Price Cap Regulation and Productivity Growth

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1. Introduction

Price cap regulation has become a popular form of regulation in many industries in the US, Canada, and the UK. In the U.S., for example, since 1999 at least 36 states were operating under some form of price cap regulation to govern the intrastate activities of their telecommunications suppliers. Since January 1998 Canadian telecommunications regulation has operated under a price cap regime. Price cap regulation typically specifies a minimum 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 offset, or X factor. Downward price adjustments arise, in part, from productivity improvements, based generally on historical experience, considered achievable during the price cap period.

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, if too large an X factor is imposed, the viability of the regulated firm can be threatened. The essence of price cap regulation is to select an appropriate X factor that challenges the regulated firm, and that promises gains for customers. This paper describes the role of total factor productivity (TFP) growth in the implementation of current typical price cap regulation.

In section 2, we characterize the role of productivity growth in the guideline to X factor determination adopted by many regulatory authorities in Canada, the US, and UK. This basic guideline provides that the X factor should reflect the extent to which the regulated industry has; i) historically achieved, and expected in the future to attain, higher productivity growth, ii) faced, and is expected to continue facing, lower input price inflation than competitive industries in the economy. This guideline is appropriate during the specified period of price cap regulation when all of the regulated firm's services are subject to price cap regulation.

Given the prominent position of productivity growth within price cap regulation, in section 3 we provide a discussion of the major issues pertaining to the characterization of productivity growth targets. In order for price cap regulation to emulate competitive market forces, the productivity target must be achievable by the average provider within the industry during the price cap period. The target must also reflect long-term productivity trends as opposed to short-term fluctuations and one-time anomalies. Lastly, the productivity target must be invariant to manipulation by regulated firms, and regulators.

The basic guideline is appropriate when all of the regulated firm's services are subject to price cap regulation. In section 4 we describe a method pivoting off of the basic guideline that shows how the X factor should be modified when a regulated firm produces both "capped services" (those subject to price cap regulation) and "uncapped services" (those not subject to price cap regulation). The X factor should be modified when the prices of uncapped services are growing at a rate that differs from the rate dictated by the basic (all-service) X factor. Failure to do so generally imposes too stringent an offset on the regulated firm.

2. The Basic Approach

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 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.

If a regulated industry operated typically like any industry 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 industries of the economy, and to pass these gains on to customers, after adjusting for the typical rate of input price inflation. Therefore, the X factor is 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 industries of the competitive economy.

More generally, a positive X factor reflects at least one of the following two conditions:

(1) The regulated industry is capable of increasing its productivity more rapidly than are other industries of the economy,

(2) The prices of inputs employed in the regulated industry grow less rapidly than do the input prices faced by other industries of the economy.

In symbols, the average growth rate of prices in a price cap regime, PG, contains two elements, an inflation rate (IR) and an offset (or X factor) to the rate of inflation:

$$PG = IR - X.$$

$$X = \{[WG(Economy) - WG(Industry)] + [TFPG(Industry) - TFPG(Economy]\}$$

where; WG is the input price growth rate, and TFPG is the TFP growth rate. Under price cap regulation, if the regulated industry is able to achieve more rapid productivity growth, or to face lower input price inflation than other industries, then the regulated industry should be required to pass the associated benefits on to customers in the form of lower prices.[1]

Generally, the rate of inflation is taken to be an average growth rate in output prices for the economy. One example is the Gross Domestic Product Price Index (GDPPI).[2] Typically regulators calculate the historically justified X factor and then set the price cap X factor equal to the historical rate unless elements can be identified which will cause future values to depart systematically from historical values. If future X factors are expected to differ from past ones then adjustment to the historical values must be made. These identifiable factors are customarily most important when price caps are being first introduced. Efficiency incentives created by the switch to price caps could result in higher future rates of productivity growth than were historically observed, although there is little evidence to substantiate this claim.

Any productivity gains associated with the switch to price caps must be temporary and dissipate when price caps have been in effect for some time. It is also possible for future rates of productivity growth to diverge from past rates, even if price caps already exist for some time. Indeed, productivity growth rates can decline. For example, one of the main sources of measured productivity growth arises from output growth due to scale economies. Since many regulated industries exhibit economies of scale, if future output growth decreases from the historical rate due to competitive pressures, then future productivity growth rates would be lower than those historically observed.

3. Productivity Target

Under price cap regulation a firm has the potential to improve its financial position by becoming more productive through the introduction of new processes, products, and management practices. The extent to which an incumbent carrier is able to improve its financial viability depends, in part, on the X factor set by the regulator. Therefore, the selection of an appropriate productivity target is critically important to the success of price cap regulation. The main issues surrounding the selection criteria of the productivity target are reviewed in this section.

