

Issues in the Design and Implementation of Price Cap Regulation

David Sappington
University of Florida

Session Objective

- Discuss how to design price cap regulation.

Please Note:

- The purpose of this session is to analyze price cap regulation, not advocate it.
- We will focus on one important way to formulate a price cap plan.

Alternatives will also be noted.

- Examples will be drawn primarily from the telecommunications sector.

Session Objectives (Continued)

- Price cap regulation is not the ideal form of regulation in all settings.
- To understand the strengths and weaknesses of price cap regulation, it is important to understand in detail how it works.

Potential Advantages of Price Cap Regulation

- By regulating prices (not earnings) and by not continually adjusting prices to reflect costs, PCR can provide strong incentives for cost reduction.

Potential Disadvantages of Price Cap Regulation

- The firm may earn very high or very low profit.
- The potential for significant earnings variation may raise the firm's cost of capital.

Outline of Presentation

Step 1.

- A. Discuss the over-arching design of price cap regulation (PCR).
- B. Examine additional details of PCR.

Step 2.

- A. Consider alternatives to pure PCR.
 - Hybrid plans.
- B. Discuss the role of regulatory options.

Step 1. The Details of PCR

- A. Examine the over-arching restriction that is placed on prices under PCR, and determine how this restriction is implemented in practice.
- B. Discuss additional features of PCR.

Other Elements of PCR

(To be Discussed Shortly)

1. Should restrictions on individual service prices accompany the overarching restriction on prices?
2. How many baskets of services should be employed?
3. Are additional regulations required to ensure desirable levels of service quality?
4. When should price cap plans be reviewed?
5. How should reviews be structured?

The Over-Arching Restriction in Price Cap Regulation

- After setting prices initially to generate a fair rate of return, prices are permitted to rise, on average, at the rate of inflation, less an offset.

$$\% \dot{p}^R = I - X$$

(% \dot{p}^R denotes the rate at which regulated prices are rising, on average.)

Questions.

1. What is the relevant “offset” (X)?
2. What is the best measure of inflation (I)?
3. What does “on average” mean?

Key Question

How do we choose the most appropriate “offset” (X)?

Initial Question:

How do Prices Change
in a Competitive Economy?

- In a competitive economy, prices reflect production costs.
 - Prices rise to the extent that unavoidable cost increases are incurred.
 - Prices decline to the extent that productivity gains are achieved.

$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}}$$

- **Consequently, in a competitive economy, the economy-wide inflation rate reflects unavoidable cost increases, after accounting for productivity gains.**

Implication

- If the regulated firm is no different from the average firm in a competitive economy, then the firm's profits will not change if its prices are permitted to rise at the economy-wide rate of price inflation.

- Therefore, if the regulated firm is likely to face unavoidable cost increases and potential productivity gains similar to those faced by other firms in the economy, an X factor of zero would replicate the discipline of competitive markets.

Observation

A policy that links allowed prices to realized inflation adjusts automatically for economy wide variations in cost increases and productivity gains.

- The regulator need not speculate about the *absolute levels* of likely cost increases and productivity gains.
- The regulator need only posit likely *differences* in cost increases and productivity gains between the regulated firm and the rest of the economy.

Can the X Factor Differ From Zero?

- If the regulated firm is deemed capable of achieving more rapid productivity growth than is typical in the economy, then the X factor should be positive to reflect this superior ability to reduce prices profitably.

- If the prices of the regulated firm's inputs are rising less rapidly than the input prices of other firms, then, again, X should be positive to reflect this increased ability of the regulated firm to keep its product prices low.

The X-Factor: A Summary

- In summary, the X factor should be a number that reflects the extent to which the regulated firm's productivity is expected to increase more rapidly and its input prices are expected to increase less rapidly than the typical firm in the economy.
- Note: The X factor can be negative.

Example

Economy Wide Data

Productivity growth rate = 2%

Input price growth rate = 1%

Reasonable Expectations for Regulated Firm

Productivity growth rate = 3%

Input price growth rate = 0.5%

$$\begin{aligned}\underline{\text{X factor}} &= [3 - 2] + [1 - 0.5] \\ &= 1.5\end{aligned}$$

Observations

1. The chosen level of X determines a productivity hurdle that the regulated firm must surpass if it is to be profitable.
2. The essence of PCR is to choose an X that provides reasonable expected benefits for consumers while posing a significant, but reasonable, challenge for the firm.

