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BANKRUPT A DECEPTIVELY SIMPLE BUSINESS STRATEGY GAME

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ABSTRACT

This paper describes a game that combines pricing analysis with decision making under uncertainty. The game is designed to be played from start to finish in a two-hour period. Although the game is quite single, good play calls for reasonably sophisticated analysis. Our experience is that many student teams do not play particularly well and that they are more influenced by the name of the game than they should be. All participants learn a lot from discussion of the game after play, especially when some teams have done well.

INTRODUCTION

For some years we have believed that relatively simple games concentrating on a relatively few concepts can do a job that is different from, and in some ways better than, the large scale top level management game commonly found in courses such as business policy.

One advantage of the smaller game stems from its concentration on one or two concepts, meaning that good or bad analysis for a particular decision will typically yield similar results, with poor analysis leading to a poor decision giving a poor result and thus immediate feedback. In larger games with many decisions, the reasons for a poor result are often masked by a variety of relationships, with a poor decision occasionally being overwhelmed by other good decisions to give a team a good result. While post-game debriefing can serve to point these things out, my experience convinces me that debriefing is most effective when the results secured clearly match up with the analysis being discussed.

Another advantage of the smaller game is that its relatively few decisions make it possible to make these decisions in a relatively short time. The general availability of micro-computers today makes it possible to umpire decisions immediately and thus play a game from start to finish in one session, further enhancing the feedback secured from the results themselves.

BANKRUPT is a short game that combines pricing analysis with decision making under uncertainty. In this game, a very simple demand function gives potential sales as a function of PRICE and the current value of the DEMAND FACTOR. The demand factor fluctuates over time, thereby introducing the uncertainty element. In addition, teams must build plant if they are to satisfy potential sales, and this becomes a fixed cost which cannot be reversed during the game. Thus a heavy downswing in demand, coupled with a team having previously built a large plant, can result in a team going bankrupt.

In earlier versions of the game, random fluctuations in the demand factor had been somewhat of a problem because demand tended to either start up and continue up or start down and continue down for all too long a time. The current version has demand necessarily cycling, although with some variability in the length of the cycle. This has added a little more certainty to the game and makes good play almost sure to beat poor play.

In games where a random factor is an important part of the game, we endeavor to play many quarters to give the random factor a chance to even out somewhat. Even though that is not absolutely necessary here, we like to play at least 15 quarters to give a full feel for the game. To do this we hook our micro-computer up to video screens in the classroom so all students can see the results as they come on the screens and this lets us easily play 15 to 20 quarters in a two-hour period. We try to keep the total number of teams down to about 12, with a typical arrangement calling for breaking a class of size 30 into 10 teams of size 3.

The write-up for the game, which each student will have, follows.

BANKRUPT

Bankrupt is a game designed to simulate the problems of a small manufacturer making parts for the machine tool industry, well known for its boom or bust cycles. These businesses are usually quite profitable in good times, but endeavoring to meet demand often calls for expanding facilities to the point where cash resources may be stretched too far, not permitting the business to be able to survive the next downturn.

In the game a very simple demand equation and an equally simple cost structure are assumed to permit concentrating on the problems of coping with uncertainties. Demand fluctuates in alternately increasing and decreasing trends. When the demand is high, considerable profits can be earned by teams having sufficient plant to produce enough to meet the demand, but when demand is low, teams with large plants have more fixed cost than they can cover through sales.

Teams whose cash position goes negative at the end of a quarter after income is received are bankrupt and out of the game, with all teams that go bankrupt finishing last. The winner of the game is the team that has the most cash at the end of the game, which will usually last for from 10 to 20 quarters.

DATA

Demand

The first demand trend will be one of increasing demand followed by one of decreasing demand and alternating throughout the game.

Each trend will be randomly generated as 3, 4 or 5 quarters in length.

Each quarter a change in the demand factor will be generated.