3.1 Industry TFP Target

One of the key requirements for proper price cap regulation is to base the offset on an industry-wide productivity index, instead of the performance of a particular regulated firm. The X factor should reflect, in part, the differential between the regulated industry's productivity growth, and that of the overall economy. If price cap regulation is to emulate competitive markets the regulated firms should be rewarded for superior productivity performance.

Superior performance must be defined in terms of outperforming rivals and not oneself. This feature improves the firm's incentive to become relatively more productive, and captures the essence of a competitive situation.[3] Since a firm can increase its profit, if it can achieve greater productivity gains than those reflected by the industry productivity target, it has an incentive to be more productive than the industry as a whole. Firms that fall short of the industry productivity target see their profit erode, and thereby have an incentive to improve and exceed the industry productivity norm. Thus it is the nexus between industry productivity gains and firm profit potential that drives the regulated firm to allocate scarce resources in a manner that facilitates its ability to surpass industry-wide productivity growth.

3.2 Long Term TFP Target

Price cap regulation encompasses a target productivity growth rate for the regulated industry. However, productivity growth rates fluctuate yearly. The proper implementation of price caps (currently) configured necessarily requires the ability to distinguish the long-term trend in TFP from short-term fluctuations. Use of the secular productivity trend causes the average price of the regulated firm to adjust to a long-term productivity potential, thereby contributing to the stability of the regulatory plan.

Secular productivity trends mitigate the impact of one-time events on annual TFP growth. Not all productivity gains achieved in one period are sustainable into future periods. For example, labor cost reductions in one year by the regulated industry, (cost reductions by one firm should not have any influence on the productivity target, since it is an industry-wide target) may lead to temporary productivity gains. However, these new gains may not be sustainable for more than a couple of years. Conversely, a short-term drop in revenue, for example as a

result of a downturn in aggregate demand in the economy, may result in a temporary output reduction that is not matched by corresponding input cost reductions. This would not result in a reduction of the long-term productivity growth trend.

Cyclical fluctuations in productivity also arise because some factors of production, such as capital and skilled labor, are fixed in the short-run. For example, when economic activity contracts, firms do not reduce its capital to the same degree that output declines because capital adjustment is very costly. Moreover, using long term productivity growth rates in X factor calculations accommodates the lumpiness of investment. Large capital projects, embodying technological advances, may be required over some time period, followed by a period of relatively low investment. These lumpy, and discrete capital additions initially lead to higher costs and thereby lower productivity growth. However, once the new capital is deployed, productivity growth increases. Short-term productivity fluctuations are exacerbated in capital-intensive industries, such as telecommunications, resulting from timing mismatches of costs and revenues. Significant expenditures may be required in the early stages of a capital project, but the benefits of that investment may not be realized for a number of years in the future. As a result industry TFP growth may be initially understated, while overstated in later periods.

3.3 Immutable TFP Target

An important feature of price cap regulation arises from the commitment that regulators will not view increased firm profitability as a source of regulatory failure. Indeed, the potential for increased profit is a fundamental premise underlying price cap regulation. Incentives are diluted if the productivity target is altered by the recent past performance of the regulated firm. If the potential exists within the regulatory framework for increasing the TFP target in response to large productivity gains in prior periods, then the incentive to innovate in the future by investing in cost reducing production methods, and developing new goods, and services will be substantially reduced or eliminated.

Review and revision of the X factor by the regulator within the price cap period is inappropriate under price cap regulation. If the productivity target is reviewed within the price cap period then the review creates an erratic and unpredictable target, undermining the incentive for productivity improvement under price cap regulation. Blunting of productivity-improving incentives also operates if price cap performance results are monitored over a relatively short period of time, with the possibility of recalculating the productivity target. In this situation, as the case of frequent productivity reviews, the potential for recapture of past productivity gains will severely dull efficiency incentives.

A firm must have a reasonable degree of certainty that it will retain the benefits of increased productivity beyond the industry norm that results from deployment of new technology, new product development, and restructuring or improvements in operations. In the absence of reasonable certainty, the firm will not have sufficient incentives to undertake such activities. To ensure that the regulatory framework provides proper efficiency incentives, price cap performance review periods should be sufficiently long so that the threat of recapture of past productivity gains is minimized.

4. Limited Regulatory Span

The discussion of the basic framework for price cap regulation in section 2 assumed that all of the regulated firm's services are subject to price cap regulation. Price cap regulation is generally applied to only a subset of the services supplied by the regulated firm. For example, in

telecommunications basic local services are typically regulated while long distance services are often unregulated. There would not be any need to distinguish between regulated and non-regulated services in price cap plans if all prices grew at the same rate. Additionally, the basic characterization of the X factor provided above could be implemented without modification if productivity and input price and quantity data that pertained exclusively to regulated operations were available. However, joint products and common costs generally make it impossible 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 capped services.

