Regulatory Ratcheting: A Classroom Game for Chapter 10

The Rules of the Game

Electricity demand is perfectly inelastic, at 1 gigawatt per firm. The price is chosen by the regulator. The regulator cares about two things: (1) getting electrical service, and (2) getting it at the lowest price possible. The utilities like profit and dislike effort. Throughout the game, utility i has "cost reduction" parameter x_i, which it knows but the regulator does not. This parameter is big if the utility can reduce its costs with just a little effort.

Each year, the following events happen.

1. The regulator offers price P_i to firm i.

2. Firm i accepts or rejects.

3. If Firm i accepts, it secretly chooses its effort level e_i,

4. Nature secretly and randomly chooses the economywide shock u (uniform from 1 to 6) and Firm i's shock u_i (uniform from 1 to 6) and announces Firm i's cost, c_i. That cost equals

$$c_i = 20 + u + u_i - x_i e_i. \tag{1}$$

5. Firm i earns a period payoff of 0 if it rejects the contract. If it accepts, its payoff is

$$\pi_i = p_i(1) - c_i - e_i^2 \tag{2}$$

The regulator earns a period payoff of 0 from firm i if its contract is rejected. Otherwise, its payoff from that firm is

$$\pi_{regulator}(i) = 50 - p_i \tag{3}$$

All variables take integer values.

The game repeats for as many years as the class has time for, with each firm keeping the same value of x throughout.

The Mechanics

Each electric utility is a group of three students.

Either the instructor or a group of 1 to 3 students is Nature. At the start of the game, Nature gives each utility a card showing its cost- reduction parameter, where equal number of cards have x equal to 3 or to 5. At the same time, Nature writes down the parameters for each firm for later use.

Utilities announce publicly whether they accept the regulator's price, but they secretly write down their effort level and give it to Nature. Nature then secretly picks u to be equal to the roll of a die, and secretly picks u_i for each firm by rolling the die more times. Nature then reveals the c_i for each firm. This can be done all at once, or one by one as each firm submits its effort level. Nature also writes down u, u_i, and c_i on an overhead slide, which can be shown to everyone at the end of the game, if an overhead projector is used (this is not crucial).

Either the instructor or a group of 5 students is the Regulator. If a student group is the regulator, that will slow down regulation considerably, but it does permit the instructor to be Nature. If the instructor is the Regulator, he should not be Nature, since it is essential to the game that the Regulator not know what effort each firm has chosen.

The Regulator displays Table 3 on an overhead slide (or on the blackboard). Each round, the Regulator writes down P_i for each firm, and then c_i or $REJECT$, so everyone can see what has happened.

Your Names: Your Firm: Your Cost-Reduction Parameter x:

Year	Price Offered	(Effort e) or REJECT	Cost c	Profit	Cumulative Profit
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

TABLE 1: ELECTRIC UTILITY SCORESHEET

Profit equals zero if the firm chose REJECT. If it did not, profit is (Price minus Cost minus Effort Squared).

Cumulative Profit is the sum of the firm's profits in that industry up to and including that period.

Year	Shock u	Firm	Parameter x_i	(Effort e_i) or REJECT	Shock v_i	Cost c_i

TABLE 2: NATURE'S SCORESHEET

Your Names:

Year	Firm	P_i	Cost c_i	50 if ACCEPT; 0 Otherwise	$-P_i$ if ACCEPT; 0 Otherwise
TOTALS:	xxxxx	xxxxx	xxxxx		

Overall Payoff:

TABLE 3: REGULATOR'S SCORESHEET

Instructor's Notes

Equipment: Two six-sided dice. Index cards with cost parameters, half of them with "x=3" and half with "x=5".

This is a complicated game, not one of the easiest to make work, because students take some time to become accustomed to how their effort affects their profit. It would work best as an online game, played by email, since that would give the players (especially the regulator) plenty of time to think.

Before starting play, the instructor needs to work out some examples of what a firm's profit will be if it has $x = 3$ and accepts a given price.

If the instructor is the regulator, he should think out loud as he decides his prices for each firm.

The maximum cost is 32. The expected cost with zero effort is 26. The minimum cost with zero effort is 22.

Strategy Note: If your firm has a high value of x, it is lucky, because it doesn't have to exert as much effort to get the same cost reduction. If the regulator figures that out, however, he will offer you a low price, eliminating your profits. That is the "ratchet effect". Thus, you must think carefully about whether your actions will reveal your cost advantage.

Lessons:

(1) A regulator must be careful not to set prices too low, or firms will not replace their capital.

(2) If a regulator finds that a firm can reduce its cost, it will lower the price the firm is offered (the "ratchet effect").

(3) It is hard to figure out a firm's cost reduction possiblities from observing its actual costs, because there are a lot of random shocks to costs.

(4) Firms will try not to reveal their abilities to keep costs low, pretending to be less efficient than they really are.

(5) If firms do not worry about future price reductions (as in a last period) they will reduce costs more.

(6) This same game fits government procurement. When the government buys airplanes from a company, it tries to set the price as low as it can such that the firm will still accept the contract. Once the order is placed, the government and seller are in bilateral monopoly, since it would be inefficient to switch to a second seller that would need to incur the big fixed cost of R & D again. When the contract is renewed for further purchases, the government will try to reduce the price if it thinks it overestimated the seller's costs the first time round.