be revised to 123.58 in June 2001. If possible, an inflation factor should be chosen that is not subject to large frequent revisions.

**Consistency with total factor productivity of the economy**

➢ The choice of price index will have a direct impact on the manner of calculating the productivity factor (X) because efficiency gains in the rest of the economy affect the operator through this index. As we discuss below, the inclusion of specific variables in the price cap formula will depend on whether an economy-wide price index or a price index for the operator's principal inputs is used. This aspect is discussed in greater detail in Section 4.3.5.



#### *4.3.4.2 Potentially Useful Inflation Indices*

With these selection criteria in mind, the next step is to examine existing inflation measures available in the country. A number of indices are normally published by or available from the government statistical office (if one exists), and/or the country's central bank. In some countries, these statistics are produced by government ministries, such as the Ministries of Finance, Statistics, Planning or Economic Development.

Potentially useful inflation measures may be classified as either economy-wide indices or non-economy wide price indices. Some inflation measures are designed to reflect national or domestic output price changes. For example, the Gross Domestic Product (GDP) price index measures the cost of a fixed basket of goods and services that make up the GDP in a particular base year. This is updated at periodic intervals. Similarly, the price index for the Gross National Product (GNP) gives economy-wide coverage.

A related index is the GDP or GNP deflator. Traditionally, the deflator is determined by dividing the cost of the basket of goods and services that make up the GDP (or GNP) at current prices by the cost of the same basket at constant prices. Hence, the deflator reflects not only pure price changes, but also changes, if any, in the weights attached to the GDP (or GNP) components.

The GDP (and GNP) indices and deflators are broadly based. They reflect changes in the prices affecting a large basket of goods and services. Many regulators in the U.S. and Canada have chosen one of these economy-wide indices as the inflation factor to be included in their price cap formula.

Other indices are narrower in scope. For example, the Consumer Price Index (CPI) or the Retail Price Index (RPI) measures the changes in prices paid by consumers. They typically measure the cost of a fixed basket of goods and services that are bought by consumers in a particular base year, and update it at periodic intervals. This narrow scope is their greatest disadvantage because telecommunications operators incur only a portion of their costs in retail consumer markets. Hence, the CPI or RPI may be relatively poor indicators of inflation affecting the operator's cost structure.

Another set of inflation measures that is narrower in scope are the producer, industrial or wholesale price indices. Generally, they measure changes in prices paid by companies economy-wide, or in particular sectors of the economy.

A number of regulators in the United Kingdom and Europe have selected retail price indices as the inflation factor to be included in their price cap formula. In fact, price cap regulation is sometimes referred to as "RPI-X" regulation, referring to the initiative of the United Kingdom in first implementing this type of regulation in the early 1980s, when British Telecom was privatized.

#### *4.3.4.3 Other Inflation Factors*

Based on the general criteria set out above and on a survey of existing indices, the regulator should consider the advantages and disadvantages of each available index as a potential inflation factor. It is possible that the regulator will decide that none of the existing national indices is appropriate. Box 4-6 presents some possible alternative inflation factors.

#### *4.3.4.4 Period of Adjustment*

The regulator must decide how often changes in the chosen inflation index will be used to adjust the price cap formula, and how often the operator will be allowed to adjust its rates. This is referred to as the periodicity of adjustment to the price cap formula. In industrialized countries, the period of adjustment is usually once a year. This is a feasible option because inflation rates tend to be relatively low and stable in such countries.

Many developing countries, however, are subject to greater economic instability. Hence, the ideal periodicity may be less than a year, say 3 or 6 months. A relatively short period between updates lessens the impact that an acceleration or deceleration of inflation can have on the operator's expenses. The regulator should weigh the benefits of frequent adjustment against the administrative costs of changing and publishing new prices on a regular, short-term basis.

#### *4.3.4.5 I-Factor Adjustment Mechanism*

One approach developed to deal with economic instability is to include a trigger mechanism in the adjustment of the price cap formula. Under this approach, the regulator may select a standard national inflation index as its inflation factor with a relatively long period of adjustment. However, as a "fall back", an immediate adjustment may be made to the inflation factor in the event of certain large and unexpected economic developments.

As an example, an adjustment might take place when the selected national inflation index increases or decreases by a significant amount. In countries with a history of relatively low and stable inflation, this amount could be in the order of 10% to 20%.

**Box 4-6: Alternative Inflation Factors**

- One option is to use an inflation index from another country (or inflation measures produced by United Nations organizations and/or international financial institutions, regional development banks, The World Bank, the IMF, etc.).
  - In Argentina, for instance, some regulated utilities use the producer price index for the United States. This is then converted into the national currency. This choice was designed to reassure foreign investors by relating their revenues to a hard currency.
- Another option is to construct a new measure of inflation that more accurately reflects the cost structure of the operators. This new "composite" index may be a weighted combination of several existing indices.
  - In Colombia, for instance, the interconnection access rates paid by wireless and long distance operators to local telephone operators is indexed on a monthly basis to a composite index made up of the following:
    - An index of the US/Colombia exchange rate and the average customs duty; weight: 0.38
    - An index of the minimum industrial wage in Colombia; weight: 0.29
    - The Producer Price Index of Colombia; weight: 0.33
  - Similarly, in Chile, the access rates paid by mobile operators to terminate calls on the networks of PSTN operators is indexed on a monthly basis to a weighted aggregate index made up of the following:
    - An index of the imported goods and services component of the Chilean wholesale price index; weight 0.263
    - The Chilean wholesale price index; weight: 0.542
    - The Chilean consumer price index; weight: 0.195

Source for Argentina example: Green and Pardina (1999)

An I-Factor adjustment mechanism can also be tied to other key changes that would seriously impact on the cost of operating a telecommunications system. In many countries, the most serious potential change is a devaluation of the national currency. While this may reduce labour costs, it can significantly increase the costs of equipment, foreign consulting services, financing charges, etc. An adjustment mechanism to deal with this type of change is presented in Box 4-7.

### *4.3.5 The Productivity Factor*

The price cap formula includes a productivity factor, which is based on an estimate of the operator's expected productivity increases over the relevant period. This variable, commonly referred to as the "X-factor" or the "productivity offset", ensures that consumers receive partly or fully the benefits of the operator's expected productivity gains in the form of lower prices. For example, if all other variables are held constant, a 3% X-factor will result in annual reductions of 3% in average consumer prices.

The proper choice of an X-factor is critical for the long-term viability of any price cap plan. Selecting the X-factor is often the most contentious aspect of implementing price cap regulation. The X-factor should be set so that it poses a challenge to the operator. It should promise consumers higher gains relative to alternative regulatory regimes. If the X-factor is set too low, the operator will earn excessive profits and the regulatory regime could fall into disrepute. If too large an X-factor is selected, the operator may not be permitted to meet its revenue requirement.

**Box 4-7: Inflation Factor for Foreign Exchange Rate Changes**

A mechanism to adjust the inflation factor in a price cap formula can be triggered by large foreign exchange (FX) rate changes. It is possible that national inflation measures will not adjust rapidly enough to reflect the real impact of large FX changes. For example, this occurred in Indonesia in 1997, when the Asian economic crises caused the Indonesian rupiah to drop rapidly from approximately 2400 rupiah per US dollar to 14,000 per dollar. In comparison, the Indonesian inflation indices remained relatively stable. Since telecommunications operators paid for equipment purchase, financing charges, etc. in foreign currencies, the drop in the rupiah translated into a massive increase in operating costs, which was not reflected in the national inflation indices.

To account for such large FX changes, a pre-established mechanism could provide for an adjustment to the inflation factor – for example, if the percentage change in the average monthly exchange rate is higher than the corresponding percentage change in the inflation factor by a specified amount (perhaps 20 to 30%) within any specified period.

By way of illustration, let us assume a 25% threshold. If the Indonesian rupiah depreciated by 35% during the relevant period (hence, increasing by 35% the number of rupiah required to purchase a US dollar), but the national inflation measure increased by 30%, the trigger mechanism would not apply. However, if the inflation measure only increased by 5%, an adjustment would be triggered.

#### *4.3.5.1 X-Factor Determination*

The X-factor may be divided into the “basic offset” and adjustment factors. The basic offset should reflect the regulated operator’s historical achievement of productivity growth. If the operator has had a history of lower input price inflation than other firms in the economy, that should be reflected in the basic offset. Adjustment factors are included to take into account changes in the operating environment of the regulated operator. For example, an adjustment factor might reflect the introduction of price cap regulation, the introduction of competition or the privatization of the operator.

