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Managing the Insurance Enterprise -- An Interactive Computer Game

Ronald R. Crabb
UW-Whitewater
&
Arnold F. Shapiro
Penn State University

ABSTRACT

An effective method to teach people how to manage the insurance enterprise is to use an interactive computer simulation of an automobile marketplace wherein a number of insurers compete for marketshare and profit. Following screen instructions and the business plan it has developed for winning the simulation, each insurer management team inputs its decisions on pricing, underwriting, advertising, paying claims, educating employees, paying commissions, and investing assets. The decisions of the several teams interact and impact upon one another. Teams win points for running the most efficient insurer and for correctly answering the quiz questions that follow each simulated business year. At the end of the game each team learns how effective (or ineffective) its strategy was via a printout showing how input decisions effected loss ratios, expense ratios, and investment earnings.

Managing the Insurance Enterprise -- An Interactive Computer Game

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INTRODUCTION

It is well established that playing games which simulate an environment is an excellent way to learn about that environment. The early work of Vygotsky and Luria (1930) to such recent studies as that of the cognition and technology group at Vanderbilt (1990) have made this clear. So compelling is the evidence that it is now becoming common for education and training to involve simulated environments that permit sustained exploration. The goal, in each instance, is to enable the user to understand the kinds of problems and opportunities that experts in various areas encounter and the knowledge that these experts use as tools.

Personal computer software has embraced this idea. Implementation has ranged from highly sophisticated applications, like a flight simulator, to simple applications, like a game of Solitaire which helps a new Windows user become proficient with a mouse.

The purpose of this paper is to discuss one such computer application, the management of an insurance enterprise in an automobile insurance marketplace wherein a number of insurers compete for marketshare and profit. The paper begins with a description of the computer program; next, a cursory description of the model is given; then, the assumptions of the model are discussed; next, potential future modifications are discussed; and, finally, a prognosis is given.

AN OVERVIEW OF THE GAME

The game involves a simulated marketplace which is served by four mutual automobile insurers, each of which is managed by a group of students. The marketplace is of constant size and is subdivided into standard, substandard, and preferred submarkets. At the beginning of the simulation, each company has one fourth of each of the three submarkets and all companies have identical assets, liabilities, and surplus.

Introductory Screens and Help Screens

When the game is run, the first things that users encounter are introductory screens and help screens, examples of which are shown in Figures 1 and 2. As explained on these screens, the independent variables are the advertising budget, the education and training budget, the claim paying policy, the commission rate paid to agents, and the prices and the underwriting policies in each of the three submarkets.

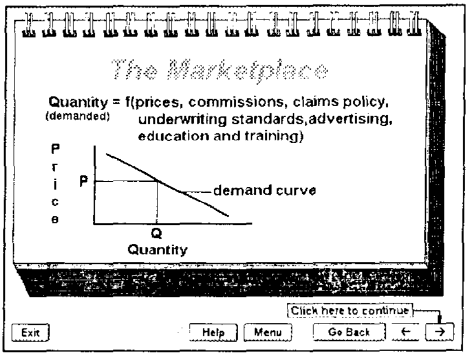

Figure 1

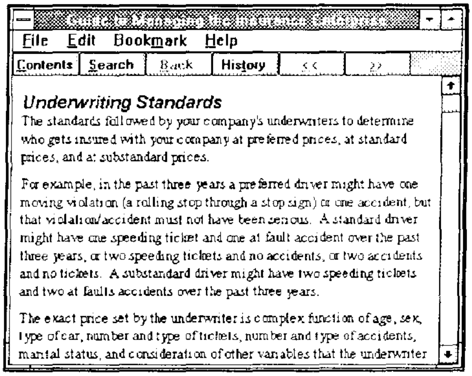

Figure 2

Data Entry

Each simulated year is controlled by the "Player's Flowchart" screen shown in Figure 3. The play begins when one of the teams (the dealer) chooses the year. Then, as indicated in the figure, each team inputs company policy, forwards that policy to the simulator, retrieves the results of the simulation, and answers a quiz based on those results.

