

## **DEVELOPMENT OF PREDICTION MODELS FOR HORIZONTAL AND VERTICAL MERGERS**

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### **Abstract**

During the five-year period of 1981-1985 the largest number of business mergers in American history were consummated. This study examines the accounting, financial, and market variables which predict merger and acquisition target companies for this active time of business combinations. A sample of firms which experienced combinations during this period was matched with nonmerged companies similar in industry and asset size. Logit binary regression analysis was used to determine the factors which predict merger and acquisition target companies for the total sample and then for the horizontal and vertical subsamples of merged companies. The model for horizontal acquisitions showed the strongest predictive ability, with the variables long-term debt/total assets, long-term debt/market value, market value/book value, asset growth, and sales growth showing significance. The results support the contention that the wave of horizontal mergers during the 1980s was possibly the result of undervaluation of assets due to previous high inflation and the conservatism dictated by accounting principles, coupled with the laissez-faire attitude of the government during the period.

### **BACKGROUND**

Merger and acquisition activity reached a peak in the late 1960s, showed a marked decline through the early and middle parts of the 1970s, then began to rise again, culminating in a record high during the late 1980s (Figure 1). The large number of companies experiencing business combinations during the period of 1981-1985 provides a unique opportunity to examine the motivations for and consequences of mergers and acquisitions, as well as the role of accounting numbers in these combinations.

Disinflation, industry deregulation, increased foreign competition, and the shift in the economy from manufacturing to services all contributed to the wave of merger and acquisition activity in the 1980s [9]. Under the Reagan Administration, antitrust litigation was not a major concern of large corporations. Thus, companies could use mergers to grow in size and compete in the increasingly global economy. As firms sought to increase the productivity of both physical and human resources, they often utilized mergers and acquisitions to enhance their technological sophistication or alter their business mix.

During the 1960s researchers defined financial characteristics which conglomerates used to determine merger targets. Since the trend during the 1980s was toward divestiture of unrelated firms by conglomerates and acquisition of companies which have either a horizontal or vertical business relationship to the parent, target firms during this time period may possess different characteristics than those identified in previous research. This study addresses the variables specific to more recent mergers. Also, unlike most earlier studies, the analysis divides the sample firms into subsamples representing horizontal and vertical acquisitions in an attempt to develop models unique to the type of business combination.

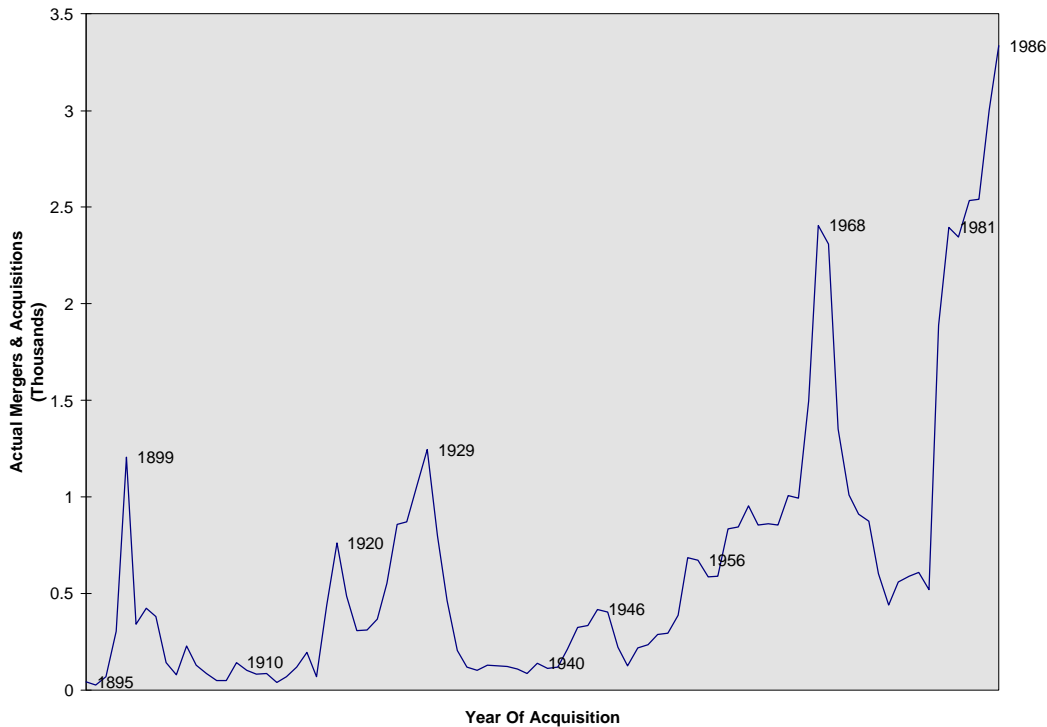
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**FIGURE 1**  
**Mergers And Acquisitions 1895 To 1986**



