

How to Determine the X in *RPI - X* Regulation:

A User's Guide

by

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Abstract

We examine the appropriate choice of an "X" factor in *RPI - X* (or price cap) regulation. After providing a basic guideline, we explain how to modify this guideline to account for: (1) limited spans of regulatory control; (2) anticipated structural changes in the regulated industry, such as a strengthening of competitive forces; (3) major impacts of the pricing decisions of the regulated firm on the economy-wide rate of price inflation; and (4) imperfect competition outside of the regulated sector.

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Running Headline

RPI - X Regulation

1. Introduction.

Price cap regulation – sometimes known as *RPI - X* regulation – has become a popular form of regulation in many industries, including the telecommunications industry. In the United States, for example, most state governments now employ some form of price cap regulation to govern the intrastate activities of their telecommunications suppliers. Price cap regulation typically specifies an average rate at which the prices that a regulated firm charges for its services must decline, after adjusting for inflation. This rate is called the *X factor*.¹

The proper choice of an *X factor* is critical for the long-term viability of any price cap regulation plan. If too small an *X factor* is imposed, the regulated firm will earn excessive profit and thereby jeopardize political support for the regulatory regime. If too large an *X factor* is imposed, the financial integrity of the regulated firm can be threatened. The essence of price cap regulation, therefore, is to select an *X factor* that poses a significant, but not insurmountable, challenge to the regulated firm, and that promises gains for consumers relative to alternative regulatory regimes.

The purpose of this article is to explain how to select an appropriate value for the *X factor* when implementing price cap regulation. In section 2, we provide a basic guideline: the *X factor* should reflect the extent to which the regulated industry has historically achieved higher productivity growth and faced lower input price inflation than other industries in the economy. This guideline is appropriate during the specified period of price cap regulation when the following four conditions hold: (1) All of the regulated firm's services are subject to price cap regulation; (2) No major structural changes (such as a strengthening of competitive forces) are anticipated in the regulated industry; (3) The rate of price inflation outside of the regulated sector is not affected by the pricing decisions of the regulated firm; and (4) The economy outside of the regulated sector is competitive. In section 3, we explain how the basic guideline should be modified when, as is common in practice,

these four conditions do not hold.² Conclusions are drawn in section 4.

2. The Basic Guideline.

Price cap regulation is intended to replicate the discipline of competitive market forces. Competitive forces compel firms to realize productivity gains and to pass these gains on to their customers in the form of lower prices, after accounting for unavoidable increases in input prices. Therefore, if all industries in an economy were competitive, output prices in the economy would grow at a rate equal to the difference between the growth rate of input prices and the rate of productivity growth.³

If the regulated industry were just like the typical sector in a competitive economy, the discipline of competitive forces could be replicated by limiting the rate of growth of regulated prices to the economy-wide rate of price inflation. This restriction would require the regulated industry to realize the same productivity gains that are realized in other sectors of the economy, and to pass these gains on to customers, after adjusting for the typical rate of unavoidable input price inflation. Therefore, the *X* factor should be *zero* when the regulated industry is capable of achieving exactly the same productivity growth rate and faces exactly the same rate of input price inflation as other sectors of the competitive economy.

More generally, the *X* factor should reflect the extent to which: (1) the regulated industry is capable of increasing its productivity more rapidly than are other sectors of the economy; and (2) the prices of inputs employed in the regulated industry grow less rapidly than do the input prices faced by other sectors of the economy. If the regulated industry is able to achieve more rapid productivity growth (perhaps due to more rapid technological change, for example) or to realize lower input price inflation than other sectors of the economy, then the regulated industry should be

required to pass the associated benefits on to customers in the form of lower prices. To illustrate this basic guideline, consider the following example.

Example 1. The expected annual rate of productivity growth in the regulated industry is 2%, and the corresponding growth rate elsewhere in the competitive 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 1.5%. In this setting, the X factor should be 2% ($= [2 - 1] + [1.5 - 0.5] \%$).

When no major structural changes are anticipated in the economy, historic data on productivity and input price growth rates often provide reasonable estimates of corresponding future growth rates. For expositional simplicity, we focus on this case in most of the ensuing discussion. However, if statistics that aid in the prediction of future growth rates are available, they can also be employed. In section 3, we discuss appropriate corrections to historic data when structural change in the regulated industry is anticipated.