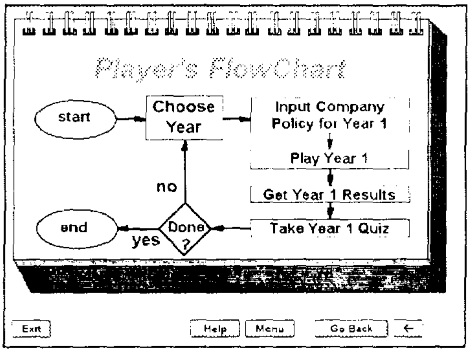

Figure 3

Each management group uses a screen similar to that shown in Figure 4 to input its management decisions with respect to such things as underwriting policy, a budget for education and training, and advertising, and investment policy. In this instance, the year for which the policy decisions must be inputed is year 1. To the right of the input column is a column of limits for each of the input values. The computer program will only accept input values which fall within these limits.

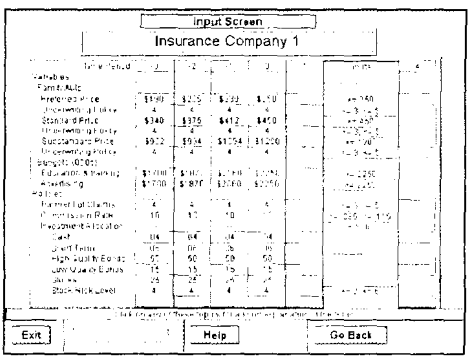

Figure 4

Of course, the implications of many of these policy decisions are probably not clear to new players. To overcome this problem, additional help messages, such as the one shown in Figure 5, are available to the players on a just-in-time basis.

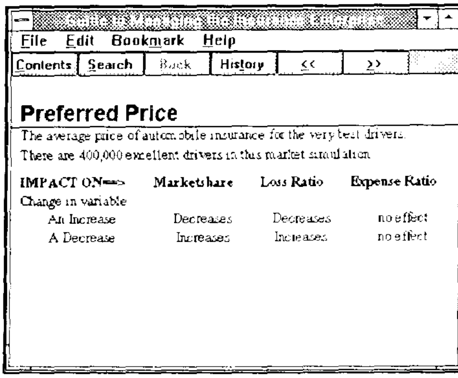

Figure 5

Thus, the user can click on any topic on the input screen, the preferred price in this case, and see an explanation of the topic and a description of the implications of various choices.

As indicated in the lower portion of Figure 4, prior to when the students take over the management of their companies ($t=-3$ to $t=0$), assets are allocated 4% to cash, 6% to short term investments, 50% to high quality bonds, 15% to low quality bonds, and 25% to common stocks. Thereafter ($t \geq 1$), the group must decide on the allocation of its assets. Moreover, each management team must choose the level of risk they are willing to assume when investing in common stocks. In this regard, rates of return for all investments are randomly generated. The least risky investment has the lowest expected rate of return and the greatest certainty; the most risky investment has the highest expected rate of return and the greatest uncertainty.

The Simulated Results

At the end of each simulated business year, the company with the largest relative increase in its adjusted surplus (statutory surplus adjusted to reflect the equity in the Unearned Premium Reserve account and in the Loss Reserves account) receives points for winning that business year. Other competitors receive fewer points, proportional to their increases in adjusted surpluses.

Each company is given an opportunity to review the year's simulated results. Generally, graphs are used for this purpose. Thus, for example, players can access the following graph to review the history of each company's adjusted surplus:

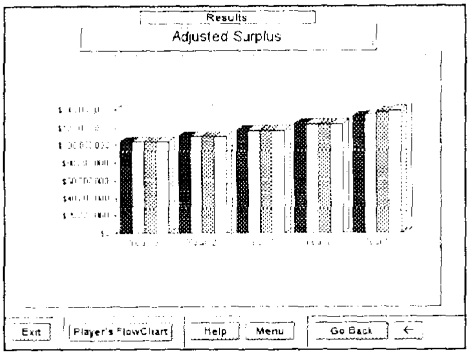

Figure 6

Similarly, they can review the inputs of the other groups, as shown in the following screen:

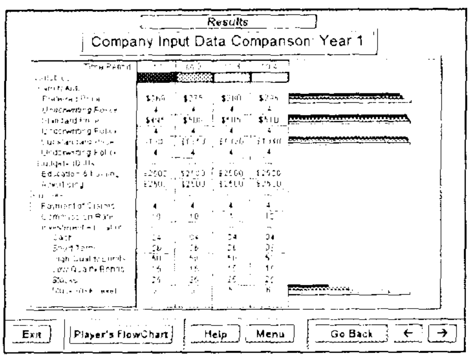

Figure 7

Finally, at the end of the game, each team receives a printout to learn how effective (or ineffective) its strategy was. That printout shows how the input decisions of a team effected loss ratios, expense ratios, and investment earnings.

