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CONSISTENCY IN BUSINESS GAMES

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ABSTRACT

This paper reports an analysis of data from The Executive Game which reveals different industries are characterized by significantly different levels of consistent decision making.

1. Introduction

In their recent article in Management Science, Hogarth and Makridakis [3] raised the important issue of the economic consequences of consistency in decision making. This paper extends their analysis by reporting an empirical demonstration of significant variation in consistency in different competitive settings.

2. Linear Decision Rules

Linear decision rules are widely used to model decision making and apply managerial intuition. Since Bowman [1] formulated his theory to justify their usage, decision rules have become an important management tool.

Bowman's managerial coefficient theory models recurrent decision making in which factors are intuitively or explicitly weighted to arrive at a decision. The weighting is reflected by a linear decision rule of the form:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n \qquad (1)$$

The dependent variable represents the decision and the X's represent the factors taken into account. The values assigned to the B's are a function of the importance of each factor and may he determined by regression analysis of past decisions. Most managers do *not* think through a problem in the *way* just described. Nevertheless, a manager's intuition is well represented by such a decision rule.

Even though a manager makes good decisions on the average he may erroneously adjust his decisions because of inaccurate messages, incorrectly understood cues, rumors, or faulty forecasts. A decision rule minimizes the erratic decision making which the theory asserts and research demonstrates to be the cause of more economic inefficiency than incorrect intuitions. Bowman called erratic decision making "variance" and incorrect intuitions. Bowman called erratic decision making variance" and incorrect intuitions "bias'. The more "consistent" a decision maker, the less erratic is his decision making.

3. Consistency in a Business Game

Hogarth and Makridakis [3J recently reported an experiment in which arbitrary-consistent and arbitrary- random decision rules were used *to* create simulated teams playing the Markstrat game [4]. The simulated teams were created with authors' heuristic decision rules described in [3, p. 97] and competed with actual 7 person MBA reams. There *were* four human teams plus one simulated team in each of the 8 industries. Four of the industries contained an arbitrary-consistent team and four contained an arbitrary-random team. The latter used the same rules as the former except random variation was imposed on the decision made using the arbitrary-consistent rules [3, p. 97).

The results of the Hogarth and Makridakis experiment are depicted in their Figure 1 [3, p. 100] and Figure [3, p. 101]. Relative to human teams, the arbitrary- random teams are less successful than the arbitrary- consistent teams outperform 41% of the other firms in their industry while arbitrary-random firms outperform only 19%. These results are congruent with Bowman's assertion [1] the erratic decision making is the major source of economic inefficiency. As shown in Figures 1 and 2, however, the rules are more successful in some industries than in others. These figures suggested an extension of the analysis reported in [5]. The research question inspired by the Hogarth and Makridakis study is:

> Are different industries characterized by differing degrees of consistent decision making?

If evidence confirms different amounts of consistent decision making, this might partially account for the differing performance of the arbitrary-consistent and arbitrary-random rules in the 8 industries.

4. The Prior Research

The data used to test the research question came from a study by Remus [5]. A brief outline of that experiment and its relevant conclusions follows; for details see [5, pp. 830-834]. In this study three key decisions (price, marketing expenditures, and production volume) are analyzed using data from The Executive Game [2], a competitive, oligopolistic business simulation. The subjects were 107 students in an undergraduate introduction to business courses. Each student played the game independently and competed In an industry of not more than 9 teams. There were 9 periods of play; to avoid data reflecting end-of-game strategies, only the first 8 periods of data were used.

The three decision rules are based upon the data from the first place teams in each industry and are contained. in Table 1 of [5, p. 831]. Since optimal rules for the Executive Game do not exist, these three decision rules are a standard of preferred performance. The intent in doing the experiment was to compare the decision making of the first place teams to the decision making of the other teams. This was done by comparing the team's actual decisions with the decisions made using the first place team's decision rules. The difference between the two decisions was then partitioned into two components: differences due to bias (differing intuitions) and differences due to erratic decision making (consistency). The latter is the subject of this note and is measured as the mean absolute deviations between the actual and preferred decisions and thus provides a measure of erratic behavior.

