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AN INQUIRY INTO THE PREDICTION OF MERGERS USING DISCRIMINANT ANALYSIS ON THE FINANCIAL RATIOS OF ACQUIRED FIRMS

by

David Charles Distad

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ABSTRACT

AN INQUIRY INTO THE PREDICTION
OF MERGERS USING DISCRIMINANT
ANALYSIS ON FINANCIAL RATIOS

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Throughout the history of mergers in the United States, share price premiums awarded to existing shareholders have exceeded market values. Because of the contradiction between share premiums and the existing value of the acquisition and because of the increasing emphasis on corporate growth through acquisition, it is appropriate to study mergers in the 1970s.

Four samples were extracted from the Compustat data bases. They are: 1. Two-hundred-thirty-five firms acquired in the period 1970-1976. 2. Data from the same time span for three-hundred-twenty-three firms not acquired as of July, 1981. 3. Fifty firms acquired in 1979. 4. Eight-hundred-forty-five unacquired firms as a control group for data set 3.

This study addressed financial characteristics presuming a potential acquisition's attributes are reflected in its financial

statements.

This study incorporated financial information to three years preceding acquisition.

Twenty types of accounting information were used to calculate thirty-seven financial ratios for each firm in the first two samples. Those ratios were used to calculate three discriminant functions. Multivariate discriminant analysis (MDA), an acceptable statistical procedure for these applications was used.

Next, the number of ratios used in the discriminant functions was reduced, but attempts to reduce the number of ratios below thirteen impaired the models' ability to classify firms correctly.

All three models separated firms better than by an other process at high statistical levels of significance in the ex post tests.

Acquired firms tended to have greater than average operating income profitability ratios, but lower than average after-tax ratios. They were slightly more levered but, cash to interest expenses was more important than any of the leverage ratios. Liquidity and asset activity ratios were generally insignificant.

The MDA models were used ex-ante to predict merged firms from those fifty firms from Sample 3. Preliminary evidence suggests ratios cannot be used to predict mergers, however, prediction success rates are highest using financial information three years prior to a firm's acquisition.

Finally, equal sample sizes from Samples three and four produce high statistically significant positive results for the ex ante model.

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INTRODUCTION

The purpose of this study is to generate a set of models which will predict mergers. This will be accomplished using publicly available data to develop a financial profile of firms more likely to be acquired in subsequent time periods.

The financial profile will be developed using multi-variate discriminant analysis (MDA). In previous studies researchers have found that MDA provides better predictors for such events as bankruptcies, credit ratings, bond ratings, and mergers than the analysis of individual financial ratios analyzed sequentially, in other words, univariate analysis.

Throughout the history of mergers in the United States, share price premiums awarded to existing shareholders of the common stocks of target firms have been large, usually in excess of 25% [1,4,22].

In recent years that premium has increased particularly when a target firm has been the object of a bidding contest between two or more potential acquirers [51]. Moreover, a dramatic increase in the number of mergers has been occurring. Finally, the number of large firms, whether measured by sales or by total assets is increasing [51].

Because of the apparent contradiction between share premiums of acquisitions and the theoretical value of the firm, and because of the increased emphasis on corporate growth by acquisition in the last twenty years, it is appropriate to conduct a study of mergers. Any technique

able to predict mergers will be of great benefit to managements either as an investment aid in identifying potential acquisitions, or to assist a firm in exposing its weaknesses in sufficient time to correct the deficiencies and prepare a defense against its future acquisition. In the event that merger candidates can be identified prior to their share price appreciation, rewards to investors would be of considerable magnitude. Perhaps of as much importance such a predicting model would have implications for the existing literature on the semi-strong form of the efficient markets hypothesis. The ability to predict mergers would open the possibility of risk arbitrage and risk adjusted excess returns. Finally, models of this nature may be useful to regulators in anti-trust litigation because of the information provided regarding the capital structures, profit margins, and rates of return on equity or assets employed of both acquirers and acquisitions. Any contributions of this nature would in turn be of benefit to the public.

CHAPTER I

HYPOTHESES AND THEIR SIGNIFICANCE

This dissertation defines a set of ratios which is useful in identifying those firms most likely to be acquired at some future time.