There are two major approaches to determination of the X-factor. One approach, which we will refer to as the historical productivity method, relies on historic information about the productivity performance of the regulated firm to set the basic offset. Once the basic offset is calculated, certain adjustment factors may be added or subtracted to take into account changes in the operating environment of the operator. These adjustment factors are based on regulatory benchmarking or other predictive methodologies. This approach is based on the understanding that past productivity, with adjustments, is a good indicator of future productivity. The implementation of this approach is subject to the availability of specific data. The calculation may be very data-intensive and requires reliable and consistent data of a very specific nature at an adequate level of detail for an adequate period of time.

The other approach, which we will refer to as the regulatory benchmarking method, recognizes that in some instances, past productivity performance may not be a good indicator of future expected performance. This may be the case where the sector was previously regulated by discretionary price setting (or not regulated at all). It may also be the case where the sector has been inefficiently operated under public ownership or is subject to very significant structural change, for instance, divestiture. In these cases, the adjustment factors may be much more significant than the calculated basic offset. A benchmarked productivity factor is likely the only practical alternative in many developing countries. There the regulator is not likely have access to reliable and consistent historical productivity data to determine the historical productivity factor.

#### *4.3.5.2 Historical Productivity Method*

A number of empirical methods can be used to help the regulator set the X-factor. Most of these methods were developed in the countries that first implemented price cap regulation (United Kingdom, United States, Canada, etc.). The preferred method to determine an X-factor is to carry out a total factor productivity (TFP) study using historical data on the regulated operator and/or on the sector. Box 4-8 provides an overview of TFP and how it may be applied to the telecommunications sector.

***Historical Productivity - Basic Offset***

Price cap regulation is intended to replicate the discipline of competitive market forces. These forces require operators to improve productivity and pass their gains on to their customers in the form of lower prices, after accounting for increases in input prices. If all sectors in the economy were fully competitive,

**Box 4-8: Total Factor Productivity**

Productivity is the measure of how effectively an entity employs inputs to produce outputs. It is a measure of operational efficiency. A typical, although partial, measure of productivity in the telecommunications industry is lines (one output) per employee (one input). Lines per employee is obviously only a partial measure, given that one could increase the number of lines by increasing capital investment or materials. Simultaneously, a telecommunications operator produces many more outputs than just the number of lines.

TFP (also known as multi-factor productivity) measures how effectively an operator, an industry or an economy employs all inputs to produce all outputs. TFP can be said to have increased if the operator produces more outputs with the same amount of inputs, or if it produces the same outputs with fewer inputs. TFP is equal to the ratio of output volume to input volume. Algebraically the TFP index may be expressed as:

$$TFP = Q/Z$$

Where Q is an index of aggregate output volume and Z is an index of aggregate input volume. Note that for price cap regulation we are primarily interested in the changes in the TFP index, rather than its level. If we refer to changes by the symbol Δ, the change in the TFP index may be expressed in the following manner:

$$\Delta\, TFP = \Delta Q/\Delta Z$$

<u>Example</u>:

If the output volume index has increased by 5% (i.e. $\Delta\, Q$=1.05) and the input volume index has increased by 2% (i.e. $\Delta\, Z$= 1.02), the change in the TFP index is 2.94%:

$$\Delta\, TFP = 1.05/1.02 = 1.0294$$

Note that for the sake of simplification regulators and analysts often approximate the multiplicative relationship between TFP, Q and Z by an additive relationship. In this instance, if output has increased by 5% and inputs by 2%, it can be said that TFP has approximately increased by 3%:

Approximation:
$$\begin{aligned}\Delta\, TFP &\cong \Delta Q - \Delta Z\\ &\cong 5\% - 2\%\\ &\cong 3\%\end{aligned}$$

It should be stressed that while this type of approximation is fairly common, it is not always accurate. While in the example above the approximation (2.94%) was quite close to the actual number (3.00%), this will not always be the case. Generally, the larger the change in TFP the larger the inaccuracy of the approximation.

output prices in the economy would grow at a rate equal to the difference between the growth rate of input prices and the rate of productivity growth.

As described in Bernstein and Sappington (1998), if regulated telecommunications operators were like a typical company, the telecommunications regulator could replicate market discipline by restricting increases in the operator's prices to the economy-wide rate of price inflation. This restriction would require the regulated operator to achieve the same productivity gains as that of the typical company, and to pass these gains on to its customers, after adjusting for the typical input price inflation rate. If the regulated operator faces the same input price inflation rate as other companies in the economy, the X-factor should be set at zero.

Generally, therefore, the X-factor should reflect the extent to which:

- the regulated operator is capable of increasing its productivity more rapidly than other companies in the economy; and
- the prices of inputs used by the regulated operator grow more slowly than the input prices faced by other companies in the economy (this is often referred to as the input price differential or IPD).

Telecommunications operators should normally enjoy faster productivity growth than other companies due to the more rapid rate of technological change in the telecommunications industry. Telecommunications operators may also have lower input price inflation due to the decreasing unit costs of processing, switching and transmission.

If the regulated operator can achieve faster productivity growth or enjoy lower input price inflation than other companies in the economy, then the regulated operator should be required to pass the associated benefits on to customers in the form of lower prices.

For example, assume the expected annual rate of productivity growth of the regulated operator is 3%. The corresponding growth rate elsewhere in the economy is 1%. Input prices in the regulated industry are expected to increase 0.5% annually, and the corresponding growth rate of input prices elsewhere in the economy is 2.5%. In this setting, the X-factor should be set at approximately 4% (= [3 - 1] + [2.5 - 0.5]). Note that for simplicity we have approximated the X-factor by adding and subtracting the different variables. As pointed out in Box 4-8, for small numbers this is generally a fair approximation to the mathematically-correct multiplicative calculation.

Table 4-2 presents the results of some studies of TFP for the US communications industry and corresponding TFP performance of the US economy as a whole. Based on Table 4-2 and other studies (including those of the Canadian telecommunications industry), it appears that in the long-term productivity growth of the communications industry in North America has been about 2% to 2.5% higher than productivity growth of the respective economies. Some of these studies are dated and the productivity differential may have changed recently.

The choice of the inflation factor will have an impact on the choice of variables to calculate the basic offset. If a general inflation index is selected for the I-factor (e.g. GDP-PI or CPI or RPI, etc.), the basic productivity offset should be calculated as in the example presented two paragraphs above. This is referred to as the *differential* approach. Based on this approach, the figures in Table 4-2 suggest a basic offset between 2.0% and 2.5%. If a sector or operator-specific index is constructed, however, the appropriate basic offset is simply the telecommunications TFP estimate. This is referred to as the *direct* approach. Based on his approach, the figures in Table 4-2 suggest a basic offset between 3.0% and 3.5%.

***Historical Productivity Adjustments***

Many regulators have adjusted the basic offset by other factors to take into account significant changes in the operating environment of the regulated operator. We review some of the key adjustment factors below. These adjustment factors are often determined based on benchmarking or predictive methods, such as time-series, cross-sectional econometric studies.

**Table 4-2: Selected Estimates of TFP for the US.**

| Study | Period | COM | US | DIFF |
|---|---|---|---|---|
| Nadiri-Schankerman | 1947-76 | 4.1 | 2.0 | 2.1 |
| Jorgenson | 1948-79 | 2.9 | 0.8 | 2.1 |
| Christensen | 1947-79 | 3.2 | 1.9 | 1.4 |
| AT&T | 1948-79 | 3.8 | 1.8 | 2.0 |
| A.P.C. | 1948-87 | 4.0 | 1.7 | 2.3 |
| Christensen | 1951-87 | 3.2 | 1.2 | 1.9 |
| Crandall | 1960-87 | 3.4 | 1.3 | 2.1 |
| DRI | 1963-91 | 3.0 | 0.2 | 2.8 |
| Christensen | 1984-93 | 2.4 | 0.3 | 2.1 |

Note: US Communications Industry (COM); US Economy and Differential (DIFF %)

Source: Taylor (1997)

***Incentive Regulation Factor***

After price cap regulation replaces ROR regulation or, more likely, when it becomes the first form of rules-based price regulation adopted, operators in the industry can be expected to achieve a higher productivity growth rate than they have in the past.

In such circumstances, some regulators have supplemented the basic offset with what is sometimes called a *customer productivity dividend* (CPD). A number of econometric studies have examined the impact of incentive regulation plans on productivity of telecommunications operators. On the whole, these studies have concluded that incentive regulation has a positive impact on productivity growth.

In principle, the CPD should reflect the best estimate of the increase in the productivity growth rate in the regulated sector that will be brought about by the improved incentives inherent in the new regulatory regime. This variable, also referred to as the *stretch factor*, could be allowed to vary over the life of the price cap plan. For example, the variable may be higher at the beginning of the plan and reduced near its end. CPDs adopted in the US and Canada have generally been below 1% per year.

***Competition Adjustment***

The rise of strong competition is another structural change that can affect the value of the X-factor under price cap regulation. The effect of increased competition, however, is unclear.

