

**CASE STUDY ON HYBRID REGULATION: DEBRIEFING POTENTIAL
SOLUTION #2
(Session 16)**

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I. Overview

- A. In this session, your case study team solved a portion of a problem in hybrid regulation. An overall hybrid system design could incorporate a earnings sharing component, a price cap or revenue cap component, and a benchmarking component (which was not considered in the case study).
- B. In this document, we describe one possible solution that combines all three components of a hybrid system. We make simplifying assumptions to make the illustration tractable, so this solution should not be considered to be applicable in any real world setting.
- C. Our study begins with benchmarking, which we use to design the menu of X -factor and earnings sharing options that we will give the operator. We then develop the menu of options.
 - 1. However, we must do our benchmarking with an eye towards how we will regulate prices, so we first decide the overall hybrid framework.

II. Overall Framework

- A. Because our electricity company is vertically integrated, we would like the price control system to reflect how the company incurs costs. We assume that this company incurs costs that are driven by amount of electricity sold and the number of customers served.
- B. Therefore, we expect the operator to provide two-part tariffs, each of which includes a monthly customer charge and usage charges.
- C. We further assume that the operator's usage charge includes a fuel cost pass through that covers all fuel costs.
- D. We also recognize that we expect the operator to expand its distribution network into unserved areas. Therefore, both the number of customers and number of kWhs sold will increase.
 - 1. Furthermore, because the number of customers will be increasing primarily because of the expansion of the distribution network into unserved areas, we do not expect the operator will not experience large gains from economies of density in the near future.

- a. As a result, we expect customer costs to be nearly linear with respect to the number of customers.
 - b. If we were expecting the operator to enjoy large gains from economies of density, then we would expect the average customer cost to decrease as the number of customers increased. In fact, the total distribution cost could be nearly constant even with customer growth if the growth triggered no additional distribution investment. However, this is not our situation.
- E. Based on the above, we plan to use revenue caps that may be indexed according to the number of customers served and kWhs sold.
1. Therefore, our benchmarking analysis will focus on how efficient we think the operator can be with respect to number of customers served and kWhs sold.

III. Benchmarking

- A. For simplicity, we assume that we already have service quality policies in place and will focus on efficiency.
- B. Choice of parameters to benchmark
1. Our revenue caps may be indexed by number of customers and number of kWhs sold, so we want to benchmark costs in those terms.
 2. We keep our parameters general and avoid granular parameters because we want to encourage the operator to use its knowledge to be efficient. We do not want to assume that we know how the operator should improve efficiency and make benchmarking design choices that restrict the operator's ability to use its own knowledge.
- C. Choice of operators for comparison
1. We choose operators in nearby countries that have similar economies and geography.
 2. However, we recognize that we cannot find operators who are in our operator's exact situation, so we perform statistical analyses to adjust for differences.
- D. Statistical Analysis
1. We choose DEA analysis because we want to know what appears to be possible.
 2. We choose to use data on customer geographic density, climate, country wage rates, and economic growth to adjust the cost data so that we obtain a realistic approximation of what an efficient operator's cost per customer and cost per kWh would be.
 3. However, we will not simply assume that our operator can achieve the frontier level of efficiency. Instead, we will use this to set the largest X-factor in the menu of options.

E. Data

1. Data will come from operator reports to shareholders and regulators. If these data are insufficient, then we will hire a consultant who can enter into confidentiality agreements with the foreign operators and enlist the foreign regulators to participate in our benchmarking exercise so that we can all benefit from the knowledge gained.

F. Results

1. We assume that we find that the most efficient operators can lower per customer costs at a rate that is ten percentage points less than the rate of inflation. The least efficient operators can lower customer costs at a rate that is two percentage points less than the rate of inflation.
2. We further assume that we find that usage costs in general do not track well with inflation. Rather, these costs are composed of capacity costs and fuel costs.
 - a. We assume that capacity costs do track with inflation and are not sensitive to number of kWhs sold as long as the operator is not adding capacity. We assume that the operator adds capacity only as the number of customers grows. Therefore, capacity costs are related to the number of customers.
 - b. Recall that we assume that fuel costs are passed through.
 - c. We further assume that the best operators appear to be able to lower capacity costs at a rate that is ten percentage points less than the rate of inflation. The least efficient operators can lower capacity costs at a rate that is two percentage points less than the rate of inflation.