Previous studies [118,135] have not always provided clear results. Different studies have produced contradicting sets of most important ratios.[1] Furthermore, the possibility may exist that the set of most predictive ratios can change over time, independent of economic factors.[2] One critic suggests the results of one test had substantially less financial significance than statistical signficance.[3]

Much of the literature and empirical work on mergers was done during the 1960s. Empirical studies were generally characterized by small sample sizes. There have also been changes in accounting rules regarding mergers. Acquiring firms, prior to the enactment of APB 15, were not required to calculate a fully diluted earnings per share reflecting the common stock equivalents (convertible preferred and convertible debentures) so commonly used in the 1960s to finance mergers. Lewellen,[4] Nielsen and Melicher[5] and others[6] believe that merger premiums and valuations have changed significantly in the ensuing years. Finally, it appears that with the exception of Singh's [20] study of mergers in the United Kingdom, no studies on industry

[1]Footnotes appear at the end of each chapter.

characteristics of acquired firms have been conducted. The pertinent questions are: 1. "Are there characteristics prevalent within certain industries which make them more susceptible to takeover?", and 2. "Can these characteristics be identified using this statistical methodology on financial ratios?"

The intent of this study is to provide timely insights into these issues and to resolve conflicts where possible. The methodology of this study extends the prior literature in that new data, much larger sample sizes, and new ratios are employed. From this, new evidence will develop as to which ratios are most important in predicting mergers, is there any continuity of a best set of ratios over different time spans, and finally, are there any identifiable industry characteristics?

Evidence from earlier literature, to be discussed in the next chapter, suggests that acquired firms are likely to have excess liquidity, unutilized debt capacity, possess favorable earnings prospects, and tend to be priced at lower levels relative to their book value per share, than are unacquired firms. Another null hypothesis in this study is that an MDA designed ratio analysis can not assist in the prediction of mergers.

Footnotes

Chapter I

1. For example consider the conflicting evidence as to the importance of price-earnings ratios and dividend payout percentages found in Michael Simkowitz and Robert Monroe, "A Discriminant Analysis Function For Conglomerate Targets," Southern Journal of Business (November, 1971): 13, and Donald L. Stevens, "Financial Characteristics of Merged Firms, A Multivariate Analysis," Journal of Financial and Quantitative Analysis 8 (March, 1973): 154.

2. Donald L. Stevens, "A Multivariate Analysis of Financial Characteristics of Acquired Firms in Industrial Mergers," (Ph.D. dissertation, Michigan State University, 1972): 116.

3. Robert J. Monroe, "Comment: Financial Characteristics of Merged Firms: A Multivariate Analysis," Journal of Financial and Quantitative Analysis 8 (March, 1973): 164.

4. Wilbur G. Lewellen, "A Pure Financial Rationale for the Conglomerate Merger," Journal of Finance 26 (May, 1971): 523.

5. James F. Nielsen and Ronald W. Melicher, "Financial Analysis of Acquisition and Merger Premiums," Journal of Financial and Quantitative Analysis 8 (March, 1973): 139, 146.

6. Three articles are of interest here. They are:
H. Kent Baker, Thomas O. Miller, and Brian J. Ramsparger, "An Inside Look at Corporate Mergers and Acquisitions," MSU Topics 29 (Winter, 1981): 49-57.

Lewis Beman, "What We Learned From The Great Merger Frenzy," Fortune, April, 1973, pp. 70-73, 144, 148-150.

"Ira Harris: Chicago's Big Dealmaker," Business Week, June 25, 1979, pp. 70-78.

CHAPTER II

THE THEORY UNDERLYING THE HYPOTHESES

There are no universally accepted reasons why firms acquire other firms. The reasons are not always obvious because desired objectives are often unfulfilled, or because the premium paid for the acquisition exceeded the desired gains.[1]

However, separating mergers according to general theories of mergers is useful in explaining the process. There are three motives for a merger most commonly described in the literature: [1, 3].

A. Managerial Theory[2]

This theory holds that

> . . . the interests of the stockholders are subordinated to the managers who control firms and who seek growth maximization which in turn maximizes the salaries and emoluments of managers. This managerial theory predicts that merger activity should have an unfavorable impact on the market values of the securities of acquiring firms.[3]

If the managerial theory has validity it has major ramifications in merger literature. Because of its importance an extensive review of the literature is provided in a later section of this chapter for each theory.

