RELATIONAL APPROACH TO GRADING PERFORMANCE IN BUSINESS GAMES

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The purpose of this paper is to describe a relational approach to evaluating performance in the general management game Tempomatic IV (Scott and Strickland, 1974). First the rank order grading procedure developed by the game authors will be discussed. Next the relational grading approach will be presented and compared to the rank order procedure. Finally, suggestions of further research will be presented.

In the general management business game Tempomatic IV (Scott and Strickland, 1974) a program to grade performance is built into the game. This program rank orders each team on each of five variables and assigns a predetermined percentage score for each variable to each team based upon its ranking. Each of the five variables can be weighted in any manner the user desires. A final percentage score for each team is obtained by multiplying the percentage score for each variable by the weight for that variable and summing across the five variables. An example is presented in Table I to illustrate the procedure and the results.

The rank order grading procedure described above appears to suffer from two deficiencies. The rank order assignment approach fails to recognize the magnitude of the differences that exist among teams. As a result, a team that is performing at an exceptionally high or low level may not be recognized. The second deficiency is that ties are not adequately accounted for. In the example shown in Table I (b), team 2 was ranked first and received a percent score of 100 for the stock price variable, while team 3 only received a percent score of 80, even though the two teams had identical stock prices.

A better performance evaluation appears to result if a relational rather than a ranking procedure is used. Such a procedure eliminates both of the previously cited deficiencies. The relational grading procedure rank orders each team from high to low on each of the performance variables just as is done by Embry, Strickland, and Scott (1974); however, the percentage score for each team for each variable is calculated as a percent of the highest team for that variable rather than by a predetermined percentage score. The percentage scores for each variable for each team are multiplied by the weight for the variable and summed for each team to obtain a percentage score for each team. An example is presented in Table II to illustrate the procedure and the results.

As can be seen by a comparison of Tables I and II, the relational grading approach as presented in Table 11(c) more adequately reflects the extremely poor performance of team 1

than does the ranking approach presented in Table 1(c). The relational grading approach reflects performance more accurately because it takes into account the magnitude of the differences among the teams The fact that the magnitude of the differences is taken into account also means that no predetermined distribution is generated. It is quite possible for all teams to have high scores if the teams cluster. It is also possible using the relational grading approach that one team could clearly dominate game play so that all but one team will have low scores. The relational grading approach also handles ties for a particular variable by giving both teams the sane percentage score for that variable.

A few comments need to be made concerning the mechanics of the relational grading approach. In the above examples performance variables which may be negative (eg., income before taxes) were included. If such variables are included, three possible conditions may result: (1) all teams have positive values; (2) some teams have positive values and some teams have negative values; and, (3) all teams have negative values. Conditions (1) and (2) are illustrated in Tables I and II., Calculating the percentages under condition (3) requires that we sort for the best performing team which is the team with the lowest negative number. Next, we obtain each team's percentage score for a particular variable by dividing its raw data value into the raw data value for the best performing team. For example, suppose we obtain the values indicated in Table 1110 It is obvious from Table III that we may end up with high percentage scores even when poor performance exists. In fact this situation can occur under conditions (1) and (2) also, due to the relational nature of the grading system Rather, than being a deficiency of the relational grading approach, this result suggests that in evaluating performance one should not merely apply a mechanical process but should randomly check the raw data values. This problem also exists with the Enibry, Strickland, and Scott (1974) rank order grading approach To some extent this problem could be overcome by introducing a par player or by introducing predetermined values for each variable.

As is illustrated in Table 11(c), it is possible under the relational grading approach to have teams end up with negative percentage scores This situation could be eliminated by adding an amount equal to the most negative score to each team's score for a particular variable. Table IV illustrates the approach using the raw data from Table I $(a)_0$ Because of the distortion in the scores which is generated we prefer not to use the approach presented in Table IV.