Quizzes

A set of questions (which change from year to year depending on company input variables) is asked to direct attention to those variables where differences among the four companies are having an impact on loss ratios, expense ratios, and/or investment earnings ratios. As the game progresses, factual questions (Who had the greatest increase in adjusted surplus?) give way to conceptual questions (Which is better: a 1% decrease in a loss ratio or a 1% increase in the rate of return on investments?) The following figure gives an example of this quiz screen:

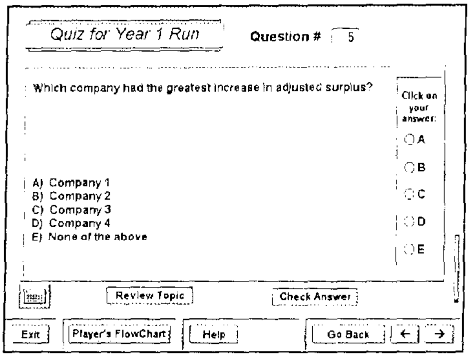

Figure 8

Software Considerations

The software is composed of an Excel engine, where the computations are done, and a ToolBook front-end, which provides a user-friendly interface. The latter have the same general appearance as those described in Shapiro, et. al. (1992). Usually, the players only deal with the interactive front-end.

The program can be run on a lan (local area network). Each management team has its own computer for fast data input and fast data output. During the playing of the game, any information needed for decision making that people would normally have access to in the real world is made available via an assortment of data screens. Information that normally would be unavailable in the real world is not available in the game simulation.

The game is currently being beta-tested at Blue Cross Blue Shield United Wisconsin, Penn State University, and UW-Whitewater.

THE MODEL

An important characteristic of the model is its heavy reliance on authenticity. In 1988, the first author presented the idea for this simulation game at the annual meeting of the American Risk and Insurance Association. Since then, the simulation has been used numerous times in both academic and industry settings and over that time period the game has been refined to make it closely simulate the real world. This section contains a brief overview of the essence of the model. More details are contained in Crabb (1989).

The marketplace is designed as a zero-sum game. For one insurer to gain marketshare, another insurer must lose marketshare, a situation quite similar to the real marketplace. Conceptually, this gain/loss is accomplished as follows.

For each independent variable, a marketshare weight is computed. For the price variable, for example,

$$PW_{i,j,t} = f\{\ P_{1,j,t}\ ,\ P_{2,j,t}\ ,\ P_{3,j,t}\ ,\ P_{4,j,t}\ \} \tag{1}$$

where

$PW_{i,j,t}$ = price weight of the i-th insurer in the j-th market in time period t, and

$P_{k,j,t}$ = market price of the k-th insurer in the j-th market in time period t.

The weighting process computes a larger marketshare weight for an insurer who charges a lower price compared to one or more competitors. Equal marketshare weights result when two or more insurers charge the same price. Marketshare weights are computed for each of the independent variables. The resulting set of marketshare weights serves as input for the marketshare equation.

$$MS_{i,j,t} = [AW_{i,t}]^{a}[PW_{i,j,t}]^{b}[CW_{i,t}]^{c}[EW_{i,t}]^{d}[CPW_{i,t}]^{e}[UPW_{i,j,t}]^{f} \tag{2}$$

where

$MS_{i,j,t}$ = marketshare of the i-th insurer in the j-th market in time period t,

$AW_{i,t}$ = advertising weight of the i-th insurer in time period t,

$CW_{i,t}$ = commission weight of the i-th insurer in time period t,

$EW_{i,t}$ = education and training weight of the i-th insurer in time period t,

$CPW_{i,t}$ = claims policy weight of the i-th insurer in time period t,

$UPW_{i,j,t}$ = underwriting policy weight of the i-th insurer in the j-th market in time period t,

a = advertising weight elasticity,

b = price weight elasticity,

c = commissions weight elasticity,

d = education and training weight elasticity,

e = claims policy weight elasticity, and

f = underwriting policy weight elasticity.