On the one hand, increased competition, like a change in regulatory regime, can force the regulated operator to operate more efficiently, and thereby achieve a higher productivity growth rate. This would seem to favour a higher X-factor, particularly if a CPD has not been imposed.

On the other hand, increased competitive forces can shift market share from incumbent operators to new entrants. The result can be an unavoidable reduction in the growth rate of the incumbent's outputs. Particularly in the short run, this lowering of the growth rate of the incumbent's outputs can be higher than any associated lowering of the growth rate of its inputs. This leads to a lower productivity growth rate for the incumbent, arguing for a lower X-factor. The empirical evidence on the effect of competition on productivity growth is mixed. A number of recent time-series, cross-sectional econometric studies have found no relationship between competition and productivity growth, after taking into account other factors.

***Privatization Factor***

The theoretical literature suggests that privatization should increase productivity growth. The theory is substantiated by recent econometric studies that have found privatization to increase productivity by at least 0.5% to 1.0% per year.

#### *4.3.5.3 Regulatory Benchmarking Method*

In some instances, past productivity performance may not be a good indicator of future expected performance. This may be the case where the sector was not price regulated, was not operated efficiently or is the subject to very significant structural change.

In these circumstances, or when the operator and/or its operating environment are undergoing drastic change, the X-factor may have to be developed based on the informed judgement of the regulator and its advisors. International experience with price cap regulation can provide a useful benchmark in such cases. This is why we refer to this method as regulatory benchmarking.

Furthermore, this approach may be the only practical alternative in many developing countries because of lack of the very specific detailed historical data over an adequate period of time to calculate TFP. More generally, the historical method may be less applicable to developing economies for the following reasons:

- Low teledensity levels, and privatization of former government telecommunications operators, can be expected to lead to significant productivity improvements;
- Significant political and economic instability, and the lack of a clear legal and regulatory framework may affect productivity levels, and;
- Recent evidence suggests that technological catch-up and the possibilities for greater sector growth in developing countries mean that productivity growth should be higher than in industrialized economies. This would suggest that the X-factor should be set at relatively high levels. On the other hand, there are some very efficient telecommunications sectors in the developing world that may not be subject to such "catch-up" phenomenon.

Countries that have had a number of price cap plans have generally increased the X-factor over time. One example is that of British Telecom (BT) in the United Kingdom (UK), where the X-factor has been increased from 3% in the 1984-1989 period to much higher factors in recent years (see Table 4-3). This regulatory "tightening" has been a result of better-than-expected performance by the regulated operator. The major increases in the X-factor from a modest initial figure also reflects a degree of regulatory caution, with an initial bias towards ensuring the regulated operator's revenue requirement is met.

No price cap plan, no matter how carefully designed, will be perfect or permanent. It is in the nature of good regulation to evolve with market and policy developments. The evolving nature of price cap regulation is perhaps best illustrated by the changes in the various price cap plans that have been applied to British Telecom. BT was the first telecommunications operator subject to price cap regulation. It remains subject to this form of regulation, but as illustrated in Table 4-3, there have been significant changes over the years. Regulators that are considering introducing price cap regulation should take comfort from the British experience. The most significant decision at the time of the privatization of BT was to adopt price cap regulation – not to specify its particular X-factor, and other details. The actual form of regulation was not cast in stone. As in other countries where price cap regulation has since been adopted, adjustments continue to be made as the regulator's experience with this form of regulation increases, particularly with respect to the determination of the X-factor.

Table 4-4 and Table 4-5 provide examples of current X-factors adopted by regulators around the world. Although there is some variation in the actual X-factors set by regulators, based on this selected sample, when a majority of the operator's services are included in price cap regulation, many regulators have selected an X-factor in the range of 3.5% to 4.5% as the initial X-factor. This range is generally

**Table 4-3: A Summary of British Telecom' s Price Cap Plans**

| Duration | X | Services Subject to Price Caps | Other Main Pricing Constraints | Main Services Not Subject to Price Caps |
|---|---|---|---|---|
| 1984-89 | 3.0 | Subscription; local and national calling | Residential subscription (RPI+2) | Rental, international calls, operator services , connection charges, public telephone calls |
| 1989-91 | 4.5 | Subscription; local and national calling | Subscription (RPI+2); connections (RPI+2); private circuits (RPI+0). | Rental; international calls and public phone calls. |
| 1991-93 | 6.25 | Subscription; local and national call charges; international calls; volume discounts. | Residential and single line subscription (RPI+2): multi-line subs. (RPI+5); connection (RPI+2); private circuits (RPI); median res.bill (RPI) | Telephone rental; public telephone calling. |
| 1993-97 | 7.5 | Subscription; local and national calling; international calls; connection charges. | All subscriptions (RPI+2); all individual prices in basket limited to RPI including connection charges; private circuit basket (RPI). | Public telephone calling. |
| 1998-2001 | 4.5 | Retail charges: residential connection subscription; local, national and international calls. Based on expenditure patterns of lowest spending 80% of residential customers. | Business assurance package, including subscription (RPI), analogue private circuits (RPI). | Public telephone calling. |
| | 8.0 | Network charges: non-competitive access services (call origination and termination, single transit, local conveyance) and interconnection specific service. | Services divided into three baskets, each basket subject to RPI-8 cap. | |

Source: Adapted from OECD (1995) and Oftel (2000a)

consistent with the differential approach to calculating the X-factor. The more detailed guidelines discussed below may assist in regulatory judgements to set the X-factor.

**Table 4-4: X-Factors of Selected National Price Cap Regulation Plans**

| Country | X-Factor |
|---|---|
| Argentina | 5.5 |
| Australia | 7.5 |
| Canada | 4.5 |
| Chile | 1.1 |
| Colombia | 2.0 |
| Denmark | 4.0 |
| France | 4.5 |
| Ireland | 6.0 |
| Mexico | 3.0 |
| Portugal | 4.0 |
| UK | 4.5 |
| US | 6.5 |

**Table 4-5: X-Factors of Selected State Price Cap Regulation Plans in US**

| State | X-Factor |
|---|---|
| Connecticut | 5.0 |
| Delaware | 3.0 |
| Georgia | 3.0 |
| Illinois | 4.3 |
| Maine | 4.5 |
| Massachusetts | 4.1 |
| Michigan | 1.0 |
| New York | 4.0 |
| North Carolina | 2.0 |
| Ohio | 3.0 |
| Rhode Island | 4.0 |
| Wisconsin | 3.0 |

***Regulatory Benchmarking***

➢ **Differential Approach**

The long-term historical productivity differential between the telecommunications sector and the economy is generally accepted to be 2% to 2.5% or higher. We discussed this range in the previous section. This benchmark can be higher where the telecommunications sector is expected to grow at a rate significantly higher than that of the economy.

The long-term historical input price differential (IPD) between the telecommunications sector and the economy is generally accepted to be positive, but smaller than 1%. The IPD could be lowered if, for example, a telecommunications worker's wages grew faster than that of the average worker. Conversely, the IPD should be raised if the rate of productivity-improving technological development in the telecommunications industry increases.

➢ **Direct Approach**

The long-term historical productivity performance of the telecommunications sector is generally accepted to be 3% to 3.5% or higher. We discussed this range in the previous section. This benchmark could be higher where productivity in the telecommunications sector is expected to grow at a rate significantly higher than that of the economy.

***Regulatory Benchmarking – Adjustments***

Adjustments can be made for the effects of the introduction of incentive price regulation, competition, and privatization, where these conditions apply. These factors and their effects are discussed above. Table 4-6 provides a numerical summary of the benchmark estimates discussed in this Section. These are of a general nature. It is recommended that each country carry out an appropriate TFP or benchmarking study based on specific national conditions.

**Table 4-6: Summary of Benchmark Estimates for Setting X-Factor (%)**

| | Differential Approach | Direct Approach |
|---|---|---|
| **Basic Offset** | 2.0 to 2.5 | 3.0 to 3.5 |
| **Adjustment Factors** | | |
| Incentive Regulation | 0.5 to 1.0 | |
| Competition | 0.0* | |
| Privatization | 0.5 to 1.0 | |

Note: * Could be increased to up to 0.5 if competition is combined with privatization.

Source: Based on McCarthy Tétrault review of the literature and experience with price cap regulation in industrialized countries. Estimates may be less applicable to developing countries. These estimates are of a general nature. It is recommended that each country carry out an appropriate TFP or benchmarking study based on specific national conditions.

### *4.3.6 Capped and Non-Capped Services*

A basic decisions to be taken in price cap regulation is the selection of which services to regulate. In general, regulators apply price cap regulation to services that are provided on a monopoly or dominant provider basis. The rationale for price regulation is discussed in Appendix B of the Handbook.