Sources: U.S. Bureau of the Census, *Historical Statistics of the United States*, Bicentennial Edition, Part 1, Washington, D.C., 1975.  
 U.S. Bureau of the Census, *Statistical Abstract of the United States* (103<sup>rd</sup> Edition), Washington, D.C., 1983.  
 U.S. Bureau of the Census, *Statistical Abstract of the United States* (108<sup>th</sup> Edition), Washington, D.C., 1987.

The characteristics identifying likely merger targets in this type of economic environment have not been empirically determined. However, theoretical debate surrounding this issue has evolved into six hypotheses to explain merger targets, as summarized by Palepu [10]. The model used in this study incorporates each of these hypothetical assumptions either through inclusion of variables or by control techniques. These are listed and discussed below.

- (1) **Price-Earnings:** Firms with high Price/Earnings (P/E) ratios may seek to acquire companies with low P/E ratios because the stock market values the combination at the P/E of the acquiring firm. The result will be an instantaneous capital gain upon acquisition through the increase in the P/E ratio of the acquired firm.
- (2) **Size:** The premise that a large firm has greater resources to fight take-over, coupled with the increased costs of absorbing larger firms into the organization, has led to the belief that both the number of bidders and the likelihood of acquisition decreases in direct proportion to the increase in size of possible target firms.
- (3) **Inefficient Management:** Inefficient managers who fail to maximize the market value of a firm tend to be replaced. One such method of replacement may be through the acquisition process.
- (4) **Low-Growth Resource-Rich Firms:** Firms with high resources which are experiencing low growth are potential acquisition targets.

- (5) **Market To Book Values:** Companies with low market values compared to book value are likely takeover candidates. However, the age and replacement value of the assets of a company would have a bearing on the applicability of this theory for any given firm.
- (6) **Industry Variations:** Gort [4] argues that mergers are a result of economic differences in industries caused by changes in technology, government regulation, and any other economic change affecting a particular industry.

Throughout the description of this study, the terms merger and acquisition are used interchangeably, as is the normal business custom. Technically, however, mergers are defined as business combinations in which only one company survives, while in acquisitions, both companies survive with one company owning the other, resulting in a parent-subsidiary relationship. Horizontal combinations are between companies which could potentially be competitors, since they perform similar functions. Vertical combinations occur between companies that could feasibly have a supplier-customer relationship.

## LITERATURE REVIEW

Early financial ratio studies [1,2] examined the ability of financial ratios to identify financially distressed firms. Although not directly related to merger and acquisition activity, these studies laid the foundation for choosing specific variables to represent characteristics of firms and established the relationships of financial ratios to underlying dimensions such as liquidity, profitability, and size. Ohlson [8] extended the research in this area by using a logit model with financial ratios from the seventies and found that the logit model performed better than multiple discriminant analysis in predicting bankruptcy.

Several researchers have attempted to build models to predict mergers and acquisitions. A summary of these studies showing the variables chosen and the dimensions represented appears in Table 1. Simkowitz and Monroe [12] used multiple discriminant analysis (MDA) to study conglomerate target firms merged during the period of April through December 1968. Data from the COMPUSTAT tapes for 25 non-merged firms and 23 merged firms were used to construct the discriminant function. A holdout group of 23 firms was used to test the discriminant function derived from the analysis groups. Twenty-four variables were selected to provide a quantitative measure of (1) growth, (2) size, (3) profitability, (4) leverage, (5) dividend policy, (6) liquidity, and (7) stock market characteristics. Of the original 24 variables, seven were found to be significant: high market activity, price-earnings ratio, past three years' dividends, growth in equity, sales, loss carryover, and the ratio of the last three years' dividends to common equity. Seventy-seven percent of the holdout group of firms were correctly classified. However, the researchers cautioned that future research should utilize holdout samples from time periods other than the one used to build the model and should normalize the data by industry.

