THE USE OF SPREADSHEETS FOR TEACHING MARKETING TECHNIQUES ON MICRO-COMPUTERS.

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ABSTRACT

Despite the widespread adoption of spreadsheet packages throughout industry, their use by marketing educators has been limited so far. An example is given of how a spreadsheet can be used to teach Bayesian value analysis together with a discussion of the benefits of such a teaching method.

Many techniques which are frequently used in marketing demand careful study and close attention by students before their subtleties are fully understood. For example Bayesian value analysis demands that students should be familiar with fairly complex computations before they can get to grips with its implications and assumptions, its strengths and weaknesses. It is not surprising therefore, that many of these techniques are unattractive to students who often feel they spend many long hours in learning the mechanics of a technique, only to discover in subsequent classes that the underlying assumptions of a model make its usefulness limited.

A partial solution to this problem is to computerise the mathematics involved, hence allowing more time for analysis of the assumptions and implications. Unfortunately, however, custom made programs are often used as a black box by students who end up knowing little about either the model or computing. The author feels that many techniques can be taught more appropriately and effectively by using a spreadsheet package.

AN EXAMPLE

Bayesian value analysis has long been advocated by academics as an approach to the evaluation of marketing research proposals. The technique is explained in many standard texts (Green 1978; Tull 1984; Kinnear 1983) and has been explored in many journal articles (Lacava 1982; Assmus 1977). Academics appear to be attracted by the elegance of its argument and students find it can formalise their intuitive reasoning, however, we can identify the following limitations in the technique which the student must be made aware of:

SOFT INPUT DATA

The probabilities used as inputs to the model are usually quantified values of managers' subjective assessments of the likelihood of each outcome. These probabilities may vary because different managers feel different degrees of optimism towards a project or, alternatively, different managers may ascribe a different probability to a given degree of likelihood: to one man the term "highly probable" may be expressed by a probability of 0.9 while to another it may mean a probability of 0.75.

Such problems can be overcome to some extent by the use of sensitivity analysis: the repeated application of the procedure using different probabilities to assess the effect of such changes.

COMPUTATION PROBLEMS

The procedure, although intuitively attractive and mathematically elegant, is longwinded; it takes time and care to calculate the expected values. This obviously makes the technique less attractive for practitioners. Demands for sensitivity analysis compound the problem.

NON-LINEAR UTILITY FUNCTIONS

Work that has been done in this area suggests that many managers are risk averse, (Swalm 1966). Faced with a choice between (a) a certain profit of $10,000 or (b) a potential profit of $50,000 if heads come up on the flip of a coin and nothing if tails come up many managers would opt for the certain $10,000 despite the fact that the expected values of the options are $10,000 versus $25,000. The expected monetary values usually associated with the Bayesian model are an inadequate expression of such risk averse activity.

LACK OF USE

Research has shown that this technique is not used widely in industry (Albaum et al 1978). This may be because industrialists see no relevance in it or it may be that they have not been exposed to it. Investigation of syllabuses circulated by the Marketing Education Group in the U.K. suggests that few colleges place teaching emphasis upon it and a study of recent examination papers reveals that few questions are set in this area. Similarly, a typical one semester course of marketing research in U.S. universities is unlikely to allow sufficient time to deal with the technique in detail. It is certainly true that to teach the subject adequately demands considerable time and application by both teacher and student. The conclusion is drawn therefore that slight weight is placed upon this area by educators, perhaps because of its time intensive nature or perhaps because it is seen as of low relevance.

While remaining an enthusiast the author accepts that teaching the model poses problems: it demands more teaching time than can frequently be justified, and it is difficult to overcome the hurdle of the computation problems, which many students encounter, before being able to tackle the more interesting obstacles of the model's assumptions and limitations.

The author has traditionally used the matrix layout of the problem as advocated by Enis (1973) rather than the decision tree approach and this layout translates simply and effectively onto a computer based spreadsheet.

Lotus 1-2-3 on an Olivetti M24 micro-computer was used for the following example but many similar packages have also been used by the author on both micro and mini-computers. Copies of the template can be obtained from the author for the price of a blank diskette. This has been used as follows:

After a general introductory lecture on the subject, and an example worked in class, students were presented with the blank spreadsheet shown in fig. 1. They were required to extract the relevant data from a case study ("A.D. Brown" Case 1-3 in Churchill 1983) and to insert the figures in the appropriate cells in the spreadsheet. Thus they need to find:

1. the probabilities associated with each outcome S1, S2, S3, S4.
2. the payoffs associated with each course of action and outcome.
3. the probabilities of each agency making a correct forecast.

The expected value of the proposed research is then calculated with the workings shown on screen. Figure 2 shows the values inserted for the bid by J.R. Flag which are then replaced by those for "The Payton Co." to allow comparison of the results.

Thus, students are presented with a familiar layout on the V.D.U. into which they can insert figures and perform recalculations immediately by overtyping the data. They are able to see how the various "answers" are achieved, and can see how the value of each cell is derived simply by "pointing" to it.