The size of each change will be a random value from a rectangular distribution with mean equal to 2000 (limits 0 to 4000) when demand is increasing and with

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mean equal to 1500 (limits 0 to 3000), when demand is decreasing, The demand factor will be initialized at 10,000. The minimum value for the demand factor is 2000.

Sales

Potential sales of each team are determined by the formula

$$\text{POTENTIAL SALES} = 3X - \text{PRICE} \left(\frac{X}{2} \right)$$

where X is the current value of the demand factor.

Actual sales will be limited by either potential sales or production capability.

Costs

Variable costs are \$1 per unit.

Each \$2 of fixed cost permits one unit to be produced.

Teams may elect to raise fixed cost per quarter in increments of \$1000 without limit.

Fixed costs per quarter can only be increased, never decreased.

Initial Conditions

Each team begins with \$5000 cash.

Each team begins with \$4000 per quarter in fixed cost, and, therefore, the ability to produce 2000 units per quarter.

Each quarter each team will make decisions about price and whether to increase fixed cost.

Profits and cash will be reported for all teams after each quarter.

You will not be told what the demand factor is.

SAMPLE CALCULATIONS

Assume that in quarter 1 X rises to 11,000 and that you charge \$5.20 and raise fixed cost 6 units to \$10,000.

$$\begin{aligned} \text{POTENTIAL SALES} &= 3(11,000) - 5.20 \left(\frac{11,000}{2} \right) \\ &= 33,000 - 28,600 = 4400 \end{aligned}$$

$$\text{PRODUCTION CAPABILITY} = \frac{10,000}{2} = 5000$$

Sales will therefore equal POTENTIAL SALES = 4400.

$$\begin{aligned} \text{INCOME} &= 4400 \times \$5.20 = \$22,800 \\ \text{COST} &= \$10,000 + 4400 \times \$1.00 = \underline{14,400} \\ \text{PROFIT} &= \$8,400 \end{aligned}$$

Assume that in quarter 2 X rises to 14,000 and that you charge \$4.00, and do not raise fixed cost, leaving fixed cost at \$10,000.

$$\begin{aligned} \text{POTENTIAL SALES} &= 3(14,000) - 4 \left(\frac{14,000}{2} \right) \\ &= 42,000 - 28,000 = 14,000 \end{aligned}$$

$$\text{PRODUCTION CAPABILITY} = \frac{10,000}{2} = 5000$$

Sales will therefore equal PRODUCTION CAPABILITY = 5000.

$$\begin{aligned} \text{INCOME} &= 5000 \times \$4.00 = \$20,000 \\ \text{COST} &= \$10,000 + 5000 \times \$1.00 = \underline{15,000} \\ \text{PROFIT} &= \$5,000 \\ &\quad * * * * \end{aligned}$$

ANALYSIS

Analysis of the game calls for consideration both of the pricing policy and of the likely fluctuations in demand, coupling them together to evaluate potential profits.

The pricing considerations are quite easy to handle if teams are capable of applying elementary calculus. Using

S = Potential Sales

X = Demand Factor

F = Fixed Cost

V = Variable Cost

P = Price

we can write an equation for profit as

$$\begin{aligned} \text{Profit} &= PS - F - VS \\ &= P \left(3X - \frac{PX}{2} \right) - F - V \left(3X - \frac{PX}{2} \right) \\ &= 3XP - \frac{X^2 P^2}{2} - F - 3XV + \frac{XV P}{2} \\ &= -\frac{X^2 P^2}{2} + 3X + \frac{XV}{2} P - F - 3XV \end{aligned}$$

Taking the first derivative with respect to the decision variable P gives

$$\frac{d \text{ Profit}}{dP} = -\frac{2X}{2} P + 3X + \frac{XV}{2}$$

Setting this equal to zero for an optimum lets X drop out and gives

$$P = 3 + \frac{V}{2}$$

Thus the optimum price is independent of the value of the demand factor and equal to \$3 plus one-half variable cost. This general result can also be reached by trial and error calculations, but it is easier with the calculus. Most management students are required to take some calculus today and it is a nice plus to be able to give them an opportunity to use it.