A later study by Stevens [13] used data for 80 firms to study the merger decision. Forty firms merged in 1966 were chosen from the Federal Trade Commission listings. Then, 40 non-acquired firms, matched by size of assets, were selected as a control group. Stevens identified 20 ratios to represent liquidity, profitability, leverage, activity, and other market characteristics. To overcome the high degree of multicollinearity, factor analysis was used to reduce the variables to six factors which appeared to represent leverage, profitability, activity, liquidity, dividend policy, and price earnings. Six of the original variables, one for each dimension, were used to build an MDA model. Four of these six variables entered the equation: earnings before income tax/sales, net working capital/assets, sales/assets, and long-term liabilities/assets. Using this model, classification accuracy was 70%. However, a higher classification accuracy was obtained with the acquired group (85%). A split sample validation technique had a classification accuracy of 67.5%, giving support to the stability of the model. A temporal stability validation was used on samples from 1967 to 1968 and achieved a 70% accuracy. This study did not standardize the sample for industry effects, nor did Stevens include nonfinancial variables to improve the discriminatory power of his model [6].

Wansley [14] used 12 discriminant models to test the sensitivity of MDA to variable selection. Twenty variables were used to represent ten dimensions. These variables and dimensions were chosen from past studies along with some which had not been previously selected. Forty-four firms that merged in 1975 and 1976 were selected from the COMPUSTAT tapes. Twelve different samples of 44 firms remaining non-merged in 1982 were selected and

matched on fiscal year-end in the same reporting period. Wansley's study examined different linear discriminant models used in merger studies to determine whether the classification accuracy and selection of variables differ according to the type of model utilized. The results showed that the results of past research using MDA may have been sample sensitive. Wansley concluded that discriminant analysis results should be viewed cautiously when the sample size is small and a sound theoretical basis for including variables is not present. His results provide a sound basis for using a large sample and logit and probit analyses when the dependent variable is binary.

**TABLE 1**  
**Summary Of Significant Studies**

Researcher(s)	Statistical Technique	Dimensions And/Or Variables											
		TRN	LIQ	PR	SZ	LEV	ACT	GR	PE	SM	MV	DP	IND
Simkowitz & Monroe 1971	MDA		X	X	X*								
Stevens 1973	Factor Analysis & MDA		X	X		X	X		X			X	
Wansley 1984	MDA		X*	X*		X*	X*		X		X*	X	
Dietrich & Sorenson 1984	Logit	-	-	?	-	-			-	+	-	-	-
Palepu 1986	Logit	X*	X	X	X*	X		X*	X		X*	X*	X*
Pastena & Ruland 1986	Probit				X*	X*							

\*Significant at the 90-99% level

MDA	Multiple Discriminant Analysis	LEV	Leverage	SM	Stock market characteristics
TRN	Turnover	ACT	Activity	MV	Market Value/Book value
LIQ	Liquidity	GR	Growth	DP	Dividend Policy
PR	Profitability	PE	Price/Earnings ratio	IND	Industry Dummy
SZ	Size				

Dietrich and Sorenson [3] overcame some of the criticisms of prior merger research by utilizing logit analysis and confining their study to four industries. The result was a model showing a 90% classification accuracy. Generalizing their results to industries other than the four represented in the study would be impossible, however. Palepu [10] used a logit model incorporating variables representing each of the six hypotheses which finance literature suggests as reasons for firms becoming targets for merger. These six dimensions are inefficient management, growth-resources imbalance, industry disturbance, firm size, asset undervaluation, and price-earnings ratio. A sample of 163 acquired firms was chosen for the period 1971-1979. A random sample of 256 firms not acquired as of 1979 was chosen to be included in the estimation model. Then, a group of firms consisting of all merged firms in 1980 and all non-merged firms not included in the estimation sample was used to test the predictive ability of the model. Palepu tested four different versions of the logit model and found that the best model classified 80% of the merged companies correctly, but only 48% of the non-merged companies.

Pastens and Ruland [11] studied the decision to merge as an alternative to bankruptcy. Probit analysis was used to test the importance of three variables in explaining the merger/bankruptcy decision. These variables were revenues, financial leverage, and the magnitude of tax carryforwards. Results showed size and leverage as

important variables because the larger firms with lower financial leverage tended to merge to avoid bankruptcy. Firms with high owner control also tended to merge and avoid bankruptcy. Pastena and Ruland suggest that the self-interest of managers motivates the choice between merger and bankruptcy.

The study described herein attempts to overcome the flaws and weaknesses of previous research by utilizing a larger sample size and a stable time period, and by controlling for industry variation. Simkowitz & Monroe [12], Stevens [13], and Dietrich and Sorenson [3] used small samples to build a predictive model. Generally, a larger sample would necessitate using a longer time span, thereby giving rise to economic variations which could bias the study. Because of the relatively large number of mergers during the years 1981 - 1985, this study is able to employ a large sample without sacrificing the stability of a short time period.