The first relevant conclusion of this research was that in competitive business games the decision maker can be modeled by a decision rule. Bowman [1] asserted that erratic behavior was found to be a linear function of the firm's final rank. Thus erratic behavior (consistency) discriminates levels of firm performance. If the Executive Game winners are thought of as the industry leaders (although that term often refers to the firm with the largest market share rather than the highest return on investment), then the findings support the use of the industry leaders as bench-marks for decision making.

It was found that leaning did occur in the Executive Came; the firms had the oligopolistic tendency to adopt uniform policies, particularly in pricing. Since they adopted the Executive Came winner's price rules, a "price leader" effect as noted the steel industry may have occurred. Firms became less erratic in using that pricing policy as the game continued.

The research found important rank and leaning effects but it also found that these effects interact to explain firm performance. The interaction of the time and rank points to at least one reason why certain firms emerged as Executive Came winners; namely, those firms that rapidly leaned to reduce their erratic decision making tended to do well in the game. Those firms that never settled on a strategy or switched from strategy to strategy did poorly. Thus, in this oligopoly consistency in strategy was rewarded.

5. The New Analysis

The hypothesis suggested by Hogarth and Makridakis requires the analysis of consistency across industries. Because of the findings the earlier study, it is necessary to block on rank, time, and the rank-time interaction to reduce the error variance. The test of the hypothesis of interest is shown in Table 1. While blocking on the effects of time, rank, and their interaction, consistency in marketing (p c .0005) and production (p = .008) decision making varies across the industries. There is no statistically significant evidence for variation in consistency in price across the industries (p .199). The latter may result from the "price leader" effect earlier noted.

6. Discussion and Conclusions

This paper explores the effect of different competitive environments on decision making as modeled by linear decision rules. The Executive Came divides firms into industries. Since all industries are based on the same underlying mathematical model, any idiosyncratic effects must result from the competitive environment created by the firms.

The differing competitive environments of each industry are reflected in differing degrees of erratic decision making related to the rules characterizing the industry leaders. This situation also occurs in the unsimulated world. For example, competing gas stations in different areas have different patterns of price wars. This difference occurs in spite of the fact that quite similar stations and brands may be located in each area. This effect is noted when the analysis includes time, rank, and the interaction of time and rank.

Hogarth and Makridakis conclude that arbitrary-consistent rules outperform arbitrary-random rules. However, arbitrary-consistent rules perform better in some industries are characterized by significantly differing degrees of erratic decision making even though they have the same underlying mathematical model. Thus, it would not be unreasonable for the arbitrary-consistent rules to perform better in industries with high erratic decision making than in industries with low levels of erratic decision making. The latter hypothesis would be predicted by Bowman's theory [1] and would have considerable theoretical Importance. If correct it would suggest that in environments with low levels of erratic decision making, consistency is necessary to survive. In high levels of erratic decision making, consistency is not as necessary but it yields greater economic returns. This hypothesis is deserving of further research.

REFERENCES

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[2] Henshaw, R. C. and Jackson, J. R., The Executive Came (Homewood, Illinois: Richard D. Irwin, 1972)

[3] Hogarth, R. M. and Makridakis, S., "The Value of Decision Making in a Complex Environment: *An* Experimental Approach," Management Science, Vol. 27, 1981, pp. 93-107.

TABLE 1

TEST ON CONSISTENCY ACROSS TIME, RANK, AND INDUSTRY USING THREE WAY ANALYSIS OF VARIANCE

Consistency is measured relative to the Executive Game winner's rules (n = 479)

Decision Rule	Significance of the Factor			
	Time	Rank	Industry	Interaction of Time and Rank
Price	<.0005	.001	.199	.006
Marketing Expenditure	.102	.0005	<.0005	.001
Production Volume	<.0005	<.0005	.008	.008

[4] Larrache, J. C. and Gatignon, H., Markstrat: A Marketing Strategy Came, (Palo Alto, California: The Scientific Press, 1977).

[5] Remus, W. E., "Testing Bowman's Managerial Coefficient Theory Using a Competitive Gaming Environment," Management Science, Vol. 24, 1978, pp. 827-835.