This ability for rapid recalculation overcomes one of the major problems of the technique which students are usually quick to point out: that of weak input data. Previously the question "What if P(S1) = 0.25, rather than 0.20?" meant time-consuming recalculation in class time for a thorough analysis of its effect but

FIGURE 1

	S1	S2	S3	S4					
PROBABILITY	0	0	0	1					
					EMV				
PAYOFF:A1	0	0	0	0	0				
PAYOFF:A2	0	0	0	0	0				
MAX	0	0	0	0	0				
EVPI	0								
	S1	S2	S3	S4					
R1	0.00	0.00	0.00	0.00					
R2	0.00	0.00	0.00	0.00	VALUE	ERR			
R3	1.00	1.00	1.00	1.00					
	S1	S2	S3	S4	P(Rk)	S1	S2	S3	S4
R1	0.00	0.00	0.00	0.00	0	ERR	ERR	ERR	ERR
R2	0.00	0.00	0.00	0.00	0	ERR	ERR	ERR	ERR
R3	0.00	0.00	0.00	1.00	1	0.000	0.000	0.000	1.000
	R1	R2	R3						
NEW PAYOFF:A1	ERR	ERR	0.00						
NEW PAYOFF:A2	ERR	ERR	0.00						
NEW EMV	ERR								
OLD EMV	0.000								
VALUE	ERR								

FIGURE 2

	S1	S2	S3	S4	EMV
PROBABILITY	0.2	0.2	0.5	0.1	
PAYOFF:A1	-300	100	300	600	170
PAYOFF:A2	0	0	0	0	0
MAX	0	100	300	600	230
EVPI	60				

	S1	S2	S3	S4		
R1	0.00	0.20	0.40	0.80		
R2	0.20	0.60	0.50	0.20	VALUE	29
R3	0.80	0.20	0.10	.00		

	S1	S2	S3	S4	P(Rk)	S1	S2	S3	S4
R1	0.00	0.04	0.20	0.08	0.32	0.000	0.125	0.625	0.250
R2	0.04	0.12	0.25	0.02	0.43	0.093	0.279	0.581	0.047
R3	0.16	0.04	0.05	.00	0.25	0.640	0.160	0.200	.000

	R1	R2	R3
NEW PAYOFF:A1	350.0	202.3	-116.0
NEW PAYOFF:A2	0.0	0.0	0.0

NEW EMV	199.00
OLD EMV	170.00
VALUE	29.00

FIGURE 3

	S1	S2	S3	S4	S5	S6	EMV
PROB.	0	0	0	0	0	0	
PAYOFF:A1	0	0	0	0	0	0	0
PAYOFF:A2	0	0	0	0	0	0	0
PAYOFF:A3	0	0	0	0	0	0	0
PAYOFF:A4	0	0	0	0	0	0	0
PAYOFF:A5	0	0	0	0	0	0	0
PAYOFF:A6	0	0	0	0	0	0	0
MAX	0	0	0	0	0	0	0
EVPI	0						

	S1	S2	S3	S4	S5	S6
R1	0.00	0.00	0.00	0.00	0.00	0.00
R2	0.00	0.00	0.00	0.00	0.00	0.00
R3	0.00	0.00	0.00	0.00	0.00	0.00
R4	0.00	0.00	0.00	0.00	0.00	0.00
R5	0.00	0.00	0.00	0.00	0.00	0.00
R6	0.00	0.00	0.00	0.00	0.00	0.00
VALUE	0					

	S1	S2	S3	S4	S5	S6	P(Rk)	S1	S2	S3	S4	S5	S6
R1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

	R1	R2	R3	R4	R5	R6
NEW PAYOFF:A1	0.00	0.00	0.00	0.00	0.00	0.00
NEW PAYOFF;A2	0.00	0.00	0.00	0.00	0.00	0.00
NEW PAYOFF:A3	0.00	0.00	0.00	0.00	0.00	0.00
NEW PAYOFF:A4	0.00	0.00	0.00	0.00	0.00	0.00
NEW PAYOFF:A5	0.00	0.00	0.00	0.00	0.00	0.00
NEW PAYOFF:A6	0.00	0.00	0.00	0.00	0.00	0.00

NEW EMV	0.00
OLD EMV	0.00
VALUE	0.00

now students are able to experiment with different probabilities and other input data and to see the effect upon expected values. As a result students quickly become able to discover those crucial inputs most sensitive to amendment. Such experiments can lead naturally to a discussion of other weaknesses in the model and suggestions for how it could be applied in "real" problems. Usually such deep analysis is only possible after lengthy explanations of the mathematics to ensure that the mechanics have been understood. In effect, the computerisation of the model minimises the calculation time and skills required and hence allows students to concentrate upon understanding the model rather than simply mastering the mechanics of the process.

The spreadsheets shown in figures 1 and 2 are simple to establish but restricted to the solution of one specific problem. It is a straightforward task to build one which is more generally applicable: fig. 3 shows one for the solution of problems with up to six outcomes and six possible courses of action. It is also possible to incorporate utility measures as well as monetary values into the spreadsheet. There is usually insufficient time available in undergraduate classes to cover non-monetary evaluation of information and the problems of non-linear utility functions: even such devotees as Tull and Hawkins seem to accept this fact by relegating their worked example to an appendix (Tull 1984). However, by using spreadsheets enough teaching time can be saved to allow the concept to be introduced. Thus, the use of this simple device allows more complex and realistic concepts to be taught than has hitherto been possible.

CONCLUSION

Ideally, if we want students to comprehend enough of the theory underlying Bayesian value analysis to enable them subsequently to use it in industry they should be able to:

(a) understand the importance of the source data
(b) compute revised expected values of information
(c) interpret the results of such computations
(d) recognise the limitations of the technique and how such limitations can be overcome.

Such detailed knowledge and understanding requires more time than is usually available. It is the contention of the author that the use of spreadsheet packages speeds up the teaching process considerably. Spreadsheet templates can similarly be of use in teaching regression analysis or indeed any procedure which demands repetitious calculations. What is required now is the creative use of such packages in both education and commerce.

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