HOSTILE TAKEOVERS: A MULTIVARIATE ANALYSIS

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I. INTRODUCTION

The intrigue and magnitude of the funds involved have made the hostile takeover game the front page financial headline for most of the 1980's. However, financial modeling of the hostile takeover has been limited. The purpose of this paper is to investigate the attempted hostile takeover by modeling the factors that may be important in distinguishing between a successful and an unsuccessful takeover attempt. To the extent that a financial underpinning exists that explains why some hostile takeovers succeed while others fail then such a model will help to explain a process that many people believe is driven solely by the egos of powerful men and the power elite on Wall Street. If financial factors can not explain the hostile takeover process then it leads credence to the suspicion that subjective factors such as the personalities and motivations of those involved affect the success of the takeover attempt.

The model of the hostile takeover process developed in this paper employes financial variables to distinguish between the hostile takeover attempts that have succeeded and those that have failed. The multiple discriminant analysis model by Eisenbeis and Avery is employed to obtain the relevant variables and parameters of the MDA model and to determine its classification accuracy. Classification is examined in reduced space and test space and via the Lachenbruch holdout procedure. The individual observations are then examined to determine potential reasons for

the misclassification results.

There are three objectives to this study of hostile takeovers:

1) To determine if financial factors can be employed to explain the differences between successful and unsuccessful hostile takeovers;

2) What variables are important in explaining these differences, including the role of resistance to the takeover;

3) Whether the more recent hostile takeover attempts are different than previous attempts.

II. THE VARIABLES, MODEL, AND DATA

The variables employed in this analysis are those that have been discussed in the financial world and previous academic research as being critical factors affecting the success of takeovers. Thus, the relevant variables used by Walkling (1985) in his analysis of (friendly) mergers plus important variables associated with the hostile takeover are inputs into the model. Variables employed by Walking that are relevant for this study are:

1) The size of the bid premium for the takeover target (in percentage terms); a bid premium would be required to insure a successful offer when an upward sloping supply curve exits for the target shares.

2) The extent of managerial resistance, measured here by the

number of times the target firm resisted a takeover offer.[1]

3) The percentage of shares of the target firm owned by the bidder at the time of the takeover attempt; shares held by the bidder indicated the strength of the suitor's voting power and influence, as well as affecting the perception of current shareholders as to the suitor's commitment to the target firm.

4) The size of any competing bids (in percentage terms); competing bids can decrease the probability of a successful takeover offer by any one suitor.

Financial and investment variables which may be relevant to hostile takeovers are:

1) earnings per share as an estimate of future profits,

2) P/E ratio,

3) debt/net worth as a measure of the target firm's ability to finance the proposed debt often associated with a takeover,

4) the total number of shares of the common stock,

5) the price of the stock,

6) the percentage of institutional holdings,

7) the percentage of the total number of shares sought by the bidder, which is typically related to what is needed to take control of the firm, and is related to the cost of the takeover bid,

8) cash flow per share, which affects the ability of the target firm to support additional debt, and

9) book value per share as an estimate of the value of the firm.

The relevance of the variables not explained is evident, since they relate to supply, demand, and cost factors.

The variables listed above measure the financial factors relevant to a hostile takeover attempt. These variables measure leverage, the value and cash flow of the firm, resistance of the target firm, and market cost, supply and demand factors.

These importance of these variables to the success of a hostile takeover is examined by employing a multiple discriminant analysis (MDA) model, with the groups being the successful and unsuccessful takeovers of the target firms. Part III employs the various options of the Eisenbeis and Avery (1972) model to investigate the relevance and individual importance of the above variables for hostile takeover attempts.

The hostile takeover attempts analyzed in this paper include all takeovers attempts of large corporations that were found in the sources from early 1982 through the latter part of 1986, namely 45 attempts with 23 successful and 22 unsuccessful situations.[2] Identification of the hostile takeover attempts was obtained from The Wall Street Journal and Barron's. The data on the individual variables was obtained from Value Line as the primary source, with The Standard and Poor's Company Reports serving as a secondary source.[3]

IV. RESULTS

A. Complete Sample Results

The complete stepwise procedure was employed to determine which set of the 13 variables contributed to the optimal discrimination between the successful and unsuccessful takeover attempts. The complete stepwise chooses the best combination of variables for a given chosen number of variables, regardless of the selection of variables for any other level of the stepwise procedure. Thus, the complete stepwise method chooses the set of variables with the highest F-value that maximizes the difference between the means relative to the variances at each variable set size. The optimal combination of six variables provides a significance level of 99%, indicating that this combination of six variables provides 99% of the information inherent in the entire 13 variable set. Table 1 provides the list of these six "best" variables as well as the classification table when these variables are employed to analyze the hostile takeover targets. The misclassification rate for both the reduced space and test space formulations is 33% for the quadratic procedure and 42% for the linear method.[4,5] Since the Box test of the groups matrix equality shows statistical significance at the .00001 level,[6] this implies that the quadratic procedure is theoretically superior to the linear method, although care must be taken in the implication for holdout samples due to the "best-fit" bias of the MDA method and the sensitivity of the Box test to small differences in the matrices, variable size, and non-normality.