IV. Revenue Cap Design

A. Baskets

1. Because we expect the operator to expand its system, we want to allow the operator to find prices that maximize the commercial viability of this expansion, except that we want to protect residential customers from paying higher prices to attract more business customers.
2. As a result, we establish two service baskets
 - a. One service basket is for all residential customers and includes all residential services
 - b. The other service basket is for all business customers, both commercial and industrial

B. Indexes

1. We note that approximately 25 percent of our operator's revenue requirement is fuel cost, which is passed through.

2. Recall that we assume that the number of customers drives the remainder of the operator's costs.
3. Therefore, we will allow the operator to choose prices that, for each basket, allows revenue (except for fuel costs) to change such that the change in revenue per customer does not exceed the rate of inflation minus X

V. Menu of Options

A. Option 1

1. We assume that our operator is on the lower end of the efficiency scale based on our benchmarking analysis. This means that its costs change at a rate that is two percentage points less than the rate of inflation.
2. Therefore, we offer Option 1, which is an X -factor of 2 with rate of return regulation. In other words, under Option 1 the operator can expect to keep earnings equal to its cost of capital.

B. Option 2

1. We would like to offer an option that provides for an X -factor greater than 2 in case the operator can become more efficient.
2. We assume that our benchmarking analysis shows that some operators are able to achieve a cost reduction that is about six percentage points less than the rate of inflation.
 - a. It is possible that our operator can achieve this efficiency level, but we do not know for sure.
 - b. If the operator can achieve this level of efficiency, then we if we want it to do so we need to give it an incentive, which means that Option 2 should allow the operator profits above the cost of capital.
 - 1) However, we do not simply allow the operator to keep all of the profits it could receive from the market because we would also like to create an Option 3 that the operator would choose if it were actually able to keep its cost increases ten percentage points less than the rate of inflation.
 - c. Therefore, we need to develop a mechanism to associate with an X -factor greater than 2 that allows the operator to keep more profits than under rate of return regulation.
3. We note from the charts that
 - a. A six percent decrease in operating costs would increase ROE to approximately 16.5 percent, an increase of approximately three percentage points.

- b. A six percent decrease in rate base would increase ROE to approximately 15 percent, an increase of a little more than one percentage point.
 - c. So a decrease in costs of six percent, if spread evenly across operating costs and investment, would allow ROE to increase approximately four percentage points.
 - d. A six percent decrease in revenue would decrease ROE to approximately 10 percent, a decrease of approximately four percentage points.
 - e. These results imply that an operator that could improve its costs by six percentage points relative to inflation would not choose an option with an X-factor of 6 because it would keep no more profits than it would choosing an X-factor of 2 with rate of return regulation.
4. Therefore, instead of having an X-factor of 6 for our second option, we choose an X-factor of 5. The additional profit allowed by the lower X-factor could induce the operator to choose the X-factor of 5 if the operator can achieve an efficiency gain of six percentage points.
- a. From the charts, it appears that a five percent decrease in revenue lowers ROE to approximately 10.5 percent, a decrease of approximately 3.5 percentage points.
 - b. Therefore, our X-factor of 5 allows the operator to keep a ROE that is approximately 1 to 0.5 percentage points higher than the cost of equity if the operator achieves the six percent decrease in costs, relative to inflation.
5. But what if the operator can really achieve an efficiency gain greater than six percentage points less than the rate of inflation? How do we ensure that the operator chooses our third option if the operator really can achieve an efficiency gain that is 10 percentage points less than the rate of inflation?
- a. We resolve this problem by capping the amount of profit the operator can hope to keep under Option 2. We will do this with earnings sharing.
6. Earnings sharing
- a. Based on the analysis below, we know that an operator who could achieve a ten percentage cost decrease relative to inflation would receive from the market a ROE that is approximately 2.5 percentage points higher than its cost of equity if the operator chose Option 2.
 - 1) From this finding and from the charts, it appears that the X-factor in Option 3 must be no more than 5 to ensure that a highly efficient operator does not choose Option 2.

- a) However, this is the same *X*-factor as in Option 2, so we need something to limit the profits of a highly efficient operator choosing Option 2.
 - b) Limiting the highly efficient operator's profits under Option 2 allows us to set a more aggressive *X*-factor in Option 3.
- 2) We want the operator to be able to receive and keep one percentage point of ROE above its cost of equity in order to induce the operator to choose Option 2 should it be able to achieve at least a six percentage point decrease in cost relative to inflation.
- a) Therefore, we allow the operator to keep all ROE received from 14.75 percent to 12.75 percent. We choose the lower range simply to have symmetry.
- 3) We want the operator to keep only an additional 0.5 percentage points of ROE if the operator can actually become highly efficient.
- a) Therefore, of the additional 1.5 percentage points in ROE that a highly efficient operator could receive from the market under Option 2, we will require the operator to return two-thirds of this amount to customers and will cap the ROE that the operator can keep at 15.25 percent. For symmetry, we will place an earnings floor of 12.25 percent.
- b. In summary, the operator can keep all ROE between 12.75 percent and 14.75 percent. ROE from the market above 16.25 is returned to customers. Market ROE between 14.75 and 16.25 is shared two-thirds with customers and one-third with shareholders. Shareholders are reimbursed for two-thirds of the difference between the received market ROE and 12.75 percent should the market ROE fall below 12.75 percent, but not below 11.25 percent. ROE from the market below 11.25 triggers a rate review.

