

An Application of Game Theory to Rate of Return Regulation in Alberta

ABSTRACT

Capital-intensive utilities and pipelines are typically subject to rate of return regulation; and regulators are routinely called upon to determine a fair rate of return on common equity based on expert evidence. In recent years, the range of expert recommendations proffered by utility and intervenor interests in Alberta have widened to 3-4%, making it increasingly difficult for the Alberta Utilities Commission to have confidence in its rate of return decisions or the underlying evidence. The Commission's rate of return decisions have tended to be close to the midpoint of the competing recommendations in generic cost of capital proceedings, thereby reinforcing the wisdom of parties in taking ever more extreme positions in an effort to "pull the average up" or "push the average down." We discuss this frustrating situation in Chapter 1 of our *Technical Memorandum*.

Game theory is the field of economics which deals with these kinds of behavioral response situations. To our knowledge, game theory has not played a prominent role in regulatory and public utility economics. But unless the rules in the present "game" are changed, it is difficult to imagine that the parties will embrace a "move to the middle" strategy that reduces the existing gap between the recommendations of utility and intervenor experts.¹

We acknowledge that the Commission does not slavishly "split the difference" when it determines rate of return just as we acknowledge that the utilities and the intervenors are not deliberately setting out to "pull the average up" or "push the average down." Indeed, the Commission is constrained by the legal requirements for a fair return which were established in *Northwestern Utilities Ltd. v. City of Edmonton*; and there is no assurance that any mathematical model such as "splitting the difference" would yield a return consistent with the requirements in *Northwestern*. Nevertheless, if the Commission's actions result in the *perception* by the parties that the awarded rate of return reflects a "split the difference" calculus, then the parties will react to that perception in the fashion that has been observed in recent years – i.e., a divergence of recommendations where utilities try to "pull the average up" and intervenors try to "push the average down."

To make it clear that we reject supplanting the regulatory process with a mathematical formula, we define the Starting Point Rate of Return (SPROR) as a single percentage which reflects the rate of return recommendations before the Commission. The Commission's discretion is not fettered by the mathematically-calculated SPROR; however, the SPROR is a point of departure which is recognised as having significant weight in the Commission's final determination. At the present time, parties may logically

¹ The word "game" is used in the technical economic sense and is in no way intended to impugn the motives of the parties or indicate disrespect for the regulatory process or the experts who develop rate of return recommendations. In economics, a "game" is a set of rules that define how parties are expected to behave in a given situation. The "rule" in the current regulatory game as perceived by the parties is that the Commission will "split the difference" between the recommendations and then deduct perhaps 25-50 basis points to arrive at the fair rate of return. In game theory, it does not matter whether such a formal rule exists or not. If the Commission's decisions conform to the rule and if the parties assume that the current *modus operandi* will continue, then they will behave as if the formal rule exists.

perceive that the SPROR is calculated by averaging the recommendations in a proceeding and then, in recent years, deducting 25-50 basis points. The question that we seek to answer here is whether there exists another formula for determining the SPROR that will reward parties for moderating their positions rather than the current formula which encourages parties to take increasingly extreme positions.

In Chapter 2 of the *Technical Memorandum*, we design specific tests for evaluating alternative games to reward the utilities and the intervenors for moderating their positions respecting rate of return and drawing closer to one another – i.e., “moving to the middle.” These tests are applied in Chapter 3, where we created and tested 66 alternative Models using 210 separate tests per Model.²

We conclude that Model 41 is a superior alternative to the current regime and should be adopted by the Commission to provide parties with appropriate and fair incentives to moderate their positions. The formal rules of Model 41 are:

1. Calculate the simple average of the four recommendations.³
2. Calculate the absolute values of the differences between each recommendation and the average.
3. Compute the absolute values of the Internal Differences between recommendations for the utilities and the recommendations for the intervenors. The Internal Differences are the difference between the two utility recommendations and the difference between the two intervenor recommendations.
4. If the difference between the lowest utility recommendation and the highest intervenor recommendation is *less* than 2.25%, then *add* the Internal Differences from (3) to the differences calculated in (2). If the difference between the lowest utility recommendation and the highest intervenor recommendation is *greater* than 2.25%, then *subtract* the Internal Differences from (3) from the differences calculated in (2). If the difference between the lowest utility recommendation and the highest intervenor recommendation is exactly equal to 2.25%, then make no adjustment to the values from (2).
5. Calculate a weighted average of the four recommendations where those recommendations having the minimum values calculated in (4) receive a weight of 6. Those recommendations having the maximum values calculated in (4) receive a weight of 1; and the other recommendations each

² We alternatively refer to “Games” as “Models.”