These results suggest that when the same sample is used to classify the observations as was employed to determine the MDA equation then up to 67% of the observations are correctly

classified (using the quadratic procedure). These results suggest that financial variables have an effect in explaining this sample of successful versus unsuccessful takeover attempts, but that other factors are also present. The variables that make up the six variable set employed in the analysis, as listed in Table 1, show the importance of the bid premiums, common stock (shares outstanding and institutional holdings), cash flow, and risk (P/E) factors. There are two aspects of this variable set that are interesting when compared to Walkling's results of (friendly) mergers. First, the bid premium shows up in our results but not in Walkling's, indicating the relative importance of the bid premium for hostile takeovers. Second, resistance - which was the most important variable in Walkling's study - does not appear in the six variable set.[7] Another interesting variable omission is debt/net worth, which first appears only in the seven variable set; the debt ratio is important to the suitor since additional debt (typically "junk bonds") are used to finance the cost of the takeover.[8,9]

B. The Holdout Results

The classification results presented above are based on classifying the same observations as were employed to determine the MDA equation. This results in a best-fit bias. To examine the extent of this best-fit bias the Lachenbruch holdout procedure is employed. The Lachenbruch method removes one observation at a time from the data set; the parameters of the model are then determined based on the remaining observations and

the holdout observation is then classified. This procedure is then repeated for the rest of the observations sequentially, to obtain an almost unbiased estimate of the best-fit bias which is inherent in the original sample. Since no holdout sample can be employed in the hostile takeover analysis because of sample size limitations, the Lachenbruch procedure serves as an excellent method to estimate the holdout sample bias. The results from this procedure using the six variable set described above provide a quadratic misclassification rate of 44% and a linear misclassification rate of 46.7%.[10] These misclassification rates indicate that after adjusting for the best-fit bias a MDA analysis of hostile takeover attempts can not adequately distinguish between the successful and unsuccessful attempts based on financial factors for the entire set of observations in the sample set.

C. Examining the Changing Nature of Hostile Takeover Attempts

While the above Lachenbruch holdout results are discouraging in terms of explaining the differences between successful and unsuccessful takeover attempts based on financial factors, one must examine potential reasons for these results before claiming that financial factors have no bearing on distinguishing between these two groups. One potential factor is a changing nature of the hostile takeover process over time. To examine this possibility, the observations are arbitrarily separated into pre-July 1985 and post-June 1985.[11] Table 2 shows the misclassification analysis of the individual observations in

terms of the time factor by using the Lachenbruch holdout from the MDA analysis of the entire set of data. The classification was based on the probability of group membership, although using the relative distance from the centroid of the group provides similar results. These results show a relatively small holdout misclassification rate for the pre-July 1985 set of data but worse than chance results for the post-June 1985 set of observations.

Obtaining separate MDA functions for each time period and examining the holdout classification tables is another way to examine the effect of the time periods. Table 3 shows that the misclassification results for these separate equations are even more supportive of the time factor effect, with the pre-July 1985 misclassification rates being 20% and 30%, and the post-June 1985 rates being 76% and 80% for the quadratic and linear rates, respectively.

The results from Tables 2 and 3 definitely show that there is an effect due to the time period. The reasons for the poor results for the most recent takeover attempts may be due to more cautious management in regards to takeover attempts. The advent of a myriad of defenses to hostile takeovers implies that firms will aggressively resist such takeovers. While such defenses are not foolproof, they do make it more difficult for suitors to succeed in their goal of a fast, complete takeover.

IV. CONCLUSIONS

This examination of hostile takeover attempts has concentra

ted on using financial variables in a multiple discriminant analysis to determine if these factors could distinguish between successful and unsuccessful takeover attempts. The misclassification results on the original sample suggested that some discrimination may exist for the sample at hand. Correspondingly, the relevant variables in the resultant MDA equation showed that hostile takeover attempts are affected by different factors than friendly takeovers.

When the holdout procedure for the discriminant procedure was employed it was determined that one can not discriminate between the successful and unsuccessful takeover bids. An examination of the effect of the time period on these results shows that pre-July 1985 takeover attempts can be successfully explained by an MDA model but that more recent takeover attempts can not be explained. Obviously, these more recent attempts are being affected by non-financial factors such as corporate defenses against takeovers. These results provide empirical evidence supporting recent arguments against hostile takeovers, since it suggests that non-financial reasons exist that determine whether a takeover will be successful.

FOOTNOTES

[1] Walkling defined resistance in terms of a binary variable which indicated if the target firm resisted the takeover or whether it was a friendly merger.

[2] Bradford, a successful takeover, was removed from the sample due to a lack of information for certain key variables.