In many markets, the distinction is made between "basic services" which are price-capped, and other services which are not. Services provided in fully competitive markets are normally excluded from price cap plans. There is sometimes a grey line between the categories, and regulators have treated the same types of services differently. Table 4-7 and Table 4-8 describe the types of services covered by price cap plans in the same jurisdictions as in Table 4-4 and Table 4-5 around the world.

Services are sometimes included in price cap baskets to promote competition and to protect consumers. An example is the case of interconnection charges. Interconnection access charges can be included under a global price cap that could incorporate consumer "retail" and access "wholesale" services. This would make it possible for expected productivity gains in the provision of access services to be passed on to competitors and be ultimately reflected in retail prices. Access services can also be placed in a separate basket from retail services to prevent the dominant supplier from "price squeezing" its competitors through its control of both retail and wholesale pricing.

### *4.3.7 Service Baskets*

Having selected the services to be included in price cap regulation, the structure of the price cap plan should be determined. One of the features of price cap regulation is that the regulated operator maintains some pricing flexibility. This flexibility is particularly important when significant rate rebalancing is required within the price cap plan. It is also important when the operator is facing competition and must respond quickly to competitive price challenges. Nevertheless, there are a number of reasons for the regulator to restrict pricing flexibility.

One reason is to restrict the operator's ability to engage in inappropriate cross-subsidization. Such a restriction can be implemented through the creation of groups of services, or service baskets, within the price cap plan. An example of how service baskets constrain flexibility is provided in Box 4-9.

It is common practice to place capped services in more than one basket. For example, Figure 4-3 and

**Table 4-7: Service Coverage of Selected National Price Cap Regulation Plans**

| Country | Service Coverage |
|---|---|
| Argentina | Basic services |
| Australia | Basic and mobile services |
| Canada | Basic local services |
| Chile | Local and access services |
| Colombia | Local services |
| Denmark | Basic and ISDN services |
| France | Basic services |
| Ireland | Basic and ISDN Services |
| Mexico | Basic services |
| Portugal | Basic and leased line services |
| UK | Basic residential services |
| US | Interstate access services |

**Table 4-8: Service Coverage of Selected Price Cap Regulation Schemes in US**

| State | Service Coverage |
|---|---|
| Connecticut | Basic and non-competitive services |
| Delaware | Basic services |
| Georgia | Basic and other services |
| Illinois | Non-competitive services* |
| Maine | All services |
| Massachusetts | Non-competitive services* |
| Michigan | Non-competitive services |
| New York | Basic services |
| North Carolina | Basic services |
| Ohio | Basic Services* |
| Rhode Island | Basic services |
| Wisconsin | Basic and other services |

Note: * excludes basic residential services

Figure 4-4 illustrate the service baskets for the Telecom Australia price cap plan. Different types of services are grouped in different baskets, and services with common characteristics are grouped within a single basket.

Many regulators have established different "sub-caps" on different baskets. In effect, these basket-pricing restrictions are used by regulators to further constrain the pricing flexibility of the operator. For instance, in Figure 4-4, subscription services would be subject to the CPI-2% sub-cap of its service basket and also to the overall price cap of CPI-5.5%.

The assignment to baskets is intended to replicate the effects of competition. The following are general criteria for assigning capped services into service baskets:

➢ degree of competition in each service basket;

➢ homogeneity of services (including similarity in demand price elasticities); and

➢ degree of substitutability of each service.

#### *4.3.8 Individual Service Pricing Restrictions*

Restrictions can be placed on the relative and/or absolute movement of prices of individual services, as well as on service baskets. This may be done, for example, if the regulator is concerned that the residential subscription rate may rise too quickly as a result of rate rebalancing.

The maximum allowable price increase for individual services will be inversely proportional to the weight of the individual service within the services basket. As a result, the price for services with relatively small weights could increase significantly if the allowed increase were channelled towards one of these services and there were smaller compensating decreases in charges for services with relatively larger weights. Conversely, a service with a relatively heavy weight within the proposed services basket would be subject to only moderate price increases if the allowed increase were channelled to this service, even though compensating decreases were made in services with relatively smaller weights.

There are two alternatives to individual restrictions, each of which may be applied to restrict the decreases and/or increases in prices.

One of these methods, commonly referred to as "banding", limits the price movement of specific services relative to another variable, usually the inflation factor. For instance, if the regulator is concerned about increases in the residential subscription price, an upper restriction could provide that the price could not increase at a rate greater than the inflation factor plus 5% (CPI + 5). If the X-factor has been set at 4% and the corresponding I-factor was 7%, the weighted average of prices could increase by approximately 3% (7% - 4%). The residential subscription price, however, could increase up to a maximum of approximately 12% (7% + 5%). This is an example of a relative restriction. In the case of Telecom Australia provided in Figure 4-3, the residential subscription and local calls are subject to an individual restriction of CPI.

The other type of restriction is absolute. For example, if the regulator is concerned that national long-distance rates may decline too quickly, a downwards restriction could provide that the average price of these calls should not decrease by more than 20% per year.

It is generally considered that relative restrictions are preferable to absolute ones because they provide the regulator with greater certainty as to the movement of the real (inflation-adjusted) prices of the services.

Restrictions may be upwards or downwards, but do not necessarily have to be symmetrical. For example, if access prices are included in the price cap, they could be subject to relative restrictions with upward and downward bounds (e.g. inflation factor ±5%).

Restrictions on the regulated operator's pricing flexibility have been implemented by most regulators. Care must be taken to design restrictions that are internally consistent and do not unduly constrain the operator. Judgment is required to set restrictions that provide sufficient flexibility to permit necessary rate rebalancing, while protecting consumers from excessive rate increases and competitors from anti-competitive subsidization. Too many restrictions on prices will eliminate pricing flexibility, one of the main benefits of price cap regulations.

### *4.3.9 Duration and Review of Price Cap Plans*

The longer the term of a price cap plan, the stronger the incentive for the operator to improve its performance. In theory, the duration of a price cap plan should be indefinite, so that the regulator would not intervene in the setting of future prices.

In practice, however, this type of price cap regime is neither feasible nor desirable. A regulator cannot estimate future productivity growth with certainty; nor can it set the X-factor at the right level for an indefinite period. With the X-factor set imperfectly,

**Box 4-9: How Service Baskets Constrain Price Flexibility - Example**

Assume a one-basket price cap plan. It includes international services and residential subscription services. Assume both have the same weight in the price cap index. Holding all other prices constant, a decrease in domestic long distance prices (say 30%) can be offset by a significant increase (also 30%, assuming the same revenue weights) in the residential subscription rates.

To constrain this type of offsetting rate rebalancing, residential subscription services and international services can be placed in separate baskets. If this were done, price decreases in one service cannot be offset by equivalent increases in the price of other services.

In practice, of course, regulators should not constrain operators from implementing necessary rate rebalancing. Individual price constraints or bands can be used to limit price increases to particularly sensitive services, with less impact on the overall pricing flexibility of operators.

**Figure 4-3: Price Cap Plan for Telecom Australia from 1989 to 1992**

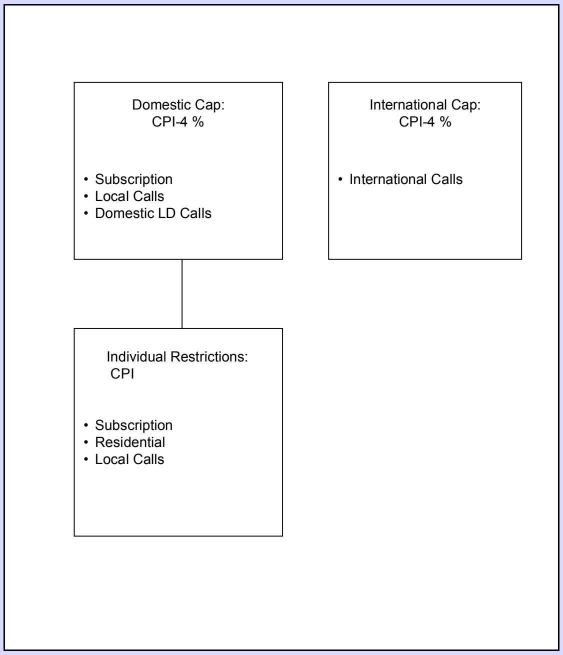
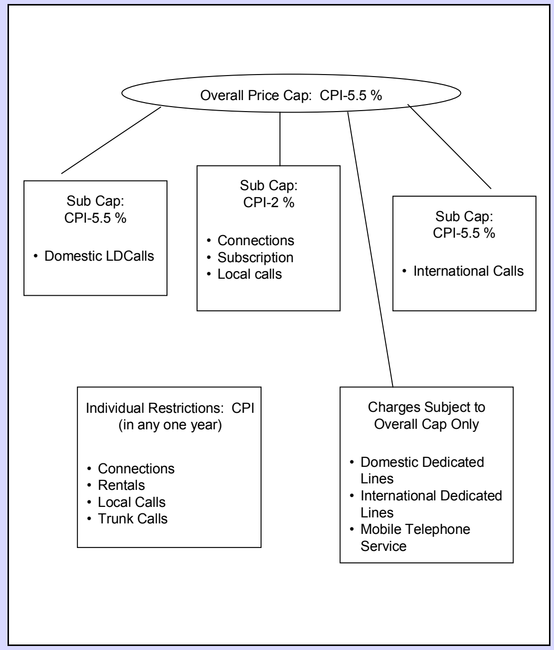



**Figure 4-4: Price Cap Plan for Telecom Australia from 1992 to 1995**




the operator would either earn insufficient revenues or unacceptably high profits. Both outcomes are inefficient and unsustainable. As a result, in a real-world price cap plan, the regulator generally sets a minimum period during which the X-factor will not be revised. At the end of the duration period, a review is undertaken. Regulators have typically chosen periods of three to five years.