Both Stevens [13] and Simkowitz and Monroe [12] recognized that industry variations of the firms in the sample could affect studies and urged future researchers to control for these differences. Dietrich and Sorenson [3] also recognized that industry variation was important and chose their sample from only four industries as a control measure, while Palepu [10] used dummy variables to identify companies by industry. This study uses a pair-matched design to control for industry variation.

### STATEMENT OF THE HYPOTHESIS

The variables used in this research were chosen from those used in the previous studies of Simkowitz and Monroe [12], Stevens [13], Wansley [14], and Dietrich and Sorenson [3]. Below is the framework for the proposed model analyzed by this research.

Equation 1

$$Probability\ Of\ Acquisition = f( Liquidity, Profitability, Size, Leverage, Activity, Growth, Price - Earnings, Stock Market Characteristics, Market Valuation, Dividend Policy )$$

This relationship can be stated in hypothesis form as follows: Variables representing the dimensions of liquidity, profitability, size, leverage, activity, growth, price-earnings, stock market characteristics, market valuation, and dividend policy have information content which can be used to predict merger and acquisition target companies.

The variables chosen to represent each of these dimensions are calculated as shown below:

**Liquidity** - Cash available plus marketable securities (CA), current ratio or current assets divided by current liabilities (CR), net working capital divided by total assets (WCTA), net working capital divided by sales (WCS)

**Profitability** - Earnings before interest and taxes or operating income after depreciation (EBITS), net income divided by total stockholders equity (ROE), net income divided by total assets (NIA)

**Size** - Net sales (NS), total assets (TA)

**Leverage** - Long-term debt divided by total assets (LDTA), long-term debt divided by net stockholders equity (LDSE), total liabilities divided by total assets (TLTA), long term debt divided by market value of equity (LDMV)

**Activity** - Sales divided by total assets (STA), cost of goods sold divided by inventory (CGSI)

**Growth** - 2-year growth in sales (SGR), 2-year growth in assets (AGR), 2-year growth in earnings per share (EPSGR)

**Price-Earnings** - Market price divided by earnings per share common (PE)

**Stock Market Characteristics** - Common shares traded divided by common shares outstanding (CTSO)

**Market Valuation** - Market price per share divided by book value per share (MVBV), 2-year percentage change in share price (SPGR)

**Dividend Policy** - Cash dividends common divided by earnings available to common shareholders (DPCS).

Some of the qualitative factors possibly relevant to merger and acquisition decisions are impounded in these quantifiable variables. Specifically, the liquidity variable cash plus marketable securities (CA) addresses the ability of the company's owners and/or management to resist takeover, since firms with more cash generally have more ability to fight takeover. Also, the variable common shares traded/common shares outstanding (CTSO) helps to identify those companies which are closely held. Normally, less stock trading activity occurs in a closely held corporation, so the variable CTSO would be smaller for closely held companies than for those companies whose stocks are actively traded on the open market. A significant relationship between acquisition and this variable could help determine if closely held companies fight takeover with more intensity or are more subject to acquisition.

## **SAMPLE SELECTION AND METHODOLOGY**

The population for this study consisted of those companies acquired in the period January 1, 1981 through December 31, 1985 which have data available on the COMPUSTAT research tapes. A total sample of 100 acquired companies was chosen, consisting of 50 horizontal mergers and 50 vertical mergers. The 100 acquired firms were self-selected and therefore not subject to control. To overcome the bias introduced by self-selected subjects, these firms were pair-matched with 100 non-acquired firms by asset size and industry. Each of the nonacquired firms was checked to ascertain that it was not acquired during the two years after the matched firm was acquired. This control measure assured that acquisition was not imminent for the nonacquired firms at the time of selection.

The sample was spread evenly over the five-year period through the selection of 40 companies each year. Firms were chosen from the Transaction Rosters of Mergerstat Review published by W. T. Grimm & Co. for the years 1981 through 1987. This publication lists all completed and pending transactions for the year and provides the names of buyers, seller, price, business and/or product line, and types of merger. Firms were numbered and then chosen, using a random number table, from each year's roster. Each firm was classified as horizontal or vertical and checked to determine if it met the following criteria: ( 1) the merger was completed, (2) the firm was not acquired by a foreign company, (3) the company was not acquired by management, (4) financial data was available on the COMPUSTAT Industrial research tapes, and (5) the firm was not acquired in part by a company which already could be classified as having a significant interest in the firm (more than a 20-25% interest). Items 2, 3, and 5 were added as control measures because overseas investors, management, and those already owning a significant interest in the company may have qualitative reasons for acquisition so company-specific that the results of the study would be biased by including those firms. After either ten horizontal or ten vertical mergers were selected, additional companies were added only in the category needed until the required number were selected.