Equation (2) provides a single marketshare number which represents the relative size of the marketshare for the i-th insurer competing in the j-th market in time period t. Since the sum of the $MS_{i,j,t}$s for each of the j markets will not, except by chance, equal one, the computed $MS_{i,j,t}$s are normalized to allocate marketshares in each of those j markets. The normalized $MS_{i,j,t}$s are multiplied by the number of insureds purchasing insurance in the j-th market to determine the number of policyholders served by the i-th insurer in the j-th market in time period t. The relative size of these marketshares thus depends simultaneously on the values of all independent variables.

ASSUMPTIONS OF THE MODEL

The *a priori* underwriting expense ratio, which is based on the actual results of the 12 largest automobile insurers in the State of Wisconsin for the period 1980-1986, is 29%. The combined ratio, based on national data for the same time period, is 111%. The loss and loss adjustment expense ratio is 82%.

The model assumes that policies are written uniformly throughout the year and that individual insureds pay for their insurance on a semiannual basis. These assumptions make the balance sheets and income statements at the beginning of the simulation reasonably similar to those of commercial automobile insurers.

In this version of the program, the claims tail is limited to three years. Similarly, the payment of claims, advertising, agent commissions, and education and training variables are handled on a company-wide basis. In reality, these variables could vary by submarket; a real company could target markets via higher commissions, heavier advertising, and/or a looser claim paying policy. Future versions of the software will incorporate this enhancement.

Ceteris paribus, the impact of each of the independent variables follows. A decrease in price increases marketshare and increases the loss and loss adjustment expense ratio. An increase in the commission rate paid to agents increases marketshare and increases the underwriting expense ratio. A looser underwriting policy increases marketshare and increases the loss and loss adjustment expense ratio. A looser claim paying policy increases marketshare and increases the loss and loss adjustment expense ratio. An increase in the advertising budget increases marketshare and increases the underwriting expense ratio. A decrease in the education and training budget increases the loss and loss adjustment expense ratio, decreases the underwriting expense ratio, and decreases marketshare.

Except for price, the impacts of all independent variables are lagged to avoid massive marketshare shifts among the four companies on a year to year basis and to recognize the reality that past practices affect current marketshare.

FUTURE SOFTWARE ENHANCEMENTS

The three enhancements to the software that have most often been suggested are: (1) to use a separate investment simulation run for each group, (2) to include a reinsurance component, and (3) to include a random claims component. These will all be implemented in a future version. However, there is no clear consensus with respect to the first suggestion. Currently, if two teams put in the same investment parameters, they get the same investment results. While the two teams would not necessarily have gotten the same result in the earliest version of the game, this change was made in response to numerous complaints from industry users. However, allowing for a separate investment simulation run for each group is a useful (and probably more realistic) option, and it will be available in future versions.

Another enhancement has to do with submarkets. Because current computer memories are significantly larger than the memory of the computer on which this game was originally developed, a future version will allow teams to target market each submarket. All of the model variables currently subscripted (i,t) will be changed to (i,j,t).

The cost of information will also be a feature in a future version. Information for decision making is currently available free of charge to the players; in a future version, some of this information will have to be bought. Companies will be able to purchase market research from InfoTec, the source for all market data in the enhanced version.

The current minimum of four players will be relaxed in future versions, so that a single user can play the game. The computer will supply the strategies for the remaining three companies, and input their data accordingly. Like chess programs, the level on which the user desires to compete will affect the choice of strategies and the reactions of the computer controlled companies to the strategy being used by the single user.

Finally, the engine of future versions will be constructed in C++, instead of Excel, to provide for faster execution and greater portability.

PROGNOSIS

In 1588, a thinking monk moved across the front of a room, lecturing as his students sat, watched, and listened. Occasionally he answered a question. In 1988, a thinking teacher moved across the front of a room, lecturing as his students sat, watched, and listened. Occasionally he too answered a question. In 1998, a teacher using an interactive computer game to teach students how to manage the insurance enterprise sat in the back of the room, listening and watching as her students, lost in thought, moved about the room as they interacted with their computers and with each other. Occasionally she too answered a question.

Suboptimal styles of teaching and learning had been improved. The teacher had become a facilitator, the activity in which knowledge was developed and deployed was an integral part of what was learned, and the student's inert knowledge problem was overcome.

ACKNOWLEDGEMENT

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