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A CONVERSATIONAL MARKETING MIX EXERCISE

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INTRODUCTION

The exercise presented here is a conversational adaption of an earlier version of a marketing decision exercise (1). It requires a student to develop a marketing mix which will maximize short run profits. The exercise is designed to meet a number of primary and secondary teaching objectives and has been used in marketing principles courses at both the graduate and undergraduate levels. It has also been used in marketing decision models courses which examine the exercise's model and the calculus methods used to solve for optimality.

This exercise is made "conversational" by employing a relatively innovative teaching device, teletype terminals which provide on-line access to a computer. Such terminals are becoming increasingly common on college campuses and are a potentially powerful teaching tool that is just beginning to be exploited in courses which do not focus primarily on computer programming or applications.

The major advantage of a conversational program is the immediate feedback provided to the student. The frustrating time delays inherent in a batch system are avoided. The exercise is also open ended; that is, the student may attempt few or many trials depending upon his learning needs and the amount of time he has available.

The value of the immediate feedback is enhanced by taking advantage of the fact that an optimal solution for this exercise exists (3). The profit obtained by the student on each trial is compared to the optimal profit and the "score" is reported to the student. The trend in scores for successive trials provides a basis for arriving at improved decision values.

The remaining sections of this paper discuss the teaching objectives of the exercise, describe the model itself, and describe the integration of the exercise with course material.

TEACHING OBJECTIVES

The teaching objectives of the exercise fall into three general categories. Primarily, the exercise is

designed to demonstrate and clarify marketing concepts. The exercise is also constructed to review, and apply to marketing, several concepts that students should recall from earlier courses. Finally, the exercise is intended to develop an awareness of the computer as a useful tool for assisting with marketing decisions.

Marketing Concepts

The primary concept of interest in this exercise is the marketing mix. The central feature of this concept is that there are a number of management controlled variables which have an interdependent effect on demand(2). For the sake of simplicity, the decision variables in this exercise consist only of product selling price, advertising budget, and selling effort.

Many students, and some managers, have difficulty grasping the notion that increased sales do not necessarily lead to increased profits. Manipulation of this program readily demonstrates that profit may indeed decline even though sales have increased.

The exercise also focuses student attention on the behavior of the breakeven point. The meaning of the breakeven formula tends to become clearer as the student sees its result in operation. More important is the recognition that the breakeven value is dependent upon the interaction of all of the decision variables. At the introductory level, it is simpler to demonstrate the concept of interdependent decision variables using the breakeven formula rather than the more complex formulas for the optimal solution.

Background Concepts

Since the concept of the marketing mix is one of the first topics covered in the introductory course, it is useful and convenient to demonstrate to the student that the course builds on earlier academic work. Since some students fail to comprehend, or tend to ignore, the fact that courses are not isolated blocks of knowledge, independent of one another, the reminder that successful completion of past courses is but a stepstone to future knowledge is a useful lesson.

Students typically are required to complete a micro-economics course and a basic statistics course, at least, before their first exposure to a marketing course. Hence, the exercise contains a limited review of marginal value and estimation error concepts.

The marginal value concept is introduced into the exercise model by imposing a constraint on the available marketing budget (total expenditures on advertising and selling effort). In many real world, and exercise, cases more profit could be made if additional marketing resources were available. The program computes the additional profit that could be obtained if an additional dollar were added to the marketing budget. Incidentally, this is a true marginal calculation rather than an incremental value. That is, the marginal value of a second dollar (in fact, of a second penny) would be slightly smaller. This

value is reported as part of the optimal solution at the program's end. As in the real world, optimality does not inevitably require that the budget be exhausted; in this case, there is no additional value to having a larger budget.

The program also generates marketing research estimates for the optimal decision variables. This feature serves several useful purposes. It gives the student some basis for setting values for his initial trial. It provides a convenient starting point for a discussion of the marketing research function -another topic of interest in an introductory marketing course. And, it provides a review of the concept of estimation errors and confidence intervals.

The Computer As A Tool

The program for this exercise is straight-forward and simple to use. As such, it is useful for building students' confidence in their ability to use computer programs. This program has been used successfully as a prelude to more involved and complex exercises.

The exercise encourages students to develop a systematic pattern of searching for improved solutions. Most students do discover that a fairly simple logical procedure for this purpose can be constructed. It is then an easy matter to suggest that the computer could be instructed to follow this procedure and find the "solution" for the students. The result is a simple decision model.

This exercise has been used in a. model building course. Calculus based optimization models are one of the tools available to decision scientists. However, students frequently have some difficulty grasping the meaning of the manipulations of the abstract symbols of calculus. The students were first exposed to the exercise and then to the derivation of the optimal results. While no formal test of the impact of the exercise as an aid to learning was conducted, class questions and comments indicated both greater interest and understanding than was encountered in previous classes which did not have the benefit of the exercise.