[3] If a target firm had a NMF (not meaningful figure) for P/E, because of negative earnings, then either the last two quarters of earnings were employed to calculate the P/E (if they were positive) or a "normalized" figure of 60 was used for the P/E. Repeating the analysis with P/E ratios of 25 for these firms did not affect the results.

[4] When the entire 13 variable set is employed the misclassification rate is 31% and 33% for the quadratic and linear reduced space method and 13% and 33% for the quadratic and linear test space method. Consequently, the increase in the degrees of freedom when one goes from 13 to 6 variables, or alternatively the reduction in the effect of "fitting the data", causes only a minimal increase in the misclassification rate except for the quadratic test space method (which is the most sensitive to the number of degrees of freedom).

[5] The use of the test space versus reduced space formulations depend on whether the quadratic or linear formulation is appropriate and the desire to control the effects of the sensitivity of the data on the classification results. If the matrices of the groups are "significantly different" then

theoretically the quadratic procedure is appropriate; in this case the test space procedure will consider all of the information in the data while the reduced space formulation may lose information. However, the test space quadratic method often is more sample sensitive. If the linear procedure is indicated then the test space and reduced space formulations will give the same results.

[6] The Box test analyzes whether there is a statistical difference between the group matrices. Such a difference suggests that a quadratic procedure is appropriate, with the qualifications noted above.

[7] Resistance does not appear in the complete stepwise set until the eight variable set is examined. Walkling defines resistance as whether the firm rejects the initial offer. All target firms in our study reject the initial offer, therefore our measure is the number of times such offers are resisted.

[8] The misclassification rate for the best seven variable set is 35% for both the quadratic and linear methods (reduced space results). The moderate improvement for the linear results over the six variable set can be attributed to the best-fit bias created by adding another variable, since the holdout results for the seven variable results are worse than for the six variable set that is reported in the next section (verifying the initial selection of six variables).

[9] The complete stepwise results for different variable set sizes shows that set on N+1 variables generally include all of the variable from the set of N variables, even though the complete

stepwise procedure may choose entirely different variables as the size of the set changes. These results indicate that the variables employed in this analysis are independent from each other, providing different information for the discrimination process.

[10] The Lachenbruch holdout method can only be preformed in test space.

[11] This separation results in a reasonable number of observations in each group for each time period, i.e. 10 observations in each group for the earlier time period and 13 and 12 observations in the two groups for the latter time period.

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TABLE 1

BEST SIX VARIABLE CLASSIFICATION RESULTS

A. Test Space Results

	Quadratic		Linear	
	Predicted Groups		Predicted Groups	
Actual Groups	Successful	Unsuccessful	Successful	Unsuccessful
Successful	14	9	14	9
Unsuccessful	6	16	10	12
	Misclassification rate=33.3%		Misclassification rate=42.2%	

B. Reduced Space Results

	Quadratic		Linear	
	Predicted Groups		Predicted Groups	
Actual Groups	Successful	Unsuccessful	Successful	Unsuccessful
Successful	18	5	14	9
Unsuccessful	10	12	10	12
	Misclassification rate=33.3%		Misclassification rate=42.2%	

C. Best Set of Six Variables Used in Classification:

- Bid Premium(%)
- Oppositaion Bid Premium(%)
- Institutional Holdings(%)
- Cash Flow per Share
- P/E Ratio
- Number of Shares of Common Stock

TABLE 2

LACHENBRUCH RESULTS BY TIME PERIOD

USING ORIGNINAL MDA EQUATION

A. Pre-July 1985 Results

	Quadratic		Linear	
	Predicted Groups		Predicted Groups	
Actual Groups	Successful	Unsuccessful	Successful	Unsuccessful
Successful	8	2	7	3
Unsuccessful	3	7	3	7
	Misclassification rate=25.0%		Misclassification rate=30.0%	

B. Post-June 1985 Results

	Quadratic		Linear	
	Predicted Groups		Predicted Groups	
Actual Groups	Successful	Unsuccessful	Successful	Unsuccessful
Successful	4	9	5	8
Unsuccessful	5	7	7	5
	Misclassification rate=56.0%		Misclassification rate=60.0%	

TABLE 3

LACHENBRUCH RESULTS BY TIME PERIOD

USING SEPARATE MDA EQUATIONS

A. Pre-July 1985 Results

	Quadratic		Linear	
	Predicted Groups		Predicted Groups	
Actual Groups	Successful	Unsuccessful	Successful	Unsuccessful
Successful	8	2	7	3
Unsuccessful	2	8	3	7
	Misclassification rate=20.0%		Misclassification rate=30.0%	

B. Post-June 1985 Results

	Quadratic		Linear	
	Predicted Groups		Predicted Groups	
Actual Groups	Successful	Unsuccessful	Successful	Unsuccessful
Successful	2	11	4	9
Unsuccessful	8	4	11	1
	Misclassification rate=76.0%		Misclassification rate=80.0%	