³ In applying Model 41, the two lowest expert recommendations from the utilities and the two highest expert recommendations from the intervenors are considered. If either the utilities or the intervenors only have one expert recommendation, then that recommendation is “counted twice.”

have a weight of 2. The SPROR is the weighted average of the four recommendations.⁴

Consider the following sample calculation. Assume that the utilities proffer recommendations of 10.0% and 9.25%; and the intervenors support recommendations of 7.25% and 7.75%. The simple average of the four recommendations is 8.56%; and the absolute values of the differences between each recommendation and the average are 1.44%, 0.69%, 1.31% and 0.81%. The Internal Difference for the utilities is 75 basis points (= 10.0% less 9.25%); and the Internal Difference for the intervenors is 50 basis points (= 7.75% less 7.25%). The difference between the lowest utility recommendation and the highest intervenor recommendation is 1.5% (= 9.25% less 7.75%) and is therefore less than 2.25%. Thus, the Internal Differences are *added* to the absolute values of the differences. The results are 2.19%, 1.44%, 1.81% and 1.31%.

The 7.75% recommendation is associated with the lowest difference of 1.31%. As a result, the 7.75% receives a weight of 6x in the weighted average SPROR calculation. The 10.0% recommendation is associated with the highest difference of 2.19%. Thus, the 10.0% receives a weight of 1x in the weighted average SPROR calculation. The other recommendations – the 9.25% and the 7.25% - each receive a weight of 2x. The weighted average Starting Point Rate of Return is therefore 8.14% (= ((7.75% x 6) + (9.25% x 2) + (7.25% x 2) + (10.0% x 1)) *divided by* 11). The 8.14% is 42 basis points *less* than the average (= 8.14% less 8.56%). An SPROR *less* than the average favours the intervenors – i.e., the intervenors emerge as the “winners.”

The intervenors *should* emerge as the “winners” in this hypothetical scenario, because the recommendations of the intervenors are more moderate in the sense that they are closer to the centre of the four recommendations after taking into account the larger Internal Difference of the utilities. The latter is important, because we wish to encourage both the utilities and the intervenors to proffer recommendations which not only “move to the middle” *vis-à-vis* the recommendations of the other party but which also minimize, to the extent practicable, the spread between the two recommendations within each group.

In Chapter 4 of the *Technical Memorandum*, we derive the optimal strategy for each party given our recommended Model and alternative assumptions about the positions that the other party is likely to take. The analysis in Chapter 4 confirms that the optimal, least risky, strategies are associated with moderation rather than extremity. In other words, it pays to “seek out the middle ground” if one believes that the Commission intends to use the recommended Model to determining a reasonable SPROR.

In plain language, if we were advising a utility faced with a regulatory regime that used Model 41 to establish a Starting Point Rate of Return, we would recommend an initial analysis of changes in general economic circumstances, including inflation and long-term bond yield trends, and the logical application of these changes to the most recently-

⁴ It is possible to have more than one recommendation assigned a weight of 6x or 1x. The SPROR is the sum of the weighted recommendations *divided by* the sum of the weights.

awarded common equity rate of return to establish a realistic view of the rate of return that is likely to be awarded by the Commission. We would then urge the Utility to proffer rate of return evidence with recommendations no higher than 50 basis points above the forecast rate of return and preferably with an Internal Difference of 0-25 basis points.

If we were advising an Intervenor faced with the same regime, we would recommend the same care and attention to estimating the forecast rate of return. We would then urge the Intervenor to proffer rate of return evidence with recommendations no lower than 50 basis points below the forecast rate of return and preferably with an Internal Difference of 0-25 basis points.

If we were advising the Commission, then we would recommend that the Commission announce its intention to set aside any notion of “splitting the difference” in favour of a formula for determining a Starting Point Rate of Return that rewards parties for moderating their recommendations. The Commission’s final decision respecting rate of return may or may not be coincident with a mechanistically-determined SPROR, because there is no certainty that the SPROR will satisfy the legal requirements for a fair return any more than there is certainty that a “split the difference” rate of return will satisfy the legal requirements. Nevertheless, the parties can expect that the SPROR is likely to receive considerable weight in the determination of the fair return. And if the parties hold this belief, then they will logically respond by seeking a middle ground and avoiding extreme positions.

In Chapter 5, we pose the tantalizing question *What results would our recommended Model have yielded if it had been applied to the recommendations in each of the seven litigated, multi-company rate of return proceedings by the Commission for major utilities?* The answer is that the average awarded rate of return would probably not have been materially different from the average of the actual awarded rates of return; however, because of the incentives to “move to the middle,” it is likely that the recommendations would have been closer together, giving all Parties a greater confidence in the end result.

The studies, conclusions and recommendations are summarized in Chapter 6 along with suggestions for further study. For sake of brevity, we use a number of defined terms which are capitalized and whose definitions are supplied in the Glossary that follows Chapter 6.

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