B. Monopolistic Theory

This theory predicts that either or both of the acquiring and acquired firms should benefit from mergers. Here the major issues are

whether the public is served economically and socially, and do the promised benefits accrue to both of the firms?

C. Efficiency Considerations and Synergy

Generally, any combination of assets producing a new firm whose value is greater than the sum of the values of the pre-merged firms produces a synergy, which may be attributable to any number of considerations including portfolio effects.

These considerations may be categorized as:

1. Operating Effects
2. Market Share Effects
3. Financial Effects
4. Conglomerate Effects

1. Operating effects

The most commonly cited motive is that a merger will produce a "fit" between two companies. An example might be two similar firms; the first has strong production capabilities; the second has strong research capabilities. The combination of the two firms produces a company strong in both areas, and hence potentially stronger than the sum of its parts.

Another operating effect involves the use of factors of production. For example, in manufacturing operations, larger firms produce longer, more efficient production, and increasing returns to scale.

While both of these examples are forms of horizontal mergers, operational efficiencies also are found in vertical mergers. Vertical mergers enable companies to acquire others at different levels in the distribution chain of a given industry. An example is an oil refinery

acquiring a chain of service stations, thereby extending its control over the flow of a product to the consumer.

Two other operational effects, management and tax considerations are included in Alberts' discussion of bargains which encourage merger activity. They are poor forecasts by existing management and inaccurate cost of capital measurements. Alberts argues the ability to use operational effects in bargaining may affect the price of the acquisition, particularly if the shares are thinly traded.[4]

Management bargains abound because, in the absence of any other information, firms are valued under the expectation that the existing management will remain in control. If the management of firm X is superior to the management of firm Y, then Y's efficiency should improve after it is acquired by X, which in fact was observed by Mandelker.[5] Copeland and Weston[6] and Lewellen[7] suggest that firms most likely to be identified as mismanagement bargains would be within the same industry, because managers there would be more capable of detecting less-than-full performance by the other firm's management. Mismanagement bargains are not restricted to horizontal mergers; in practice, they may be vertical or conglomerate mergers.

Two other operational effects are tax effects of mergers and the value of accumulated tax losses. With regard to the former:[8]

> One such tax consideration is to substitute capital gains taxes for ordinary income taxes by acquiring a growth firm with a small or no dividend payout and then selling it to recognize capital gains. Also, when the growth of a firm has slowed so that earnings retention cannot be justified to the Internal Revenue Service, an incentive for sale to another firm is created. Rather than pay out future earnings as dividends subject to the ordinary personal income tax, future earnings can be capitalized in a sale to another firm. Most substantial mergers are tax-free exchanges. Not only is a lower capital gains tax

applicable, but it is also postponed until the securities received in the tax-free exchange are liquidated for cash.

Once the assumptions of perfect capital markets are lifted, individuals or firms may have difficulty selling their tax losses in the marketplace.

> If losses are not salable in the market, then a merger allows a firm with substantial losses to benefit immediately from the loss (by cancelling the loss against the profits of a profitable firm with which the losing firm has merged).[9]

2. Market Share and Market Power Effects

These motives for mergers are not as clearly defensible as operating effects, for a number of reasons. Manne, in citing Supreme Court Rulings, questions any merger between competing firms, suggesting they are " . . . at least suspect and perhaps per se illegal. The latter result seems especially likely when one of the combining firms already occupies a substantial position in the relevant market."[10] He concedes an economic interpretation of the failing firm defense is that a firm's tendency toward bankruptcy suggests it is no longer a competitor. A failing firm defense of a merger is, " . . . a civilized alternative to bankruptcy . . . that transfers assets from falling to rising firms."[11]

The consensus of the courts and many economists is, " . . . there are no important economies of scale [that] can be attained through a [horizontal] merger which cannot be gained either by internal growth or, at worst, by a cartel, if that were legal."[12]

Furthermore:

> Takeovers of corporations are too expensive generally to make the 'purchase' of management compensation an attractive proposition. It is far more likely that a second kind of reward provides the primary motivation for most take-over attempts. The market price of shares does more than measure the price at which the normal compensation of executives can be sold to new individuals. Share price . . . measures the potential gain inherent in the common

> stock. The lower the stock price, relative to what it could be with more efficient management, the more attractive the takeover becomes . . . and the potential return from successful takeovers and revitalization of a poorly run company can be enormous. . . . we can see how . . . taking over control of badly run corporations is one of the most important 'get rich quick' opportunities in our economy today.[13]