The duration of the plan should be sufficiently long to allow efficiency incentives to be acted on. However, it should not be so long that market developments undermine the regime. In the Regulatory Benchmarking Section, above, it was suggested that a prudent approach would be to set an initial X-factor conservatively. In such as case, the plan should be reviewed reasonably soon, to minimize the negative impact of miscalculations or errors of judgement in setting the X-factor.

The price cap plan review process should be carefully designed. The key variable that will have to be reviewed, and perhaps reset, is the X-factor. This will be a primary focus of the review. It involves some complex incentive issues for the regulator to grapple with.

If productivity improvements achieved by the operator exceed the X-factor by a substantial amount, the operator will make significant profits. There may be pressure on the regulator to adjust the value of the X-factor upwards. Rate of return or other profit indicators are generally used to reset the X-factor. This review mechanism will reduce the regulated operator's incentive to continue to increase its productivity. The incentives for further efficiency improvements will tend to fall as the review approaches, particularly if the operator knows that any additional cost savings will result in a higher X-factor resulting from the review process. In this instance, price cap regulation will approximate ROR regulation during the review period. The optimal selection of incentives/disincentives will ultimately be based on regulatory judgement.

The approach to resetting the X-factor will depend on how the regulator evaluates the need for the operator to earn higher profits to increase its ability to attract investment, compared to the consumer benefits of lower prices (operator-consumer equity objective). It will also depend on the relative importance placed on productive and dynamic efficiency. The higher the weight placed on consumer benefits relative to profits in the short term, the more the regulator will tend to reduce future profits by setting a higher X-factor at the time of the review.

## 4.4 Price Cap Variations

### 4.4.1 Introduction

This Section considers some of the variations that have been applied to the basic price cap formula. Depending on national telecommunications market conditions, regulators may include some of these variations in their price cap plan.

### 4.4.2 The Exogenous Factor

As discussed above, the inflation factor is a proxy for the changes in the regulated operator's input prices. There may be instances, however, when the operator faces a significant change in input prices that are outside its control and not captured by the inflation factor. An example is provided in Box 4-10. Regulators must decide whether to include in the price cap formula a cost pass-through variable (also referred to as an "exogenous" variable or "Z-factor") to address this possibility.

**Box 4-10: Examples of Unexpected Input Price Change Outside Control of Regulated Operator**

An increase in customs duty from 20% to 40% is imposed on imported capital equipment, including telecommunications equipment. The telecommunications operator faces a significant input price increase. Assuming new equipment purchases account for 20% of the annual costs of the operator, the customs increase could increase total costs by 4%. This change may not be fully reflected in the inflation factor. Assuming that new foreign equipment purchases account for 5% of economy-wide costs, an economy-wide inflation index would increase by only 1%. As a result, the operator would have to absorb the remaining 3% increase in its costs.

The inclusion of a Z-Factor in a price cap formula is not always warranted. Many US state regulators have not included a Z-factor in their price cap plans. They may consider that there are very few truly exogenous events that are not captured in the inflation factor. Most developing country price cap plans do not include a Z-factor. However, the situation may be quite different in emerging markets where significant exogenous events are more common.

If the regulator decides to include a Z-factor adjustment, the amended price cap formula would be as follows:

$$PCI^t = PCI^{t-1} \times (1 + I^t - X \pm Z^t)$$

It should be recognized that the practical application of a Z-factor adjustment could be administratively challenging and a source of controversy. Some of the uncertainty can be eliminated by carefully defining the types of cost changes covered by the Z-factor.

Based on the considerations outlined in Box 4-11, the regulator should define the exogenous factor to promote certainty in price regulation of the sector. In preparing this definition, the criteria should be general enough to capture the impact of certain events without diminishing the operator's incentive to control its costs.

**Box 4-11: What are Exogenous Cost Changes?**

The following considerations are relevant in determining which cost increases may be covered by a Z-factor:

- Generally, *legislative, judicial or administrative actions that have a significant impact* on the regulated operator should be considered. Such actions are usually beyond the control of the operator. With respect to "significant", there may be an advantage to setting a threshold below which adjustments would not be considered. A threshold in the range of 1% to 2% of revenues may be reasonable.
- Regulators should only consider *events that do not represent normal business risk*. In assessing whether costs should be included in a Z-factor, the regulator should consider whether the operator can take reasonable measures to mitigate the consequences of the cost-producing events.
- The Z-factor costs should not otherwise be reflected in the price cap formula and must be such that they have specific or disproportionate impact on the operator. The burden of proof should be on the operator to show that the proposed event is not already accounted for in the inflation factor and would be reflected in prices charged by operators operating in competitive markets.
- Events, such as an economic downturn, that affect the whole economy would generally not be considered to produce exogenous cost increases eligible for Z-factor treatment. While such events may have a negative impact on the demand for the operator's services, and decrease its ability to recover costs, the purpose of the Z-factor is not to guarantee a rate of return for the operator. Such a guarantee would not be consistent with the objective of using price cap regulation as a proxy for competitive market conditions.
- *Z-factor costs should be quantifiable and known*. The operator must be able to estimate the specific costs in monetary terms.

In theory, the impact of the exogenous event should be allocated across capped and uncapped services, with only the impact allocated to capped services being included in the price cap formula. In practice, the regulator could use revenue shares or other weights to allocate the impact to capped services only.

Generally, the regulator will design the exogenous factor so that the regulated operator must request the inclusion of exogenous cost changes in the price cap formula. The onus is placed on the operator to take action in the matter. The regulator only has to decide on the issue if and when there is an application before it.

An exogenous event may increase or decrease the costs of the operator. It will be in the interest of the operator to request the consideration of an event that has increased its costs. Where an event has decreased the operator's costs, however, the operator has no incentive to request consideration. If a Z-factor exists, the regulator will likely have to ensure that savings are passed on to consumers.

### *4.4.3 Quality of Service*

Like other services, telecommunications services have a quality component and a price component. In theory, a telecommunications operator subject to price cap regulation could increase profit by lowering the quality of its service. This prospect is of most concern when the operator is a monopolist, or is dominant so that it's service levels are not subject to effective competitive pressure from other operators.

**Table 4-9: Q-Factor Example –Rhode Island Scheme**

The price regulation plan for the incumbent operator in Rhode Island, NYNEX, includes a Service Quality Adjustment Factor "SQAF". It was added to the basic price cap formula in the following manner

$$PCI^{t} = PCI^{t-1} \times (1 + I^{t} - X \pm SQAF^{t})$$

Each month, NYNEX provides reports to the regulator on QoS performance. As illustrated in the table below, the maximum value for the Service Quality Index (SQI) is 42. The regulator has determined that a passing monthly score is 25. The price cap formula is adjusted once a year. At that time, for each of the 12 most recently measured months that NYNEX has not achieved a passing score in the SQI, the SQAF will be increased by .0417%. Hence, if NYNEX does not receive a passing score in 6 months, the SQAF will take the value of 0.25%, and prices must be decreased by that amount in the next period to compensate for poor QoS performance.

| | **Nynex Performance** | **Points** |
|---|---|---|
| New Installations orders not completed within 5 working days (%) | <12<br>12.0-13.99<br>≥14.0 | 2<br>1<br>0 |
| Installation appointments missed (%) | < 2.5<br>2.5 – 3.49<br>≥3.5 | 2<br>1<br>0 |
| Line out of service > 24 hours (%) | < 40<br>40 – 44.99<br>≥45 | 4<br>2<br>0 |
| Repeat repair reports (%) | < 11<br>11.0 – 13.99<br>≥14 | 2<br>1<br>0 |
| Repair service answer time (sec.) | < 14.0<br>14.0 – 16.99<br>≥17 | 4<br>2<br>0 |
| Directory assistance answer time (sec.) | < 4.0<br>4.0 – 5.99<br>≥6.0 | 2<br>1<br>0 |
| Average duration time – special access 1.5 Mbps Circuits (hours) | < 2.5<br>2.5 – 4.49<br>≥4.49 | 2<br>1<br>0 |
| **Sub-total (maximum available)** | | **22** |
| Customer trouble reports per 100 lines per central office (CO) | < 4.0<br>4.0 – 4.99<br>≥5 | 2<br>1<br>0 |
| Sub-total (maximum available assuming 10 CO's reviewed) | | **20** |
| **TOTAL POSSIBLE POINTS/MONTH** | | **42** |

Price Regulation

Telecommunications Quality of Service (QoS) has many aspects. It has traditionally been measured by a number of QoS indicators, such as:

- Call Completion Rate
- Dial Tone Delay
- Delivery Precision
- Call Failure Rate
- Fault Clearance
- Complaints
- Billing Accuracy.