A control group was then chosen from companies which met the following selection criteria: (1) the company must be in the same industry as evidenced by the two-digit Standard Industrial Classification (SIC) code, ( 2) the asset size must be as close as possible to the acquired firm in the same industry, (3) data must be available for the year before merger, (4) relevant financial data must be available on the COMPUSTAT tapes, and (5) the company must remain unacquired for two years. Data for each merged firm and its matching firm were drawn from the last full years' financial statements available before the merger occurred.

Data from the last full year's financial statements available before the merger occurred were collected from the COMPUSTAT tapes for each merged firm and its matching firm. The statistical technique employed was logit regression analysis, which is a binary regression technique considered powerful when the research purpose is to determine the likelihood of an event or the probability of its occurrence. In binary regression, the independent variables are used in linear equation to find an intermediate quantity called  $t$ . This  $t$  value is used to read another value, called  $F(t)$ , from a curve that is restricted to a range from 0 to 1. The equation for this model is as follows [5, pp. 79-33]:

Equation 2

$$t = b_0 + b_1 \times X_1 + \dots + b_m \times X_m$$

where:

$b_0$  = the constant or intercept

$b_1 \dots b_m$  = the coefficients for the independent variables  $X_1 \dots X_m$

*Predicted Value* =  $Y = F(t) + e$

The logistic distribution curve is given by the equation:

Equation 3

$$F(t) = 1 / (1 + e^{-t}) \quad [5, \text{pp. 79-88}]$$

Outputs include coefficients and the predicted probabilities of a  $Y$  value of 0 or 1 classified on the independent variables with  $F(t)$  values less than and greater than .50.

Logit analysis was expected to prove more powerful than multiple discriminant analysis (MDA) which was used in earlier studies by Stevens [13], Simkowitz and Monroe [12], and Wansley [14]. Discriminant analysis requires the data to have multivariate normal distribution and the dispersion matrices of the groups to be equal. Neter and Wasserman [7, p. 329] state "both theoretical and empirical considerations suggest that when the dependent variable is binary, the underlying relationship is frequently curvilinear." In logit analysis, no assumptions need be made about the prior probability that the firm belongs to a specific group, and the assumptions of normal distribution and the equality of variances and covariances across groups are less critical.

## STATISTICAL RESULTS

A stepwise procedure was utilized for entering the variables into the equation. Maximum likelihood estimation of the  $Y$  function was performed three times using iterative techniques for the entire sample, the sample of firms representing horizontal mergers, and finally, the sample of firms representing vertical acquisitions.

### Total Sample

After the companies with missing data and their matching companies were eliminated, the final sample used to estimate the parameters of the equation consisted of 160 firms. The results of estimation for the total sample are given in Table 2 which shows the parameter estimates for each variable, their estimated standard errors, the probability values, measures of goodness of fit, and the results of the prediction as a percentage. The prediction rate of 63.75% is significantly better than chance and the overall model is significant at the 99% confidence level.

However, only two variables, long-term debt to total assets (LDTA) and long-term debt to market value (LDMV), are significant at the 90% confidence level. Although both variables were chosen to represent leverage, in this model the coefficients are of opposite signs.

Long-term debt to total assets is the most influential with a positive sign and supports the popular hypothesis that mergers are a result of attempts to gain financial leverage. The positive sign of influence for this variable appears to indicate that firms whose long-term debt is higher in relation to asset size would be more likely acquisition candidates. As assets are commonly pledged as security for long-term debt, the higher debt would support the theory that the assets may be undervalued on the books. The significance of long-term debt to total assets also supports the theory that assets are obtained at a lower cost through merger than by building. The age and condition of the assets would also be important if the merger decision is primarily based on replacement cost of assets. After a period of high inflation, it seems reasonable that both of these hypotheses have merit. The variable LDMV shows a negative relationship with the merger outcome, which indicates that a firm becomes a more likely candidate as the amount of debt decreases in relation to the market value of the firm.

Although these results may seem paradoxical at first glance, upon reflection one may conclude that they lend support to the theory that the wave of merger activity during this time period was a reaction to the rampant inflation during the seventies. Companies may choose to acquire firms with assets already in place rather than to build the same facilities at the higher inflated prices. These results would also support the theory that, during and after an inflationary period, the assets which have been recorded at cost quickly become undervalued in the financial statements due to the conservatism required by the cost principle. The significance and negative direction

taken by long-term debt to market value of equity would also support this theory because a higher market value indicates that the higher actual values of the assets are recognized in the market price of the stock.