3. Financial Effects of Mergers

a. Corporate Debt Capacity

The financial consideration most commonly cited for mergers involves the alteration of an acquiring firm's existing debt structure and the resulting reduced probability of bankruptcy. Lintner[14] found mergers beneficial for four reasons: (1) reduction of the lender's risk in bankruptcy losses, (2) reduction of scale diseconomies in credit investigations of what was formerly a smaller firm, (3) lowering flotation costs of public issues enhancing their marketability, and (4) producing combined larger issues of debt.[14]

Evidence exists that one of the most important factors influencing the quality of a bond rating is the size of the offering,[15] which provides some support for Lintner's fourth rationale for mergers. Concurring, Lewellen believed the increased size of the combined firm, in conjunction with a reduced joint probability of failure, would create additional debt capacity, and lower lenders' risks. The latter should result in lower interest rates, assuming that ratings agencies perceive the reduction in risk.[16]

Copeland and Weston attack Lewellen's logic:

> While reducing the unused debt capacity will increase the value of the firm, it has not been established that a merger is the necessary and only method capable of bringing about this method. The firm with the unused debt capacity is perfectly able to increase the amount of its borrowing without the merger.[17]

Replying to Copeland and Weston, Haley and Schall contend:

> If the merger reduces the variability (uncertainty) of firm cash flow, the newly merged firm may wish to raise its total debt above the total debt of the unmerged firms. The merged firm will set its debt at the level which maximizes firm value, and this level of debt will often be higher than the total debt of the premerger firms.[18]

Copeland and Weston also fail to discuss excessively leveraged firms. As Stevens indicates:

> . . . in the case of the acquiring firm with excess debt, the merger would lower financial risk and move the new firm in the direction of an optimum capital structure.[19]

b. Undervalued Assets - Tobin's q

Mergers are often undertaken because a potential acquirer believes the market misvalues the assets of a possible acquisition. The hypothesized misvaluation may be due to unusually large amounts of cash, unutilized debt capacity, or future cash inflows estimates perceived by the potential acquirer to be different than market estimates.

Ratios should assist the potential acquirer in the screening process to find those firms possessing the above attributes or any other quantitative attributes deemed to be important by the acquirer.

In the last few years more emphasis has been placed on the possibility of asset misvaluations. The misvaluation contention is that the acquirer will be unable to build new facilities, whether it be an asset or an entire company for a comparable price; that the market value of an acquisition is less than its replacement cost.

Any mergers study should address the misvaluation problem, and this study has done so, by testing thirty seven ratios assessing liquidity, leverage, asset management, and profitability. Included in those ratios in Tables 3-1 and 3-2 is fixed asset turnover which is

discussed in greater detail in Chapter 5. Another possible ratio for measuring misvalued assets, Tobin's q, was considered but not included. Because of its wide acceptance, the decision not to use that ratio should be explained.

To begin, valuation disequilibriums are illogical to financial theorists who believe the market pricing mechanism should restore an equilibrium to market values and replacement values. There are many reasons for a misvaluation of physical assets ranging from the obvious potential of obsolescence to the less obvious discount rate used to value the incremental cash flows of that asset by a host of potential acquirers possessing varying risk levels, to the range of values from going concern values to liquidating values. A theorist will contend the above three reasons ought to apply to equity share values as well, but will intuitively concede a misvaluation is more likely to exist in the appraisal of a partially depreciated physical asset than for an equity share actively traded in a secondary auction market. Such a potential misvaluation introduces the availability of risk adjusted excess returns to the arbitrageur.

James Tobin developed a ratio to measure the discrepancy between market values and reproduction values of assets which is now referred to as the q ratio. The numerator of his ratio is the market valuation, the prevailing market price for exchanging existing assets. His denominator is the replacement or reproduction cost, the market price for newly produced assets.[20]

Tobin believed that disequilibriums existed for more than brief time periods for two reasons: 1. in examples of improvements on real property a time lag exists because of construction time, and 2.

valuations of existing assets will be more volatile than for the price of reproductions.[21] However, ultimately the numerator and denominator will be brought into equilibrium. Indeed, a market value greater than replacement value provides an incentive to create more of the asset in pursuit of an economic profit which will persist until either market values fall, reproduction costs rise, or both.