The relational approach for evaluating game performance appears to offer advantages relative to a ranking approach. For future research we would suggest that performance results in Tempomatic IV and other games be compared using the ranking approach suggested by Embry, Strickland, and Scott (1974) with

the rational approach suggested in this paper to see if differences result. Research is also needed on the weighting of variables and the impact different weightings may have. It appears that a general program could be developed which could be adapted to any game.

REFERENCES

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Embry, O. H.; Strickland, A. J., III; and Scott, C. R., Jr. Instructor's Manual-Tempomatic IV: A Management Simulation. Boston, Mass: Houghton Mifflin Co., 1974.

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TABLE I

CALCULATION OF GRADES - EMBRY, STRICKLAND AND SCOTT (1974) PROCEDURE

(a) Hypothetical Raw Data

Team	Sales	Income Before Taxes	Return on Sales	Return on Assets	Stock Price
1	200	-1000	-.10	-.10	10
2	1000	4000	.25	.15	25
3	2000	1500	.18	.20	25

(b) Percentage Scores for Each Vairable Based Upon Rank Order

Team	Sales	Income Before Taxes	Return on Sales	Return on Assets	Stock Price
1	70.0	70.0	70.0	70.0	70.0
2	80.0	100.0	100.0	80.0	100.0
3	100.0	80.0	80.0	100.0	80.0

(c) Percentage Scores for Each Team After Weights are Applied

Variable Weight	.5	.2	.1	.1	.1	
Team	Sales	Income Before Taxes	Return on Sales	Return on Assets	Stock Price	Weighted Percentage
1	35.0	14.0	7.0	7.0	7.0	70.0
2	40.0	20.0	10.0	8.0	10.0	88.0
3	50.0	16.0	8.0	10.0	8.0	92.0

TABLE II

CALCULATION OF GRADES - BIGGS AND SLOCUM (1975) PROCEDURES

(a) Hypothetical Raw Data

The same raw data as presented in Table I(a) is used.

(b) Percentage Scores for Each Variable Based Upon Percent of Top Score

Team	Sales	Income Before Taxes	Return on Sales	Return on Assets	Stock Price
1	10.0	-25.0	-40.0	-50.0	40.0
2	50.0	100.0	100.0	75.0	100.0
3	100.0	37.5	72.0	100.0	100.0

(c) Percentage Scores for Each Team After Weights are Applied

Variable Weights	.5	.2	.1	.1	.1	
Team	Sales	Income Before Taxes	Return on Sales	Return on Assets	Stock Price	Weight Percentage
1	5.0	-5.0	-4.0	-5.0	4.0	-5.0
2	25.0	-20.0	10.0	7.5	10.0	72.5
3	50.0	7.5	7.2	10.0	10.0	84.7

TABLE III

ILLUSTRATION OF PERCENTAGE CALCULATION WHERE ALL TEAMS ARE NEGATIVE

Team	Income Before Taxes	Rank	% of Top Team
1	-50	1	-50 ÷ -50 = 100.0
2	-200	2	-50 ÷ -200 = 25.0
3	-75	3	-50 ÷ -75 = 66.7

TABLE IV

ELIMINATION OF NEGATIVE VALUES

(a) Adjusted Raw Data - From Table I(a)

Team	Net Income Before Taxes	Sales	Return on Sales	Return on Assets	Stock Price
1	-0	200	0	0	10
2	5000	1000	.35	.25	25
3	2500	2000	.28	.30	25

(b) Percentage Score for Each Variable Based Upon Percent of Top Score

Team	Net Income Before Taxes	Sales	Return on Sales	Return on Assets	Stock Price
1	0.0	10.0	0.0	0.0	40
2	100.0	50.0	100.0	83.3	100
3	50.0	100.0	80.0	100.0	100

(c) Percentage Scores for Each Team After Weights are Applied

Team	Sales	Income Before Taxes	Return on Sales	Return on Assets	Stock Price	Weighted Percentages
1	5.0	0.0	0.0	0.0	4.0	9.0
2	25.0	20.0	10.0	8.3	10.0	73.3
3	50.0	10.0	8.0	10.0	10.0	88.0