**TABLE 2**  
**Logit Estimation Results**  
**Total Sample**

Variable	Coefficient	Standard Error	P - Values
Intercept	0.287	1.733	0.868
MT	0.060	0.398	0.880
CA	0.011	0.008	0.173
CR	-0.066	0.207	0.748
WCTA	1.472	1.988	0.459
WCS	-0.627	1.719	0.715
EBITS	4.593	3.208	0.152
ROE	-6.950	4.560	0.128
NIA	0.670	11.347	0.953
NS	-0.000	0.000	0.285
TA	0.000	0.000	0.703
LDTA	9.857	4.273	0.021*
LDSE	-0.461	0.756	0.542
TLTA	-3.933	3.234	0.224
LDMV	-0.928	0.523	0.076**
STA	0.454	0.383	0.235
CGSI	0.049	0.031	0.118
SGR	0.000	0.002	0.565
AGR	-0.002	0.003	0.499
EPSGR	0.155	0.112	0.166
PE	0.001	0.005	0.923
CTSO	0.462	0.503	0.359
MVBV	-0.453	0.282	0.109
SPGR	-0.001	0.003	0.686
DPCS	-0.150	0.393	0.702
Likelihood Ratio	135 df	188.70	Prob. 0.001*
Log Of Likelihood Function	94.35		
Percent Correct Predictions	63.75		

\*Significant at 95%

\*\*Significant at 90%

Market value to book value (MVBV) is the next most influential variable at a confidence level of 89%. Firms with low market-to-book value ratios are generally assumed to be “cheap” buys and therefore prime candidates for takeover. Since replacement costs of assets are not reflected in book values, this assumption has questionable economic validity [10, p. 18]. However, this variable does have a negative sign which supports this popular hypothesis and adds more credence to the assumption that the relationship between asset valuation and asset replacement costs is important to the acquisition decision. The efficient market hypothesis is based on the assumption that the market price of the stock reflects the financial information and other data available for the firm. If the market is truly efficient then other characteristics of a firm could also contribute to this negative relationship and should be considered. For example, profits could be depressed by competition, lawsuits pending, or new technology in the industry. In spite of other considerations, the fact that this variable shows a high significance level reveals that this theory deserves consideration.



## Horizontal Sample Results

Table 3 presents the results of analyzing the 78 firms involved in horizontal combinations. The three variables (long term debt to total assets, long-term debt to market value of equity, and market value to book value per share) showing the highest degrees of significance in the total model are significant in this model at the 95% confidence level. Coefficients for all three variables have the same sign as the total sample, but are all larger than for the total sample. The overall model is a better predictor for the horizontal subset than for the total sample, as indicated by the higher percentage of correct classifications (78.21% for the horizontal subsample versus 63.75% for the total sample).

In addition, asset growth (AGR) and sales growth (SGR) are significant at the 90% confidence level for this subgroup. These results support the conclusion that data for the horizontal acquisitions exert the most influence on the equation derived from the total sample.

**TABLE 3**  
**Logit Estimation Results**  
**Horizontal Merger Sample**

Variable	Coefficient	Standard Error	P - Values
Intercept	2.119	3.757	0.573
CA	0.044	0.027	0.109
CR	-0.321	0.742	0.665
WCTA	4.594	4.947	0.353
WCS	-5.062	6.494	0.436
EBITS	7.458	6.695	0.265
ROE	-9.868	7.980	0.216
NIA	5.036	20.658	0.807
NS	-0.003	0.002	0.197
TA	0.003	0.003	0.333
LDTA	20.367	9.465	0.031*
LDSE	-1.116	1.142	0.328
TLTA	-7.523	6.874	0.274
LDMV	-1.711	0.744	0.021*
STA	0.178	0.847	0.834
CGSI	0.046	0.048	0.339
SGR	0.013	0.007	0.093**
AGR	-0.027	0.016	0.099**
EPSGR	0.054	0.224	0.808
PE	0.010	0.028	0.714
CTSO	1.547	0.955	0.105
MVBV	-1.122	0.543	0.039*
SPGR	0.001	0.004	0.876
DPCS	-0.634	1.116	0.570
Likelihood Ratio	54 df	74.66	Prob. 0.033*
Log Of Likelihood Function	37.33		
Percent Correct Predictions	78.21		

\*Significant at 95%

\*\*Significant at 90%

Asset growth has a negative sign which supports the theory that firms with older, possibly undervalued, assets have a higher probability of being merger candidates. Dietrich and Sorenson [1971, 13] used equity growth as a

growth variable to serve as a proxy for stockholder's expectations of future growth. They found that low-growth firms were absorbed when defining the variable in this manner. Palepu [10] used a growth-resource imbalance dummy variable which he found to be significant with the expected positive sign.