C. Option 3

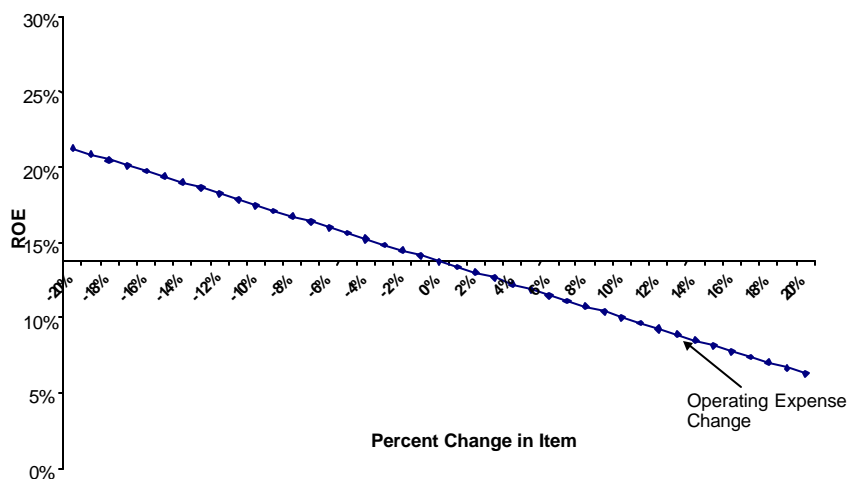
1. Recall that the most efficient operator's costs change at a rate that is ten percentage points less than the rate of inflation.
 - a. We believe that this is the best we could expect our operator to do.
2. We note from the charts that
 - a. A ten percent decrease in operating costs would increase ROE to approximately 17.5 percent, an increase of approximately four percentage points.
 - b. A ten percent decrease in rate base would increase ROE to approximately 16 percent, an increase of a little more than two percentage points.

- c. So a decrease in costs of ten percent, if spread evenly across operating costs and investment, would allow ROE to increase approximately six percentage points.
 - 1) Therefore, if the operator chose Option 2 and could really decrease costs by 10 percentage points less than the rate of inflation, then it would receive a ROE that is 2.5 percentage points higher than the cost of equity.
- d. Recall that a highly efficient operator choosing Option 2 would receive an ROE that is 1.5 percentage points above its cost of equity.
 - 1) To induce such an operator to choose Option 3, we choose an *X*-factor that allows the operator to receive at least the same ROE that it would receive under Option 2.
- e. We note from the charts that an *X*-factor of 7 would allow a highly efficient operator to receive a ROE that is 1.5 percentage points higher than its cost of equity.
 - 1) We do this by
 - a) Noting that an *X*-factor of 10 lowers the ROE by six percentage points, which is the same number of percentage points that the decrease in costs raise the ROE, which means that the operator would receive just its cost of equity if the *X*-factor were 10.
 - b) Noting that an *X*-factor of 7 lowers the ROE by only 4.5 percentage points.
- 3. In summary, we offer Option 3, which is an *X*-factor of 7 with no sharing of profits.
 - a. We expect the highly efficient operator to choose this option because it does not limit the operator's profits and provides just as much expected profit as Option 2.

Charts



Effect of Cost and Revenue Changes on ROE

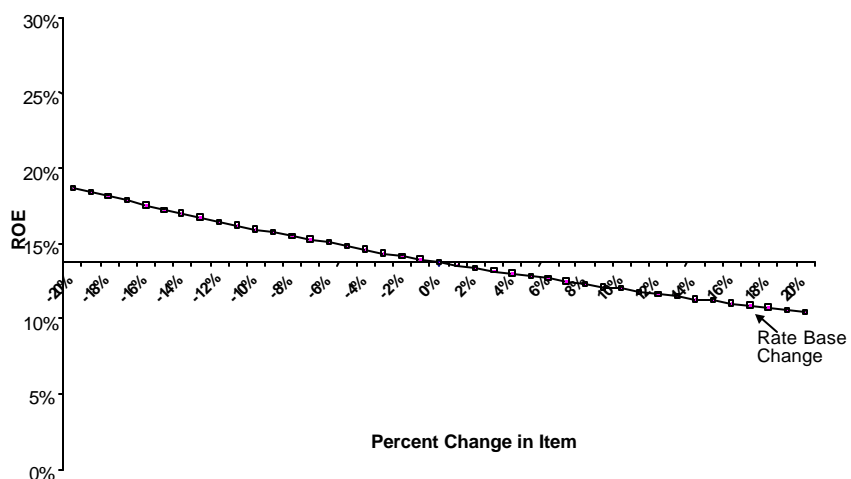


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Effect of Cost and Revenue Changes on ROE



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