3. If $X < I$, then PCR allows prices to rise ($\%Dp^R = I - X > 0$).

4. If $X > I$, then PCR requires prices to fall ($\%Dp^R = I - X < 0$).

Possible Approaches to Setting X

1. Purely Historical Approach.

- Set X equal to X_0 , the average historic difference between the firm's and the economy's productivity (less input price) growth rates.
- This approach uses the past as the best indicator of the future.
- This approach requires significant data.

2. Modified Historical Approach.

- Set X equal to $X_0 + S$.
- S is a “stretch factor” that accounts for the stifling effects of historic regulation and/or anticipated changes in industry conditions.

Examples of Explicit Stretch Factors

- FCC for LECs: 0.5%
- Pennsylvania: 0.2%
- Illinois: 1.0%
- Canada (LECs) 1998: 1.0%
- Canada (LECs) 2002: 0.0%

- **Stretch factors are often implicit:**
 - **The selected X factor exceeds historical productivity trends, but the excess is not explicitly called a stretch factor.**

3. Draw From Experience Elsewhere.

- Set X equal to the level that appears to have worked well in other jurisdictions.

4. Additional Possibilities.

- Set X equal to the productivity differential achieved by other firms in the industry.
- Allow X to vary as key input prices vary.
 - Fuel adjustment clauses.

4. Additional Possibilities (Continued).

- Examine historical price changes relative to inflation, and require similar ongoing changes (perhaps with a stretch factor adjustment).
- Develop a model of the efficient firm (as in Chile), and set X to match the price movement of the hypothetical efficient firm.

Examples of X-Factors

- U.S. Local Rates: 2.7%.
- U.S. Access Prices: 6.5%.
- Hong Kong: 4.0%.
- Great Britain (1997): 4.5%.
- Great Britain (2002): RPI.

X-Factors in Brazil

Service	1999	2001	2003	2005
Local Calls	0	1	1	1
Local Access	0	5	15	20

Source: Anatel.

Progress Check

1. We have answered Question #1: "What is the X factor?".
2. We have examined how X might be calculated in practice, recognizing that the choice of an X factor is not an exact science.

Next Question:

What are good measures of the expected rate of economy-wide price inflation (I)?

Choosing the Inflation Index (I)

- The inflation rate for a given year is often approximated by the realized inflation rate in the previous year.
- A reliable forecast of inflation can also be employed.

Desirable Characteristics of I

- Reflects general price movements in the economy.
 - Not focused on a particular segment of the economy. [*CPI* vs. *GDPPI*].
- Reliable indicator.
 - Based on reliable data.
- Available in a timely manner.
- Not subject to frequent revision.

Progress Check

1. We have answered Question #1: "What is the X factor?".
2. We have examined how X might be calculated in practice.
3. We have discussed good measures of inflation (I).

4. To determine how to implement price cap regulation of the form

$$\% Dp^R = I - X$$

it remains to define $\% Dp^R$ (i.e., to determine what “on average” means).

Average = Weighted Average

- Price changes on services that affect many customers should be counted more heavily than identical price changes on services that affect few customers.
- To do so, a weighted average of price changes is employed to measure the percentage change in regulated prices ($\% \Delta p^R$).
- The weight placed on a change in the price of service i is the fraction of total revenue accounted for by service i .

Example

- Three services: A, B, C.
- Revenue from service A = 60.
- Revenue from service B = 30.
- Revenue from service C = 10.
- Suppose the price of service A declines by 10%, and the price of services B and C each rise by 10%.

- The (weighted) average price increase is:

$$\begin{aligned} & \frac{60}{100} [-10] + \frac{30}{100} [+10] + \frac{10}{100} [+10] \\ & = -\frac{200}{100} = -2\%. \end{aligned}$$

Summary of Step 1A

1. The over-arching restriction on prices under PCR plans often takes a relatively simple form.
 - Prices are allowed to rise, on average, at the rate of inflation less an X factor.
2. Economic principles suggest that the X factor should reflect the extent to which productivity is expected to increase more rapidly and input prices are expected to rise less rapidly in the regulated industry than elsewhere.