3. Extensions of the Basic Guideline.

The derivation of the basic guideline in section 2 assumed: (1) all of the regulated firm's services are subject to price cap regulation; (2) there are no major structural changes in the regulated industry; (3) the rate of price inflation outside of the regulated sector is not affected by the prices set in the regulated industry; and (4) the economy outside of the regulated sector is competitive. In this section, we explain how the basic guideline for setting the X factor should be modified when these conditions are not satisfied.

Accounting for a Limited Span of Regulatory Control.

In practice, price cap regulation is often applied to only a subset of the services supplied by the regulated firm. For example, in the telecommunications industry, basic local services are typically regulated while enhanced and special services are often unregulated. The basic guideline provided above could be implemented without modification if productivity and input data that pertained exclusively to the firm's regulated operations were available. But this is seldom, if ever, the case. Available data invariably pertain to the firm's entire operations. Furthermore, joint products and common factors of production generally make it impossible to employ the aggregate data to derive productivity growth rates and input price growth rates separately for "capped services" (those subject to price cap regulation) and for "uncapped services" (those not subject to price cap regulation). Consequently, the guideline described above must be modified to define an appropriate X factor for the firm's capped services, using only measures of productivity and input price growth rates for the firm's entire operations.

The key modification of the basic guideline is the following. The X factor should be decreased when the prices of uncapped services are growing more slowly than the difference between the growth rate of input prices and the productivity growth rate in the regulated industry.⁴ The magnitude of the appropriate decrease is proportional to the fraction of the regulated firm's total revenue that is derived from the sale of uncapped services. The rationale that underlies this adjustment is relatively simple. Price cap regulation is designed to compel the firm to pass on anticipated productivity gains to customers in the form of lower prices, after correcting for unavoidable increases in input prices. If the prices of uncapped services are rising more slowly than they would be if they reflected only anticipated productivity gains and unavoidable cost increases, then the firm is passing on to customers of uncapped services more benefits than price cap regulation

of the firm's entire operations would dictate. Therefore, it can be appropriate to permit a compensating reduction in the benefits that must be delivered to the customers of capped services. This reduction can be implemented by reducing the X factor.

The magnitude of the appropriate adjustment to the X factor can be substantial. To illustrate this fact, consider the following example.

Example 2. The productivity and input price growth rates for the regulated industry and the rest of the economy are as stated in Example 1. One half of the regulated firm's revenue is derived from the sale of uncapped services, and competitive forces preclude price increases on these services. In this setting, the X factor should be 0.5% ($= 2 - [0 - (0.5 - 2)]$ %).

The 0.5% X factor cited in Example 2 represents the difference between the 2% X factor prescribed in Example 1 and the correction for the limited span of regulatory control. This correction (1.5%) is the difference between: (1) the rate of growth of the prices of uncapped services (0%); and (2) the difference between the rate of growth of the regulated firm's input prices (0.5%) and its productivity growth rate (2%).

Accounting for Structural Change in the Regulated Industry.

Price cap regulation attempts to divorce authorized prices from realized costs. Consequently, it can provide strong incentives for the regulated firm to reduce its operating costs. In contrast, rate-of-return regulation can provide limited incentives for cost reduction to the extent that it reimburses the regulated firm for realized operating costs. Consequently, when price cap regulation replaces rate-of-return regulation in an industry, firms in the industry can often be expected to achieve a higher productivity growth rate in the future than they have in the past. Therefore, it can be appropriate to augment any historically-based estimate of the X factor described in section 2 with

what is called a *customer productivity dividend* (CPD). In principle, the CPD should reflect the best estimate of the increase in the productivity growth rate in the regulated sector that will be induced by the enhanced incentives in the regulated industry.