Sales growth has a positive sign which indicates that, during the period covered by this research, firms with the ability to generate sales increases were likely candidates for acquisition. Dietrich and Sorenson [3, p. 400] describe their results as indicating that firms make attractive merger targets when management is deficient in producing sales rather than maintaining profit margins. These conclusions were drawn because the P/E ratio was not found to be significant. They found size of the company and volume of shares traded in the market to be significant with negative and positive signs respectively and concluded that smaller firms with high trading volume are more easily acquired. The significance of the trading volume variable coupled with the insignificance of the price-earnings ratio led them to conclude that merged companies have average margins but low sales relative to assets. That is, they were generally deficient in producing sales but were able to maintain profits. However, the data for their study covered the period 1969-1973 and the differences between their results and the results of this study using data from 1981-1985 could be a result of the economic changes which have occurred. Inflation was lower during the period covered by this study so one could assume that the level of sales would be related to efficient management rather than to general inflation.

Palepu [10] used a three-year average sales growth to represent growth. He found the growth variable significant with a negative sign and concluded that targets are characterized by low-growth. However, Palepu used a sample covering a period of high inflation (1971-1979). Some may argue that increased sales is only indicative of inflation and not a result of management efficiency. However, the differences in the results of this study and the Palepu study would make this argument suspect. While the variables related to profitability are not statistically significant, earnings before interest and taxes and return on equity do appear to contribute to the model with p-levels of 0.265 and 0.216 respectively.

Overall, the results for the horizontal subsample are in direct contrast to the theory that companies with inefficient management are likely targets for merger and acquisition. Upon close examination, one finds that the variables earnings before interest and taxes and return on equity contribute to the model while net income to total assets has a very low significance level. Earnings before interest and taxes and return on equity are indicative of profitability while net income to total assets shows the return on assets after interest and taxes. If a firm is highly leveraged with long term debt requiring high interest payments, this latter variable might not be a valid measure of the current ability of management. Net income/assets (NIA), earnings per share growth (EPSGR), and share price growth (SPGR) contribute the least to the equation. The insignificance of both earnings per share growth and share price growth indicates that profitability is not considered an essential requirement for a target company. The significance of sales growth in the horizontal subset suggests that firms seeking to expand their market share choose to merge with companies whose sales are increasing.

## **Vertical Sample Results**

The model based on 82 firms classified as vertical acquisitions is significant at the 99% level. The total equation correctly predicted 67.07% of the firms as acquired or unacquired. An examination of Table 4 showing the parameters of the equation identified by the estimation using the vertical sample reveals only one variable, dividend policy to common shareholders (DPCS), to be significant at the 90% confidence level. This variable has a positive coefficient which could be interpreted to mean that companies which consistently maintain or increase dividend payments are the most likely takeover candidates.

The variable dividend policy to common shareholders represents the dividend payments to shareholders relative to the earnings available. This variable is related to the profitability and dividend payout, so perhaps it may be considered a surrogate for identification of a stable firm when making the vertical acquisition decision. Firms with a history of long-term profitability and stability are more likely to pay out higher percentages of earnings to shareholders.

The next most significant variable contributing to the equation is total assets (TA) which relates to the size of a firm. This variable shows a negative relationship which suggests that smaller firms are more likely candidates than larger firms. Dietrich and Sorenson [3] found size to be significant with a negative sign and also concluded that smaller firms are more likely targets. This research lends support to their conclusions.

**TABLE 4**  
**Logit Estimation Results**  
**Vertical Merger Sample**

Variable	Coefficient	Standard Error	P - Values
Intercept	-1.188	3.836	0.757
CA	0.000	0.010	0.962
CR	0.354	0.397	0.372
WCTA	1.833	3.886	0.637
WCS	-2.843	2.626	0.279
EBITS	-1.113	5.016	0.824
ROE	-10.424	11.810	0.377
NIA	8.160	22.664	0.719
NS	0.000	0.001	0.912
TA	-0.002	0.001	0.188
LDTA	4.760	9.177	0.604
LDSE	-0.416	4.089	0.919
TLTA	0.602	7.034	0.932
LDMV	-0.402	1.828	0.826
STA	-0.378	0.764	0.621
CGSI	0.055	0.092	0.553
SGR	0.003	0.004	0.444
AGR	0.006	0.006	0.329
EPSGR	0.232	0.185	0.209
PE	0.000	0.006	0.945
CTSO	0.454	0.810	0.575
MVBV	-0.143	0.483	0.767
SPGR	-0.000	0.005	0.943
DPCS	1.784	0.988	0.071**
Log Likelihood Ratio	58 df	91.57 Prob.	0.003*
Log Of Likelihood Function		45.78	
Percent Correct Predictions		67.07%	