3. It can be difficult to identify the ideal value for X . Many different approximations are employed in practice.
4. The rate of inflation should reflect changes in a broad measure of prices in the economy.
5. In calculating the percentage change in regulated prices, relative revenue weights are employed.

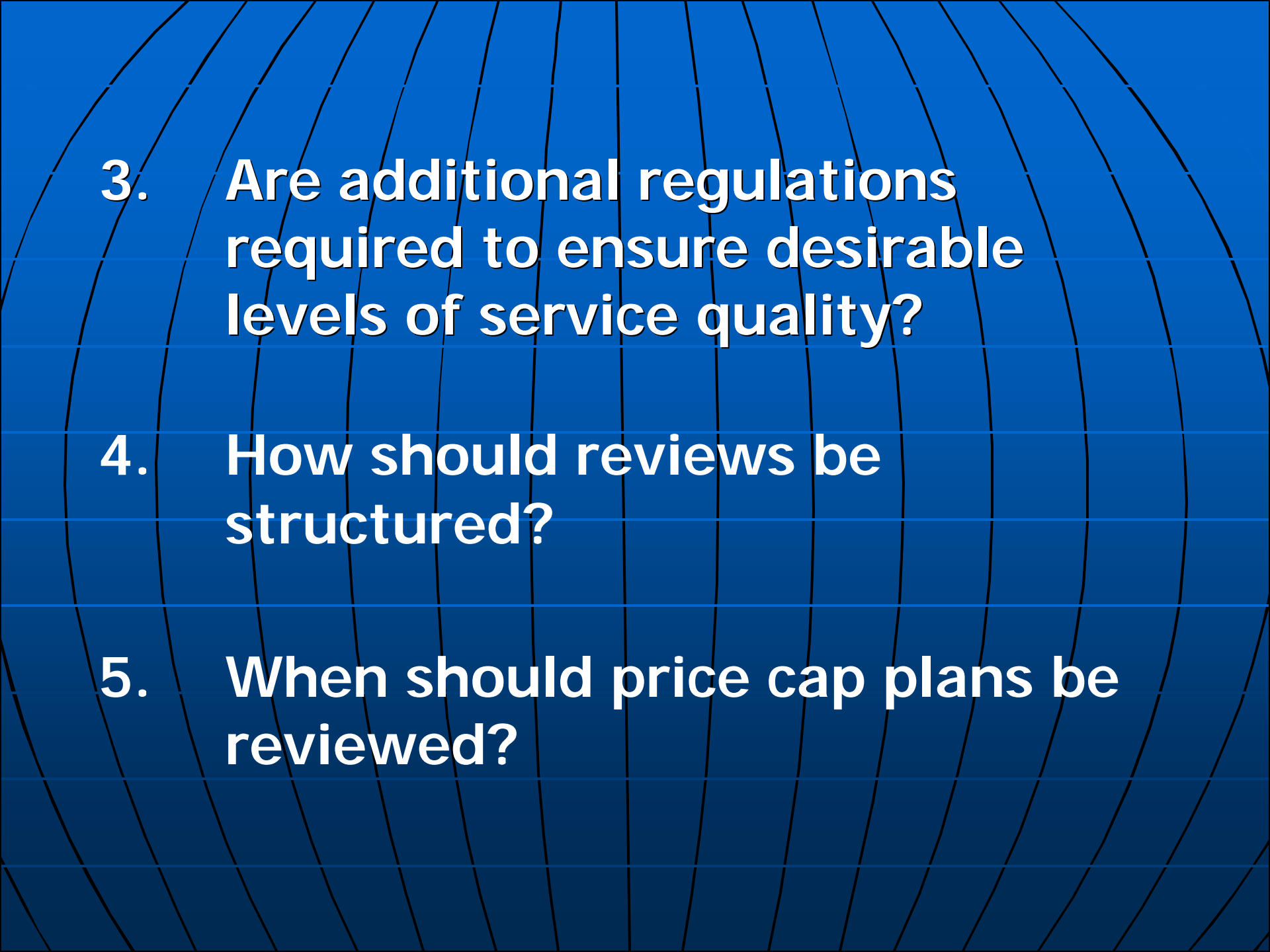
Observation

- To this point, the discussion has focused on the single aggregate constraint that is imposed on prices under *PCR* plans.
- In practice, the design and implementation of a successful price cap plan involves many more details.