If a regulator decides to regulate QoS of an operator subject to price cap regulation, it can adopt several approaches. The traditional approach is to set a series of QoS targets or standards for each indicator. Sub-standard performance can be dealt with on a case-by-case basis, or by pre-set sanctions (e.g. monetary fines or penalties payable by the operator).

An innovative approach is to integrate a QoS variable, often referred to as a Q-factor, in the price cap formula. This is a relatively new approach. It is being implemented in a few states of the US. Table 4-9 provides a summary of such an approach in the US State of Rhode Island. A similar approach has also been recently adopted in Colombia at the national level. This approach is consistent with the objectives of incentive regulation. In addition, it has the advantage of directly linking QoS with the price mechanism, thus mimicking the quality/price trade-off in competitive markets. The following formula illustrates how a Q-factor fits into the basic price cap formula:

$$PCI^{t} = PCI^{t-1} \times (1 + I^{t} - X \pm Q^{t})$$

The objective of including a Q-factor is that a reduction in quality should result in lower prices for consumers. Conversely, increased quality may lead to higher prices. If there is concern that quality may drop to unacceptable levels, the regulator may set minimum quality standards similar to minimum price floors. It should be recognized that the incorporation of a Q-factor can be complex and administratively challenging. Few regulators have integrated QoS and price cap regulation in this manner.

### *4.4.4 New Services*

A key objective of telecommunications sector reform is to promote innovation, particularly in the introduction of new services. The regulator must determine whether or not to subject new services to price regulation. If the decision is affirmative, price cap regulation is sufficiently flexible to accommodate most new services.

In markets that are subject to competition, many regulators have concluded that it is not in the public interest to regulate most new services. Such decisions provide an additional incentive for operators to introduce innovative services; mobile services are a common example.

Where such a decision is taken, it is important for the regulator to ensure that a regulated operator's "new" service is truly new. Operators will have an incentive to try to repackage existing services as "new" services in order to avoid price regulation. To avoid confusion in the industry, the regulator may want to consider publishing a definition of a new service based on the criteria, such as the following:

- Does the new service include a new technology or functional capability?
- Does the new service replace an existing service and consequently not expand the range of services available?

### *4.4.5 Rate Rebalancing and Price Caps*

Rate or price rebalancing is discussed in Section 4.1.2 and in Appendix 4.2. It refers to the adjustment of price levels for different services to more closely reflect the costs of providing each service. Rebalancing can be achieved under most forms of price regulation.

A regulator that implements a price cap plan should consider including a transitional period for rate rebalancing, either before the plan comes into effect or as part of the plan. The transition period should be kept as short as possible and, depending on the level of price-cost imbalances, should not last more than 5 to 7 years. This will ensure that prices at the beginning of a price cap plan are more in line with costs than they would be without a transition period. In a number of countries, regulators have allowed the regulated operators a period of several years to achieve limited rebalancing. This decision is based on the conviction that the benefits of price cap regulation are greater when prices are balanced. Rebalanced prices are clearly closer to those found in a competitive market.

A new regulator will likely be confronted with the necessity to rebalance prices and to introduce a form of price regulation for the first time. Given the benefits of rebalancing and price cap regulation, neither should be delayed. Hence, there may be no opportunity to attain any significant rebalancing prior to the implementation of price cap regulation. It will have to be done as part of a price cap plan. The regulator may prescribe the specific targets or target ranges for some or all prices for regulated services. Some regulators have only specified end-of-period targets while others have also specified intermediate targets. In this manner the regulator may be sure that over the transition period the operator will move prices in the desired direction. If this is done, the operator should be given sufficient pricing flexibility to achieve rebalancing.

Establishing a transition period for rebalancing before a price cap plan is implemented is only a practical option when there is another form of price regulation in place. In Canada, the incumbent operators were subject to ROR regulation during the transition period. Clearly, where the operator is a privately-owned monopoly or dominant operator, some form of price regulation is preferable to none at all. In countries where price cap regulation is the first form of price regulation to be introduced, the more desirable option will be to undertake rate rebalancing within a price regulation regime.

### *4.4.6 International Accounting Rates*

Technological developments and the liberalization of telecommunications markets have put downward pressure on international accounting rates. Accounting rates are the charges payable to interconnecting international operators under traditional settlement arrangements for mutual termination of traffic between their networks. In most countries, during the last few decades of the 20th Century, the level of accounting rates was well above the cost of providing international service termination.

Profits from high accounting rates provided a significant source of cross-subsidies, particularly to developing countries. It also led to a major imbalance in payment of accounting rates from countries that originated more calls than they terminated. There has been strong pressure from the US and other countries with outbound accounting rate imbalances to reduce accounting rates. This pressure, the ITU response, international service competition and technological developments have all led to significant decreases in accounting rates.

One recent technological development that undermines the accounting rate regime is Internet telephony, also referred to as “Voice over the Internet”, or “voice over IP” (VoIP) technology. Internet telephony generally bypasses the accounting rate regime, and hence allows VoIP providers to price their services below those of operators of conventional PSTN networks.

The downward trend in international accounting rates can be seen as an international form of rate rebalancing - between international and national service. Operators in a large number of countries will need to increase revenues from national services to offset potential losses from international settlements.

The demand for international calling is generally considered to be price elastic, especially at higher prices. Reductions in international rates will therefore usually lead to increases in international calling. Local access and calling, on the other hand, are generally less price elastic. The result of this rebalancing could therefore be higher overall revenues for operators providing both services.

The need to rebalance international and national rates has important implications for price cap regulation. For many countries, a significant amount of rate rebalancing may be both desirable and necessary. Accordingly, pricing restrictions should not deprive the operator of sufficient pricing flexibility to implement rebalancing. The potential volatility of international prices and uncertainty of customer response, may make it beneficial for the regulator to implement a fixed-weights scheme for the price cap formula, at least until the majority of the rebalancing has occurred.

## *Appendix 4-1: OECD Rate Rebalancing*

This appendix provides an overview of the OECD tariff comparison methodology and recent analysis of rate rebalancing trends in the OECD member countries.

Figure 4-5 and Figure 4-6 show the most recent Business and Residential Tariff basket comparisons for OECD member countries. Note that these baskets are based on standard listed prices rather than the myriad of discount schemes generally available in competitive markets.

In its 1999 publication, *Communications Outlook*, the OECD noted significant rate rebalancing in its 29 member countries. For instance, it noted a major trend towards postalized rates at the national level. Postalization is the term given for the trend towards flat rates for long distance services regardless of the distance. In other words, long distance service is heading for a world where, like postal services, it is usually priced the same irrespective of distance. This has been referred to in the industry as "the death of distance."

For instance, Figure 4-7 shows the difference between the cost of long distance calls and a local call (3 km) between 1990 and 1998. In 1990, the average price of a call at 490 km was 20 times greater than a local call at 3 km. In 1998, the margin was reduced to about seven times.

There are a number of reasons for postalized rates. Incumbent operators typically tend to reduce the number of long-distance bands in response to competitive entry. Another reason is the prevalence of discount plans that require consumers to sign up to a specific operator, often having to pay a fee. In return, loyal consumers receive significant savings over standard listed prices. Figure 4-1 in the main text of this Module indicates that rate rebalancing is also evident in the price trends of calls at different distances.

Rebalancing has been slower for the residential basket, as shown in Figure 4-8, than the business basket, which is illustrated in Figure 4-2 in the main text of this Module. When rate rebalancing occurred in 1994, however, significant cost savings for both residential and business consumers were realized. Fixed charges are now slightly lower than in 1990. Combined with usage charge reductions in the order of 25%, the overall price of the basket has been reduced by nearly 15%. Note that overall teledensity in the OECD countries has increased steadily, despite rebalancing.

**Box 4-12: OECD Tariff Comparison Methodology**

In 1990, the OECD established a harmonized methodology that enables international comparisons of national telecommunications prices, using a basket of the different elements for a particular service. This comparison can be made across countries and across time.