\*Significant at 95%

\*\*Significant at 90%

## Temporal Validation

The model developed for predicting horizontal mergers shows the highest significance level as compared to the other two models in the study. A sample consisting of ten firms merged in 1986, twelve merged in 1987, and ten non-merged firms was used to test this model's classification and temporal accuracy. Although the model is based on events that occurred in the period 1981- 1985, it is expected to have predictive value in future years until drastic changes, such as a return of rampant inflation or other economic and general business shifts, occur which would affect the merger decision.

Table 5 presents the results of these analyses. Column one shows the actual group (merged or non-merged) and column two the actual number in that group. Column three shows the percent of companies in that group which were correctly predicted as merged or non-merged. Columns four and five show the predicted numbers in each group. The model correctly predicted 19 of the 22 merged firms, or 86.36%. However, this model only correctly classified three, or 30%, of the non-merged firms. Some may question the economic usefulness of the equation because of its misclassification of non-target companies. The cost of this misclassification is relatively high to companies trying to accumulate excess returns [10].

**TABLE 5**  
**Classification Accuracy**  
**Total Logit Sample Model**

Actual Group	Number	Percent Correctly Predicted	Observations Correctly Predicted	
			Merged	Non-Merged
Merged	22	77.27	17	5
Non-Merged	10	50.00	5	5
Total	32		22	10

## DISCUSSION

The results presented above raise questions about the samples that have been used in previous studies. Historically, different periods have been dominated by certain kinds of mergers. Simkowitz and Monroe [12] and Stevens [13] used samples of firms merged in 1966 and 1968 respectively. During the sixties, over 75% of the mergers were classified as conglomerate, so the samples could be expected to be biased toward conglomerate acquisitions, while the combinations during the 1980s were generally of the horizontal or vertical type. The results of this study suggest that the variables considered when evaluating possible target companies depend upon the type of acquisition and the specific needs of the parent firm.

The extreme differences in the results of the analysis of the horizontal and vertical samples suggest that merger studies should consider the type of business combination as a potentially significant factor in explaining relationships. Perhaps the composition of the samples of previous studies have been at least partially responsible for the mixed results obtained. The results of this study support the policy of segregating samples according to type of merger, since the models developed herein are better predictors of horizontal combinations than of vertical combinations.

A plausible explanation for the lack of significant variables in the vertical analysis in this study could be that the decision to acquire a company with a vertical relationship to the acquiring firm is company specific. The reasons for these acquisitions usually depend upon the makeup of the two companies involved. When considering a vertical acquisition, a firm has only a minimum number of choices, or often only one choice, of target firms which fulfill its requirements. Therefore, if the variables considered when determining vertical acquisition targets are different for each decision, none may show a high level of significance when these types of mergers are analyzed. On the other hand, firms considering horizontal mergers with other companies in the same line of business or within the same industry normally may select from many possible targets. This research shows that horizontal targets are possibly evaluated by the value of their assets and the recognition of that value by the market. Companies which have low asset growth and high sales growth appear to be the primary targets.

One limitation of this study stems from the high multicollinearity of the variables used. Because financial variables tend to overlap, the possibility of an overstatement of the standard errors of the regression coefficients which can mask their statistical significance must be considered. Also, since the COMPUSTAT tapes contain data only for those large firms listed on the two major exchanges, this study is heavily biased toward relatively large firms whose stocks are publicly traded. The results are not generalizable to the general business population, only to those firms with data included on the COMPUSTAT Tapes. Any statistical significance of size may reflect a general COMPUSTAT bias. This bias may have been overcome partially by using a pair-matched sample with size as a matching criteria. As data is difficult to obtain for smaller firms, most studies of this type will experience this same bias. However, the mergers of general interest to investors are those which include large publicly traded companies.

The other major limitation relates to the role of qualitative variables in the merger decision. This study uses only quantitative variables. To help overcome this limitation, several variables were chosen which are quantifiable yet could be expected to represent qualitative dimensions. As explained earlier, cash plus marketable securities (CA) was chosen to represent both liquidity and the cash available to management to resist take-over. The variable common shares traded/common shares outstanding (CTSO) was chosen to represent activity of the compeer variables which are not quantifiable may still exert an influence and weaken the results of this research. If so, future studies should be structured to reveal the strength of the qualitative variables to the acquisition decision.

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