Strengthening competitive forces constitute another structural change that can affect the most appropriate value for the X factor under price cap regulation. Perhaps surprisingly, the effect of increased competition on the proper X factor is ambiguous, especially in the short run. On the one hand, increased competition, like a change in regulatory regime, can compel the regulated firm to operate more efficiently and thereby realize a higher productivity growth rate. This effect of increased competition argues for a higher X factor, since it is reasonable to require the regulated firm to pass on to its customers some of the benefits of an anticipated higher productivity growth rate. On the other hand, increased competitive forces can shift industry sales from incumbent suppliers to new entrants. The result can be an unavoidable reduction in the growth rate of the incumbent supplier's outputs. Often, and particularly in the short run, this reduction in the growth rate of its outputs can exceed any associated reduction in the growth rate of its inputs, leading to a lower productivity growth rate for the incumbent regulated firm. This effect argues for a lower X factor.⁵ Overall, the direction and magnitude of the most appropriate modification of the X factor to account for strengthening competitive forces reflects the best estimate of the net impact of these countervailing effects.

Accounting for Endogeneity in the Economy-Wide Inflation Rate.

The logic that underlies the simple guideline described in section 2 presumes that the economy-wide rate of price inflation is not affected directly by the prices set in the regulated industry. This assumption can be unrealistic in some settings, particularly in small, developing

economies where regulated outputs constitute a large fraction of total production in the economy. In such settings, the simple guideline described above must be modified to account for the endogeneity of the economy-wide rate of price inflation.

The central modification is to weaken the link between the realized rate of price inflation in the economy and the authorized rate of price increase in the regulated industry. In particular, a one percent increase in the economy-wide rate of price inflation should not authorize a full one percent increase in the rate of price inflation in the regulated industry. The difference between the two inflation rates should generally be greater the larger is the regulated sector relative to the economy as a whole and the greater is the fraction of regulated revenues derived from the sale of intermediate goods (i.e., those used to make other goods).

To understand the essence of this modification of the basic guideline, suppose the authorized rate of price inflation in the regulated sector increases with the realized rate of price inflation in the economy on a one-for-one basis. Also suppose that higher rates of price inflation in the regulated sector cause higher rates of inflation in the economy as a whole. Under these conditions, price increases in the regulated sector effectively serve to authorize further price increases in the sector. Consequently, the presumed form of price cap regulation will not constrain price increases in the regulated sector appropriately. Effective constraints can be restored by reducing the extent to which the price cap formula authorizes higher growth rates for regulated prices as the realized rate of price inflation elsewhere in the economy increases.

Accounting for Imperfect Competition in the Economy.

The simple guideline described in section 2 may also require modification when some of the industries outside of the regulated sector are not competitive. This is the case even if output price

inflation in these industries is not affected by the prices set in the regulated industry. In industries that are not competitive, all productivity gains net of unavoidable cost increases are not necessarily passed on to customers in the form of lower prices. Consequently, the realized rate of price inflation outside of the regulated sector can exceed the rate of price inflation that would arise if all markets were competitive. When this is the case, a higher X factor can be appropriate to offset the extent to which the realized economy-wide inflation rate exceeds the rate that would arise in a competitive environment.

4. Conclusions.

This article provides two main messages. First, there is a simple guideline that can inform the selection of an appropriate X factor in price cap regulation plans. The guideline states that the X factor should reflect the extent to which the regulated industry has historically achieved more rapid productivity growth and faced lower input price inflation than other sectors of the economy. Second, this guideline should be modified to account for limited spans of regulatory control, structural change in the regulated industry, endogenous rates of economy-wide price inflation, and imperfect competition outside of the regulated sector. The details of the appropriate adjustments can be somewhat intricate, but their basic nature is generally intuitive and their magnitudes are readily calculated. Failure to make the adjustments can result in X factors that deviate significantly from their most appropriate levels.

REFERENCES

Bernstein, J., Sappington, D. (1999). Setting the X factor in price-cap regulation plans. *Journal of Regulatory Economics*, 16 (1), 5-25.

FOOTNOTES

1. In some settings, the retail price index (RPI) is employed to measure the economy-wide rate of (output) price inflation, which explains why price cap regulation is sometimes referred to as "RPI - X" regulation.
2. A more detailed analysis of these modifications is provided in Bernstein and Sappington (1999).
3. The (total factor) productivity growth rate for a firm or an industry is the difference between the rate at which its outputs grow and the rate at which its inputs grow.
4. Similarly, the X factor should be increased when the prices of uncapped services are rising more rapidly than the difference between the growth rate of input prices and the productivity growth rate in the regulated industry.
5. Increased competition for scarce factors of production can also increase the growth rate of input prices in the regulated industry, which provides an additional justification for a lower X factor.