The significance of q to the merger movement is not clear because its empirical test are inconclusive, in spite of the contentions of its advocates.

Throughout the 1960s, the ratio was greater than one, based on Tobin and Brainard's original empirical studies.[22] Q rose from 2.21 in 1960 to 2.54 in 1968, dropped to 2.12 in 1969, and plunged to 0.97 in 1974. Q levels higher than one are expected to stimulate investment and in response, the 1960s are now characterized as the decade of conglomerate mergers.

Tobin attributed the drop in q from 1973 to 1974 as being due to a spectacular rise in the discount rate applied to earnings brought about by tight anti-inflationary monetary policies rather than to declines in earnings.[23] The drop in the value of q also coincided with the end of the great merger era.

Q fell to .8 in 1974-75 and according to one researcher is now at .73 in spite of the record levels of merger activity.[24] If a high q is expected to stimulate investment and produces record levels of mergers, ought not we to expect an absence of mergers if q is at levels below 1, given the disincentive to invest?

According to Ciccolo, q levels less than one, accompanied by low prices of equities, make it cheaper for firms to acquire other firms,

invest in treasury bills, or increase cash dividends rather than make new capital investments.[25] He contends it is the low level of q currently that accounts for the record merger activity which began in the latter half of the 1970s. Ciccolo's theory does not explain the high q levels associated with the merger experience of the 1960s, nor does he define low stock prices or when they cease being "low."

Other empirical studies of q produce conflicting results. Von Furstenberg, Malkiel, and Watson [127] concluded q was a powerful influence on levels of investment. However, testing for q at the firm level, rather than in the aggregate, Chappel and Cheng produced contradictory results, generally as a function of the industry in which a company functioned.[26]

There also appears to be a measurement problem in quantifying q. Ciccolo calculated q to be 1.65 in 1965,[27] well below the 2.5 calculated by Tobin.[28] At the same time, the Council of Economic Advisers which also calculates q, determined its level to be 1.25.[29]

In 1974, Tobin calculated q to be 0.97,[30] Ciccolo calculated it to be 0.8,[31] and the Council of Economic Advisers determined q to be 0.663.[32]

Because Ciccolo contends that at any time span q levels vary from firm to firm, it would seem that care must be taken in selecting a "representative" sample.

Furthermore, the potential for misvaluation exists in spite of sample selection. Because Tobin and Brainard used a set of valuation assumptions, those assumptions have been followed in subsequent tests, doubtlessly to promote "comparability." Tobin's q ratio numerator, in empirical tests, is not the market value of assets, it is the market

value of the firm's common stock, preferred stock and long term debt. Ironically, the first step in the testing process to measure disequilibrium of asset values and stock values is to assume that they are in equilibrium. It is difficult to test for misvaluations by presuming there are none. Because the available data bases do not provide market values for bonds and preferred stocks, their market values must be estimated. Companies are assumed to have Baa twenty year maturity long term debt (Chappel and Cheng assumed twenty years, but matched yields according to ratings classes),[33] and their preferred stock is valued at the year end Standard and Poor index of preferred stock yield, regardless of the firm's risk level.[34] Those estimates do not seem critical however, when compared to the potential errors from estimations used in the denominator. The denominator, replacement cost, " . . . is the sum of the book values of common stock, preferred stock, and long term debt, connected by a common annual index of the ratio of replacement cost to book value."[35]

The replacement cost of assets is an attempt to adjust for depreciable assets at the rate of five percent per year as opposed to accounting depreciation. It is also to revalue inventories at replacement cost and adjust for inflation using the price deflator for the fixed investment component of GNP. Strangely, the category "other assets" is left at book value. Unfortunately, "other assets" includes many of the potential misvaluations, especially land and intangible assets.[36]

Perhaps most puzzling is Ciccolo's contention that individual firms have varying q ratios.[37] That implies varying degrees of disequilibrium at the firm level, and more specifically that those firms

are not being valued at the correct discount rate. Both investment professionals and the academic community must be interested in his perceptions of the correct discount rates for various firms.