Applying this result to the actual problem is a little more difficult. Three separate cases need to be considered.

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1. PLANT IS TOO LARGE

If our plant is already overbuilt and we are in a period of very low demand, then the fixed costs are truly fixed costs and our variable cost is \$1, giving an optimum price of $3 + 1/2 = \$3.50$.

2. PLANT EXPANSION IS BEING CONSIDERED

If we are trying to decide how big a plant to build, then our fixed costs are not yet incurred and thus are, in effect, variable costs for planning purposes. The variable cost will, then, be \$2 + \$1 \$3, giving an optimum price of $3 + 3/2 = \$4.50$.

3. PLANT IS TOO SMALL

If our plant is too small to produce all we can sell at \$4.50, and we do not want to increase the size, then the optimum price is the highest price that will just let us sell all we can produce. Similarly, If our plant is too large for the \$4.50 price, but not large enough to justify going to the lower limit of \$3.50, then the optimum price is once again the highest price that will just let us sell all we can produce.

The other item to be considered is the demand factor fluctuation. If all cycles and changes were at the average, the demand factor would, in four year intervals, rise to 18,000, drop to 12,000, rise to 20,000, drop to 14,000, etc. If these values are even approximately right, there are a lot of profits to be made, and it does not pay to be overly conservative about building plant. Nevertheless, there are some risks and plant expansion cannot be done indiscriminately.

SUGGESTED STRATEGY

1. Raise fixed cost to \$18,000 immediately and charge \$4.50. (If the demand factor increases to the expected value of 12,000 or beyond, this will result in a profit of \$13,500 the first quarter.)
2. Any quarter your plant is not big enough, as evidenced by sales equaling capacity to produce, add another \$2000 to fixed cost and continue to charge \$4.50.
3. Any time your plant is too big, as evidenced by sales being restricted by price, calculate the value of the demand factor and continue to charge \$4.50 but without increasing fixed cost.
4. Any time the demand factor drops from one quarter to the next, as shown by calculations in step 3, drop price, all the way to \$3.50 if necessary, and plan to ride out the down trend.

This strategy will result in handsome profits when things are going well. There is always some risk of the up trend being only 3 quarters long with very small increases, while the following downtrend is 5 quarters long with very large changes. In these circumstances the suggested strategy will result in going bankrupt, but, statistically, the chance of going bankrupt is very small and the suggested strategy is actually quite conservative.

RESULTS

While some teams play quite well and get good results in the game, an average team tends to be overly impressed with the risks involved and play much more conservatively than is called for. Some teams have told me that the name of the game "BANKRUPT" is inhibiting. These teams tend to raise fixed cost very slowly, charging an appropriately high price such as \$5 or more in order to keep track of the demand factor. This strategy gives reasonably good results but far short of what can be achieved.

Another result of being over-impressed by the risks is that some teams tend to spend all their time worrying about the risks and fail to do an adequate job of analyzing pricing policy. Teams have told me that price just didn't seem that important in light of the risks involved.

Fortunately, in nearly every class some teams will do a fine job of analysis and get very good results. This makes discussion of strategy following the game considerably easier by permitting the winning team to explain its strategy and then looking for ways to improve on a good strategy rather than starting from the beginning to explain what should have been done.

SUMMARY

The game is single enough to be played and enjoyed by groups at almost any level but in actuality calls for reasonably sophisticated analysis and works best with fairly advanced students. It calls for a fairly simple pricing decision that can be overlooked if teams allow the uncertainty to dominate their thinking. It illustrates the difference between a fixed cost that has already been incurred and one that is merely planned. It provides the opportunity to illustrate the advantage of elementary calculus. It calls for decision making under uncertainty where the risks must be evaluated in order to play well, but where the risks appear emotionally to be far greater than they are in actuality. All of this is packed into a single short game that most people find very enjoyable to play, and I believe the learning to time taken ratio to be very high indeed.