Step 1B.

Discuss Other Elements of PCR

1. Should restrictions on individual service prices accompany the over-arching restriction on prices?
2. How many baskets of services should be employed?

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- 3. Are additional regulations required to ensure desirable levels of service quality?**
 - 4. How should reviews be structured?**
 - 5. When should price cap plans be reviewed?**

1. Restrictions on Individual Prices.

Substantial price increases on selected (popular, essential) services can be prohibited, even if other prices decline significantly.

- Residential basic local service rates.

Example: New Jersey.

- Residential basic local service rates were frozen from 1993 to 2000.

2. The Number of Baskets.

- **Services may be placed into distinct baskets, each with its own price cap.**
 - **Services sold to similar customers (e.g., residential vs. business) may be placed in the same basket.**

- This segregation ensures that substantial price decreases to one group of customers (e.g., business customers) do not authorize substantial price increases for another group of customers (e.g., residential customers).
- By placing a separate price cap on a distinct basket of services, particular types of customers (e.g., residential customers) can be protected in their aggregate purchases.

- **By placing a separate cap on a particular service (e.g., residential basic local service), consumers can be afforded price protection on this particular service.**
- **Some plans include multiple baskets and restrictions on individual prices.**
 - **These plans provide both aggregate and product-specific price protection to some customers.**

3. Service Quality Regulation.

- By providing enhanced rewards for cost reduction, *PCR* may provide incentives to reduce the delivery of (costly) service quality.
- Since *PCR* allows suppliers to retain the increased revenues that arise because of higher service quality, *PCR* can enhance incentives for service quality.
- The predominant effect will depend on the sensitivity of consumer demand to service quality.

Methods of Promoting Service Quality

- Monitoring, with financial rewards and penalties for superior/inferior service quality.
- Penalties can be imposed in the form of targeted rebates to affected customers.
 - Penalties for interrupted or delayed service.
- Penalties can also be imposed in the form of a higher X factor.

Evidence From the U.S.

- Despite anecdotes about serious declines in quality under incentive regulation, careful empirical studies reveal little decline, if any.
- However, these studies have not controlled adequately for ancillary policies to ensure desired levels of quality.

4. The Structure of Reviews.

- A. If reviews are employed primarily to reset future requirements to reflect recent accomplishments by the firm, then PCR will function much like RORR.
- Key difference will be an exogenous, and perhaps longer, regulatory lag.
- B. Such profit reviews limit incentives for superior performance, but ensure that earnings do not diverge from target levels for too long a period of time.

C. Alternatives to firm-specific profit reviews are possible in some settings.

- The X factor may be reset to reflect industry performance.

D. In settings with emerging competition, reviews should also assess carefully the status of industry competition.

- Competition reviews are designed to determine if some or all price cap constraints can be eliminated.

5. The Time Between Reviews.

The ideal review lag depends upon:

A. The nature of the review.

- If the review is a profit review, a longer period between reviews creates greater incentive for superior performance.
- If the review is designed to update the X factor for a firm without employing the firm's individual performance excessively, then a short period between reviews can ensure an appropriate X factor without dulling incentives.

B. Uncertainty about future industry conditions.

- The need to update initial cost and demand projections is less pronounced in a stable setting with little uncertainty.

C. The nature of the price cap plan.

- If stringent limits on changes in politically-sensitive prices are in place, the need for frequent reviews of the plan is less pronounced.

Summary

1. Price cap regulation plans often incorporate additional restrictions on the prices charged for key services.

For example, the rate at which the price of basic local telephone service for residential customers can rise is often restricted.

- 2. Separate baskets of services can prevent undesired variation in the treatment of different customers.**
- 3. PCR plans can embed or add financial incentives for the delivery of service quality.**

4. If periodic reviews of price cap plans proceed much like rate hearings under rate of return regulation, then incentives for superior performance will be dulled.