To conclude, intuitively the prospect of some assets being misvalued by potential acquirers are more probable than for other assets. But empirical tests to date do not clearly demonstrate that entire firms are being valued incorrectly given their existing management and current economic states of nature.

c. Accounting Treatment of Mergers

The accounting treatment of mergers, which changed in the 1970's has probably lost its presumed significance.[38,39] A study conducted by Hong, Kaplan and Mandelker indicates the pooling-of-interest method of accounting for mergers did not lead to abnormal stock returns.[40] Furthermore, they contend that the efficient capital market should be able to see through the particular accounting convention used to describe a merger and respond to the "economies of the merger, not its accounting description."[41]

In a separate study, Mandelker found no evidence of accounting treatment of mergers influencing the profitability of a merger.[42]

Nevertheless, misconceptions persist. Ferguson and Popkin's recent article disregarded pre-merger price appreciation of target firms and the presence of negative risk adjusted excess returns accruing to acquirers in the post merger period, contending that existing accounting conventions for depreciation encouraged mergers.[43]

d. Price-Earnings Ratios

Mergers occurring in the 1960s were often "justified" by the expectation that a parent firm's price-earnings (p/e) ratio may

remain unchanged after it acquired a firm with a lower p/e, and presumed lower growth prospects. Such an acquisition, in theory, should depress the price-earnings ratio of the acquiring firm. The new price-earnings ratio should reflect this change in outlook for the growth of the combined firm. Aside from the more obvious defects in a price-earnings analysis (vis-a-vis the quality of earnings), it is the value of the combined firm, not its earnings, which is the relevant test.

* * * * * * * * * * * * * * * *

Some acquisitions have less economic suitability than others. It is those which are discussed next.

4. Conglomerate Merger Effects

Conglomerate mergers are defined as those mergers which lack any of the operational, market-share, or financial advantages previously discussed.

In the absence of those advantages, any two firms whose returns over time are less than perfectly positively correlated will benefit from diversification creating a superior risk adjusted investment due to the reduction of the costs of bankruptcy.

Levy and Sarnat observe:

> . . . diversification can be expected to produce a true economic gain owing to the fact that the combination of the financial resources of the two firms making up the merger reduces lenders' risk while combining each of the individual shares of the two companies in investors' portfolios does not.[44]

Most of the other reasons for conglomerate mergers are categorized as operating, management, or financial effects which are not exclusive to conglomerate mergers.

Alberts, in illustrating the reduction of risk, erroneously concluded investors could diversify their own portfolios. However, he

failed to consider bankruptcy costs.[45]

Haley and Schall concede that once bankruptcy costs are considered, " . . . there may be benefits from reducing financial distress costs as a consequence of the mergers."[46]

Rubinstein states:

> Bankruptcy penalties, . . . , create an incentive to merge since mergers almost invariably diminish the probability of bankruptcy.[47] Synergistic benefits could clearly cause the same project to have different marginal dollar returns and costs to different firms.[48]

Levy and Sarnat suggest:

> . . . mergers may create financial advantages. For example, large firms have better access to the capital markets and also enjoy significant cost savings when securing their financial needs.[49]

Logue and Naert advocate conglomerate mergers not only for the previously mentioned reasons but also because of an extension of the diversification argument, called the "resource allocation and resource utilization synergy."[50]

Haugen and Langetieg, in discussing synergy, observe that it:

> . . . may result because the merger makes possible entry into new product lines which change the level, stability and cyclical nature of the firm's profitability. Vertical combination may reduce the risk of fluctuations in the price and availability of raw materials. It is possible that management of the acquired firm is replaced by individuals who are more aggressive in nature. Merger may raise the profitability of a depressed firm in poor financial condition and significantly reduce the risk of bankruptcy. For the relatively small firm, it opens new sources of capital and it may also reduce the possibility of insolvency due to an unfavorable liquidity position. It may also significantly affect the volatility of the market value of their common stock. In any case . . . these factors should manifest themselves in a change in the distribution of rates of return to stockholders of the merged firm.[51]

a. Foreign Acquisitions

Another motive for mergers which might be categorized in a

conglomerate context is an extension of the risk reduction argument for diversification; the acquisition of foreign based assets to reduce further the systematic risk in a portfolio [24,36,82,115,122]. Such reduction of systematic risk is due to the less than perfect positive correlation of the respective asset returns. Aside from diversification benefits, there are additional risk reducing factors explaining this activity in the United States. Those factors include political instability and foreign exchange. "There exists a desire to shelter capital by moving it into the comparative safety of the United States."[52]