In recognition of the calling patterns and different prices faced by residential and business consumers, the OECD constructed a Residential basket and a Business basket. Each basket is made up of two elements, a fixed charge and a usage charge. The fixed charge covers a one year's subscription with the installation charge discounted over 5 years.

Once the fixed charge is calculated, the usage charge is based on OECD averages for the overall allocation of fixed charges to usage charges. Based on telephone usage patterns, the usage charge can be allocated to national calls. These calls are then priced out for each of the countries to arrive at the monetary amount, which is either expressed in US dollars at prevailing exchange rates or based on purchasing power parity (PPP).

**Figure 4-5: OECD Business Tariff Basket**

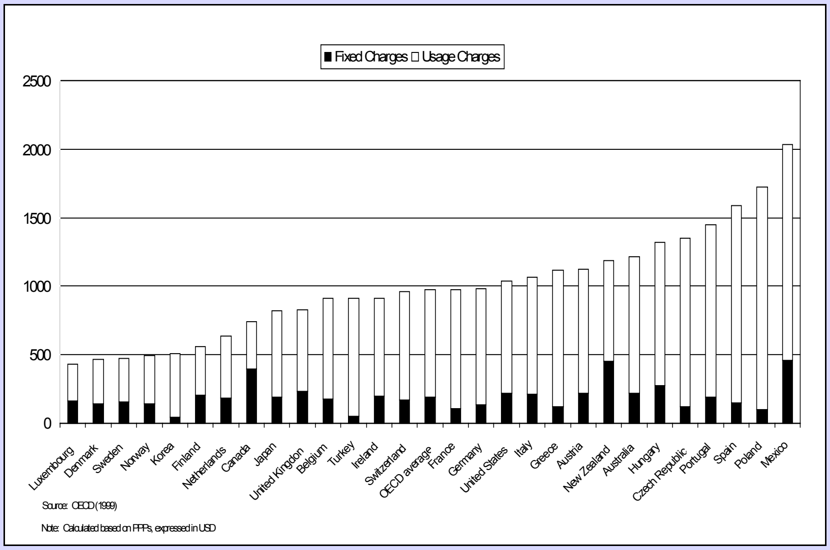



**Figure 4-6: OECD Residential Tariff Basket**

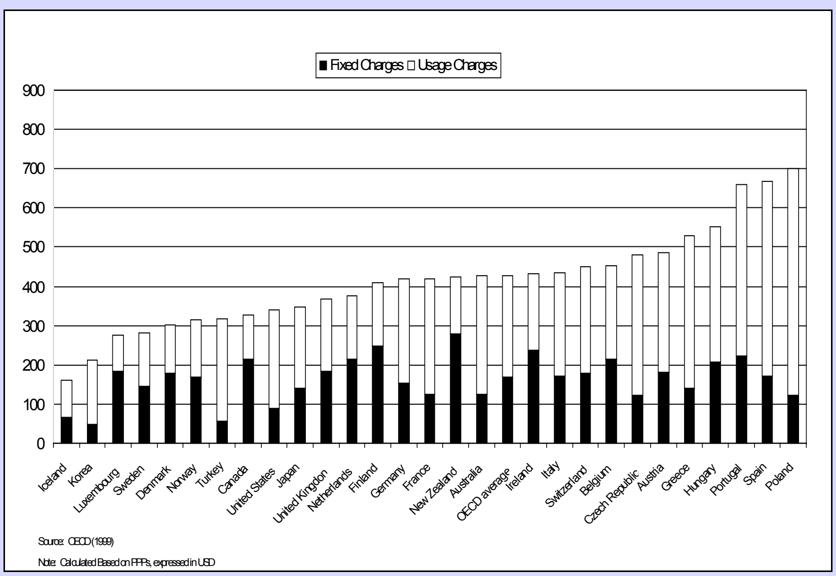


**Figure 4-7: Index of OECD Tariff Rebalancing, by year- The "Death of Distance"**

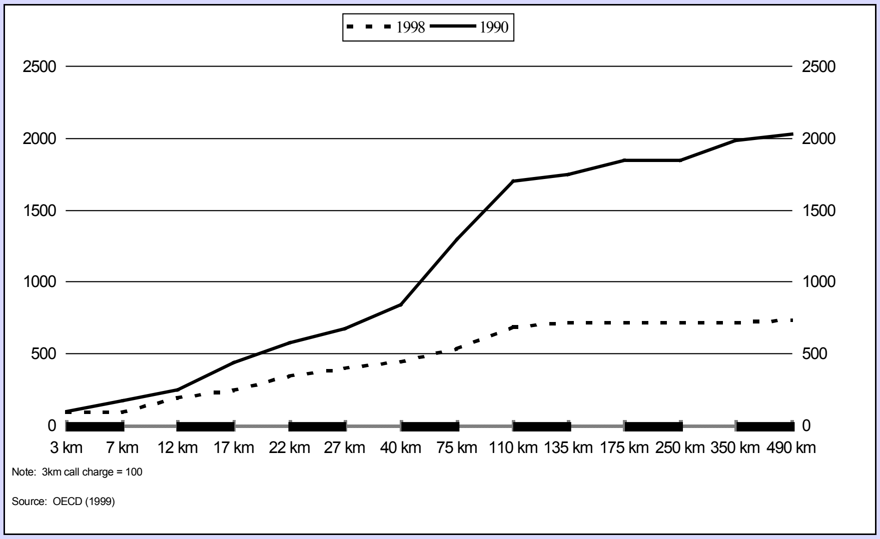
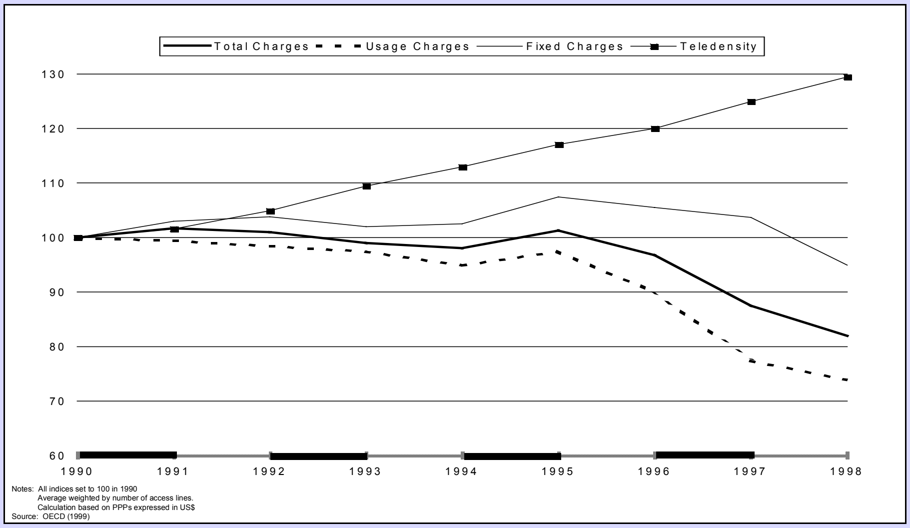



**Figure 4-8: Index of OECD Residential Charges and Teledensity**



## *Appendix 4-2: Welfare Benefits of Rate Rebalancing*

This Appendix provides an overview of the potential benefits to public welfare that may be expected from rate rebalancing.

The OECD study of telecommunications price trends (Appendix 4-1) indicates that rate rebalancing provided most consumers with lower prices in a majority of the countries surveyed. This is not the only benefit of rebalancing. Rate rebalancing will also increase social welfare by moving prices closer to costs. This will provide benefits to the economy in addition to those that result in lower overall prices. Rate rebalancing, therefore, should be undertaken whether competition is being considered or not.

Regulators may be requested to justify rate rebalancing. The recent modelling of rate rebalancing that carried out in Australia may be useful in this regard. The model was prepared for Australia's incumbent operator, Telstra, to estimate the potential efficiency gains from different rebalancing scenarios. Similar analyses have been carried out in other countries. This example uses a number of concepts, including long run incremental costs (LRIC), demand elasticities, revenue requirement, and Ramsey Pricing, which are discussed in Appendix B of the Handbook.

Table 4-10 provides a summary of the main estimates used in the model. By way of explanation, the unit of measurement for access is connections. For local calling, it is number of calls, for long distance and international calling, it is minutes. Net revenue is the difference between price and cost (LRIC) times the quantity. For instance, the net revenue loss for residential access of $614 million is equal to the difference between price $139.80 and LRIC $235.00, times 6.45 million connections. Note that the sum of the net revenue is $2,909 million, which we later assume to be its net revenue requirement.

The price elasticity of demand was based on a review of available estimates that were considered appropriate for national conditions. With the exception of local calling elasticity, the estimates are within the intervals discussed in the Appendix B of the Handbook.