In this section we describe a method pivoting off of the basic guideline that shows how the X factor must be modified when a regulated firm produces both capped services, and uncapped services. The X factor for capped services must be decreased when the prices of non-capped services are falling more rapidly (or growing more slowly) than prices dictated by the basic (all-service) X factor. Failure to so so imposes to stringent an offset on the regulated firm.[4]

Calculation of the offset begins with the fact that the average growth rate of prices (PG) for a regulated firm are separable into growth rates for prices subject to price caps (PGC) and growth rates for prices that are uncapped (PGU). The weighted sum of output price growth rates is shown as:

$$PG = \alpha PGC + (1-\alpha)PGU = IR - X$$

$$X = \{[WG(Economy) - WG(Industry)] + [TFPG(Industry) - TFPG(Economy)]\}$$

where α is the revenue share of capped services. Isolating the average growth rate of capped service prices leads to:

$$PGC = IR - X^*$$

$$X^* = X + Xa$$

$$Xa = [(1-\alpha)/\alpha]\{PGU - WG(Industry) + TFPG(Industry)\}$$

The rationale that underlies this adjustment is straightforward. Price cap regulation is designed to compel the firm to pass on anticipated (industry-wide) productivity gains to customers in the form of lower prices, after correcting for increases in input prices. If the prices of non-capped services are falling more rapidly than they would be if they reflected only anticipated productivity gains and input price increases, then the firm is actually passing on to customers of non-capped services more benefits than price cap regulation for the firm's entire operations would dictate. Under these circumstances, the prices of capped services must decline by less than the rate implied by price cap regulation based on the firm's entire operations. This reduction implies a reduced X factor relative to the basic all-service offset. Similarly, the appropriate X factor for capped services must be increased when the prices of non-capped services are falling less rapidly than prices dictated by the basic (all-service) X factor.

In general, the X factor must be based on the services subject to price caps. Prospective differential growth rates between capped and non-capped prices necessitate an offset adjustment for the basic X factor. Failure to do so significantly biases the offset imposed on the regulated firm.

The magnitude of the appropriate adjustment to the X factor can be substantial. To illustrate this fact, consider the following example drawn from the current Canadian telecommunications price cap plan.

Example:

TFP Growth(Industry)	4.2%
Less TFP Growth(Economy)	1.0%
Plus Input Price Growth(Economy)	3.0%
Less Input Price Growth(Industry)	2.7%
Equals	
X Factor	3.5%
Plus (uncapped revenue, 60%/ capped revenue, 40%) Multiplied by	
Uncapped Price Growth	-3.8%
Less Input Price Growth(Industry)	2.7%
Plus TFP Growth(Industry)	4.2%
Equals Uncapped Adjustment	
Xa Factor	-3.45%

X* (Capped)= X(Overall) + Xa = 3.5% - 3.45% = 0.5%

5. Conclusion

This article provides three main messages. First, there is a simple guideline to the selection of an appropriate X factor in price cap regulation plans. The guideline states that the X factor reflects the extent to which the regulated industry has achieved more rapid productivity growth and faced lower input price inflation than other sectors of the economy. Second, in order for price cap regulation to emulate competitive market forces, the productivity target must not be firm specific, but relate to the industry. The target must also reflect long-term productivity trends as opposed to short-term fluctuations, and the productivity target must be invariant to strategic manipulation by regulated firms, and the regulator. The third message is that the offset guideline must be modified to account for limited spans of regulatory control. The details of the appropriate adjustments are intuitive and their magnitudes are readily calculated. Failure to make the adjustments result in X factors that deviate significantly from their most appropriate levels.

Notes

* The unabridged version of this article can be found online at www.csls.ca. Email: jeff.bernstein@carleton.ca.

1 The offset is often referred to as the productivity offset. However, this terminology is incorrect since the differential in input price growth rates between the regulated firm and the economy also forms part of the offset.

2 In a strict sense the regulated industry's services should be netted out of the economy-wide measures. However, in practice, the subtraction from economy-wide measures is not undertaken since a regulated industry's services form a small part of the overall economy.

3 Theoretically it may be appropriate to apply an industry-wide productivity target to a given firm that excludes the firm's own productivity performance. Therefore, the firm's productivity would have no effect on the industry productivity measure included in its price cap formula. However, this would require a separate productivity target for each firm operating under price caps. This may not be a practical option.

4 Similarly, the X factor for capped services must be increased when the prices of non-capped services are falling less rapidly than prices dictated by the basic (all-service) X factor.

References

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