5. The optimal timing of reviews depends on:

- The nature of the review.
- The nature of the price cap plan.
- The nature and extent of uncertainty in the industry.

Appendix: Implementation Details

- Initially, authorized starting price levels are established.
- In practice, the starting price levels are often determined by a standard rate hearing.
- The authorized starting price levels form the basis of indices of actual and allowed prices.
- Actual price index = 100 initially.
- Price cap index = 100 initially.

- The actual price index is updated to reflect the prices set by the firm.
- The price cap index is revised annually to reflect authorized changes in average price levels.
- The actual price index (*API*) must remain below the price cap index (*PCI*) throughout the remainder of the price cap period.

- Formal representation of the aggregate price cap restriction:

$$API^t \leq PCI^t \quad \text{for all } t = 1, \dots, T,$$

where:

API^t = actual price index in year t ;

PCI^t = price cap index in year t ; and

T = number of years for which price cap regulation is imposed.

Ensuring Compliance with the Price Cap Constraint

- The prevailing levels of the *API* and the *PCI* must be calculated on an ongoing basis.
- Calculation of the prevailing *PCI* is straightforward.
 - The index of authorized prices in any year is simply the index from the preceding year, updated to reflect inflation and the relevant *X* factor.

- **Formal representation:**

$$PCI^t = PCI^{t-1} [1 + I^t - X^t]$$

where:

I^t = inflation index for year t ; and

X^t = X factor for year t .

- **Example:**

- *PCR* begins in 2000.

- Inflation in 2000 = 5%.

- Specified *X* factor is 4% annually.

- In 2000, $PCI^{00} = 100$.

- In 2001, $PCI^{01} = 100 [1 + .05 - .04]$
 $= 100 [1.01] = 101$.

Calculating the Actual Price Index

- The calculation of the *API* is similar, but a bit more complicated.
- Changes in the *API* are not governed solely by exogenous parameters (like I and X).
 - The *API* changes as the firm changes prices.

- The actual price index in any year is a multiple of the *API* in the preceding year.
 - The multiple is a weighted average of the price changes implemented by the firm.
- The price change on each service is represented as the ratio of the new price to the old price $\frac{p_i^t}{p_i^{t-1}}$.

- These individual price changes are weighted to reflect their relative impact on consumers.
 - Price changes that have a major impact on consumers are counted more heavily than those with a minor impact on consumers.
- A common measure of the relative impact on consumers is the relative revenue derived from the service in question.

Weighting Price Changes Using Relative-Revenue Weights

- The weight on the price change for service i (denoted r_i) is the fraction of total regulated revenue accounted for by service i .

$$r_i = \frac{\text{Revenue from service } i}{\text{Total regulated revenue}} = \frac{R_i}{R}$$

- It is appropriate to update the weights annually to reflect changes in consumers' purchasing patterns.

$$r_i^t = \frac{R_i^t}{R^t} \cdot$$

Summary Calculation of the API

$$API^t = API^{t-1} \sum_{i=1}^n r_i^t \frac{p_i^t}{p_i^{t-1}}$$

Sample Calculation of the API

- PCR begins in 2000.
- 2000 Data

	Price	Revenue
Service 1	10	100
Service 2	10	200

- Proposed 2001 prices:
Service 1: $p_1 = 11$.
Service 2: $p_2 = 9$.

- $$API^{01} = API^{00}$$

$$100 \frac{11}{30} + \frac{200}{300} \frac{9}{10} = 100 \frac{11}{30} + \frac{18}{30} = 96.7$$

Summary of PCI and API Calculations

1. The ceiling on prices, the Price Cap Index, is updated routinely each year.
2. The index of actual prices, the Actual Price Index, is updated as prices change.
 - The new *API* multiplies the old *API* by a weighted average of price changes.
 - Relative revenue weights are employed to translate individual price changes into their relative impact on consumers.

3. If a set of proposed price changes results in an *API* that is less than the prevailing *PCI*, the proposed price changes are approved.
4. If the proposed price changes lead to an *API* that exceeds the *PCI*, the proposed price changes are not allowed.