The demand model that underlies the exercise is a simple multiplicative exponent model:

$$Q = k\, P^{p}\, A^{a}\, S^{s} \qquad (1)$$

where

Q is the quantity demanded, in units
k is a scale constant,
P is price,
p is price elasticity (a negative number),
A is advertising expenditure,
a is advertising elasticity,

S is selling effort, expenditure, and
s is selling effort elasticity.

The profit function is

$$Z = (P - C)\,Q - F - A - S + M\,(B - A - S) \qquad (2)$$

where

Z is total profit
C is unit variable cost,
F is fixed cost,
M is the marginal value of an added dollar of budget, and
B is the maximum available budget.

The budget constraint is introduced into the profit function by using the Lagrangian multiplier, M, which is zero if A + S is less than B and positive if A + S equal B. Optimality is achieved when the partial derivatives with respect to P, A, S, and M are equal to zero. The second order condition for maximization is satisfied when price is elastic, that is when p is strictly less than minus one.

The program uses a random number generator set at an arbitrary starting point to obtain values for k, P~ a, s, and C. Thus, a unique problem is generated every time the program is run. The advantage of this feature is that the program may point out the optimal decision values at the end of each run without diminishing the future usefulness of the exercise. A student may, therefore, experiment with the exercise many times, but he cannot rely on the "answers" obtained by a friend, or even the results of his own prior effort.

INTEGRATION WITH COURSE MATERIAL

The exercise is quite simple to operate, and several trials can be attempted in a few minutes. The student effort required to operate and analyze the program is about the same as for the short cases that appear in several of the introductory texts. Hence, the exercise is a suitable homework assignment. An example ~f a very brief run (only one trial) is included in Figure 1 of this paper.

Students may be asked to turn in answers to several questions along with a print-out of their efforts. Some questions which may be useful are:

1. What is a 95% confidence interval, and what is its operational meaning for this problem?
2. What is a breakeven point, and why does the breakeven value change each time any one of the three decision variables are altered?
3. What does the figure for the "marginal value for an added budget dollar" mean?

FIGURE 1

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OLD:MKTMIX
RUN

MKTMIX      10:17:09      3 OCT 74


TRIAL AND ERROR MARKETING EXERCISE
DEMAND IS A FUNCTION OF YOUR MARKETING MIX -
PRICE, ADVERTISING, AND SELLING EFFORT

UNIT VARIABLE COST, C, IS   $11.00
FIXED COST, F, IS $5000
MAXIMUM MARKETING BUDGET (ADV + SELLING) IS $150000
PROFIT = (PRICE - C)*DEMAND - F - ADV - SELLING

MARKETING RESEARCH ESTIMATES FOR THE OPTIMAL
MARKETING MIX (95% CONFIDENCE INTERVAL)

                 LOWER    UPPER
PRICE           $21.16   $30.09
ADVERTISING     $67729   $96703
SELLING EFFORT  $64300   $86328

PRICE? 25.50
ADVERTISING? 81000
SELLING EFFORT? 69000

UNITS SOLD                28991
PROFIT                $220368.57
BREAK-EVEN (UNITS)        13793
SCORE (IN PERCENT)        93.94
DO YOU WANT TO TRY AGAIN? NO

OPTIMAL MARKETING MIX
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PRICE                  $21.16
ADVERTISING            $83517
SELLING EFFORT         $66483
MARGINAL VALUE FOR AN
ADDED BUDGET DOLLAR       .50

PROFIT AT OPTIMUM    $234580.61


TIME :       .215      I/O  :  11
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4. Can you think of a "decision strategy" that may be used to arrive at increasingly more profitable trials until you reach the optimum values?

While no formal evaluations of this version of the exercise have been conducted, some generally positive evaluation of an earlier application of this exercise concept has been reported (1). A major shortcoming of the earlier, batch version was the time required to accomplish the assignment. The conversational version has several advantages which overcome this problem. Terminals tend to be more conveniently located and accessible than the "batch window". Indeed, several night students used off-campus terminals and called the computer from their work sites. The exercise can be conducted in a single sitting, and feedback is immediate. Finally, errors in data entry can be corrected immediately.

The exercise has generated some informal feedback, including several useful suggestions for improving the program. A number of students have spontaneously discovered the concept of sensitivity by noting that fairly significant percentage differences from the optimal decision values frequently lead to much smaller percentage differences from optimal profit. The responses to the exercise questions have proven to be a useful indication of the students' grasp of the application of statistical and economic concepts as well as their comprehension of the marketing mix.

REFERENCES

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3. Kotler, Philip, Marketing Decision Making: A Model Building Approach, New York: Holt, Rinehart & Winston, 1971, pp. 61, 70-72.