The concept of efficiency loss requires some explanation. It is based on the theory that marginal cost pricing is optimal, that is, it maximizes the sum of consumer and producer surplus. (This concept is discussed in Appendix B of the Handbook.) When prices do not equal marginal costs, there are efficiency losses because either consumer or producer

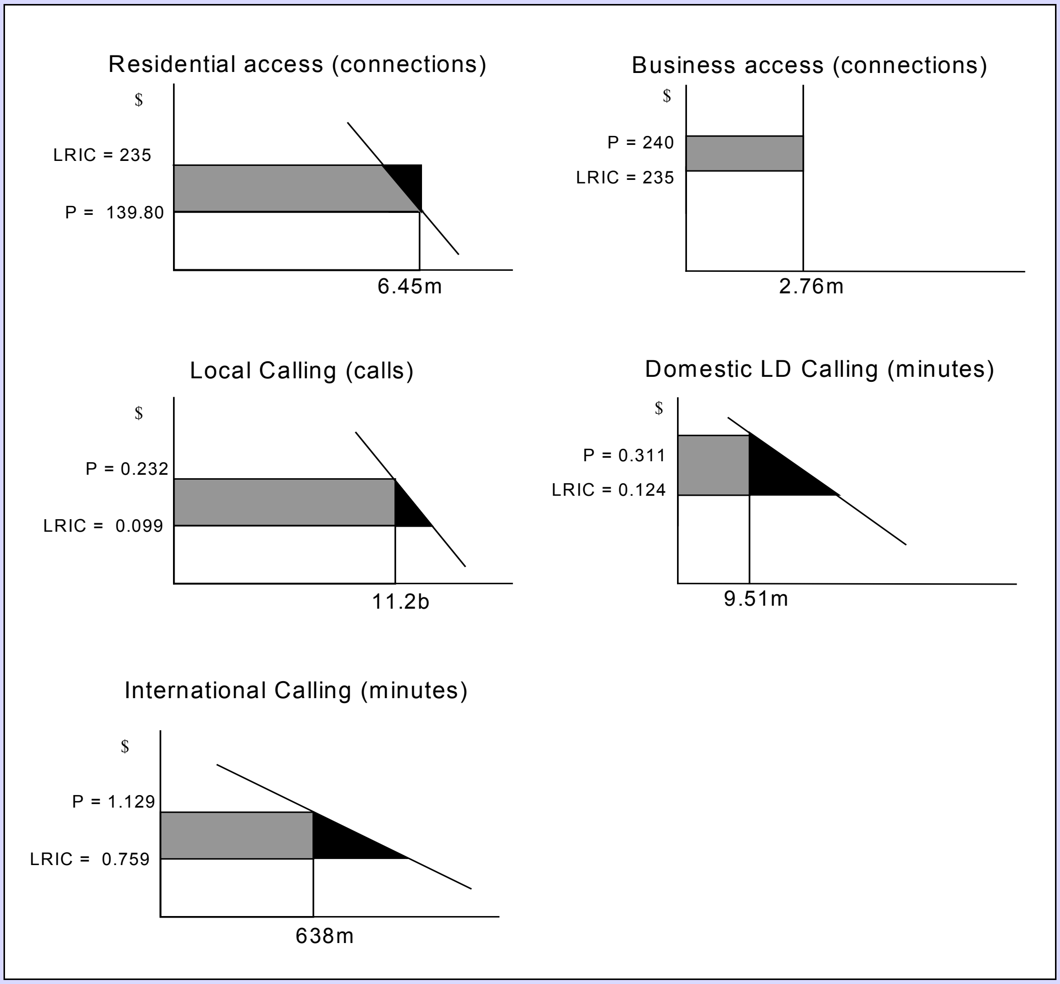
**Table 4-10: Estimates Used in the Telstra Rate Rebalancing Model – Base Scenario**

| Markets | Price ($ per unit) | LRIC ($ per unit) | Quantity | Net Revenue ($m) | Efficiency Loss ($m) | Price Elasticity of Demand |
|---|---|---|---|---|---|---|
| Res. Access | 139.80 | 235.00 | 6.45 m | -614 | 8 | -0.04 |
| Bus. Access | 240.00 | 235.00 | 2.76 m | 14 | 0 | -0.00 |
| Local calls | 0.232 | 0.099 | 11.20 b | 1492 | 26 | -0.006 |
| Dom. LD calls | 0.311 | 0.124 | 9.51 b | 1782 | 322 | -0.60 |
| Intntnl. Calls | 1.129 | 0.759 | 638.00 m | 236 | 46 | -1.20 |
| **Total** | | | | **2909** | **402** | |

Source: Australia Productivity Centre (1997) surplus are reduced. Figure 4-9 provides a graphical presentation of the main estimates used in the analysis. The black shaded areas are the efficiency losses associated with each instance of non-marginal cost pricing. Note that efficiency losses increase when the price-cost disparity is greater and when demand is more elastic. (Note the light shaded areas represent net revenues for each service).

The price-cost gap at initial conditions (the base scenario) imposes a loss in economic efficiency of $402 million, or nearly 15% of total operator revenues. Note, however, that while marginal cost pricing will eliminate this loss in economic efficiency, it will not meet Telstra's net revenue requirement, which is assumed to be equal to $2,909 million. As discussed in Appendix B of the Handbook, the solution to this dilemma is to calculate the corresponding Ramsey prices, that is, the set of prices that minimize efficiency losses and meet the revenue requirement.

**Figure 4-9: Rate Rebalancing - Base Scenario**




Note: Figures are not to scale.

Source: Australia Productivity Centre (1997)

Table 4-11 presents the results of five rebalancing scenarios, with the corresponding net revenue contribution and efficiency losses, and contrasts these to the base scenario.

Scenario #1, which totally eliminates the efficiency loss, would appear to be an extreme case. Ramsey prices call for the highest price over cost mark-up for the least price-sensitive service. In this instance, business access price is raised to $1,287 and contributes the entire net revenue of $2,909 million because it has an estimated zero price elasticity.

Scenario #2 holds the business access price to $350 and calculates the constrained Ramsey prices. Scenarios #3, #4, and #5 are other permutations that put further constraints on prices. Note that the more constraints that are placed on Ramsey prices, the smaller the efficiency gains. Note also, however, that even modest price movements towards LRIC can result in significant efficiency gains. These gains are likely to be greater in developing countries because of the generally greater disparity between prices and costs.

**Table 4-11: Results of Rate Rebalancing Scenarios**

| | Variable | Residential Access | Business Access | Local Calls | Domestic LD Calls | International Calls | Total |
|---|---|---|---|---|---|---|---|
| **Scenarios** | LRIC $ | 235.00 | 235.00 | 0.099 | 0.124 | 0.759 | |
| Base Scenario | Price ($) | 139.80 | 240.00 | 0.232 | 0.311 | 1.129 | |
| | Net. rev ($m) | -614 | 14 | 1492 | 1782 | 236 | **2909** |
| | Eff. Loss ($m) | 8 | 0 | 26 | 322 | 46 | **402** |
| Scenario 1: Unconstrained Ramsey Pricing | Price ($) | 235.00 | 1287.00 | 0.099 | 0.124 | 0.759 | |
| | Net. rev ($m) | 0 | 2909 | 0 | 0 | 0 | **2909** |
| | Eff. Loss ($m) | 0 | 0 | 0 | 0 | 0 | **0** |
| Scenario 2: Constrained Ramsey Prices | Price ($) | 354.00 | 350.00 | 0.235 | 0.148 | 0.804 | |
| | Net. rev ($m) | 723 | 318 | 1529 | 301 | 38 | **2909** |
| | Eff. Loss ($m) | 13 | 0 | 27 | 5 | 0 | **45** |
| Scenario 3: Constrained Ramsey Prices | Price ($) | 235.00 | 350.00 | 0.291 | 0.158 | 0.822 | |
| | Net. rev ($m) | 0 | 318 | 2120 | 418 | 53 | **2909** |
| | Eff. Loss ($m) | 0 | 0 | 54 | 10 | 1 | **65** |
| Scenario 4: Constrained Ramsey Prices | Price ($) | 235.00 | 350.00 | 0.232 | 0.209 | 0.919 | |
| | Net. rev ($m) | 0 | 318 | 1492 | 975 | 124 | **2909** |
| | Eff. Loss ($m) | 0 | 0 | 26 | 67 | 8 | **101** |
| Scenario 5: Constrained Ramsey prices | Price ($) | 140.00 | 350.00 | 0.232 | 0.272 | 1.036 | |
| | Net. rev ($m) | -614 | 318 | 1492 | 1520 | 194 | **2909** |
| | Eff. Loss ($m) | 8 | 0 | 26 | 203 | 25 | **262** |

Source: Australian Productivity Centre (1997)