What is perceived as an increase in socialism in Europe[53] and in Canada[54] has made the United States appear to be one of the last bastions of a capitalist-oriented free enterprise system.[55] Regarding foreign exchange:

> Foreign buyers have special reasons of their own for playing the takeover game. With both the dollar and the stock market on the mat, U. S. companies look enchantingly cheap, even though their earnings are also in dollars.[56]

Carberry commented on the relative "cheapness" of U. S. corporations [40]. Regarding Real Estate Investment Trusts:

> In Europe there aren't as many properties available for investment; it takes longer to arrange financing, and most deals are done with at least 50% cash. An added allure for foreigners is the low value of the dollar relative to foreign currencies and the comparative security of investments in the United States.[57]

Rout also comments on foreign acquisitions of United States companies:

> The foreigners appetites for U. S. concerns have been whetted during the last two years by a variety of conditions, ranging from the weak U. S. dollar . . . The foreigners are cashing in on a combination of cheap companies and cheap dollars. . . . with the weak dollar has meant the U. S. companies are undervalued absolutely and even more so given the currencies of the acquirers.[58]

From an untitled article in a European publication came the following quotation: " . . . movements in exchange rates and recent rates of inflation have made the United States again a relatively low cost producing area . . . "[59]

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D. Literature Review - Managerial Theory

The Management Theory of Mergers led Mueller to explain abnormally low returns of firms during the post-merger period compared to the pre-merger period. He suggests that corporate management may be at cross purposes with the broad goals of the corporation in that while a corporation seeks maximization of the firm's value, managers often are compensated for their ability to produce asset expansion.

Managerial salaries, bonuses, stock options, and promotions all tend to be more closely related to the size or changes in size of the firm than to its profits.[60]

In one observation of mergers policy within A. H. Robbins, the acquisitions staff was split into teams. The head of one team wanted to find the acquisition so he could put another picture on his office wall to accompany pictures of other acquisitions for which he was responsible, according to a critic on one of the other acquisition teams.[61]

Mueller also contends that smaller growth oriented firms have higher marginal rates of return than do more mature firms.[62] A similar statement can be made about their marginal cost of capital. Furthermore, the investment opportunities of the mature firm, within its traditional business activities, are more restricted. Because of that, the schedule of marginal rates of return on investments is likely to

intersect well within the horizontal segment of its marginal cost-of-capital function.

If Mueller's contentions are correct, the results would have enormous ramifications in merger theory and in the valuation of acquisitions. His article produced several rebuttals and observations [84,3,73,86] as well as his subsequent reply [102].

Mueller's argument that mature firms have lower costs of capital drew criticism from Copeland and Weston:

> If the managers were making investment decisions using an investment hurdle rate below a market equilibrium rate and therefore below the alternative returns to stockholders, stockholders would shift their investment to firms offering higher rates of return. Basic capital market forces would not permit different firms to follow a 'two-tier' investment hurdle rate policy.[63]

The reconciliation of these views is reasonably simple. Mueller, in discussing conglomerates, seems to have missed the correct rationale for his own argument. Acquiring firms do not use lower discount rates in order to maximize growth rather than shareholder wealth. As Logue and Naert observed:

> . . . a firm . . . (holding a group of diversified assets with significant overall variance reducing covariance effects) will be able to establish a broader clientele of investors and thus because of the greater clientele, sell at a higher price.[64] . . . we would rather argue that a lower discount rate is used because of management's expectation of synergistic effects.[65]

However, it is Mueller's first contention--that firms maximize growth, not shareholder wealth maximization—that draws the most criticism.

Lewellen and Huntsman's study of fifty of the top ninety-four companies in the Fortune 500, from 1942-1963, regressed managerial compensation on profits and sales. Then to avoid debate over whether

profits maximization was the same as stockholder wealth maximization, they ran a second regression replacing profits with market value of equity. In both instances, the regressions produced high coefficients of determination. The coefficient of sales was insignificant in both regressions, and coefficients of both profits and market value of equity were large in their respective regressions.[66]

Haley and Schall devoted an entire chapter to the concept that firm objectives, in imperfect markets, might produce conditions where firm-value maximization is inconsistent with shareholder-wealth maximization. The most likely of the two causes for divergence exists if a firm adopts investments which change the risk of the firm's outstanding bonds.[67]

> If management pursues policies that maximize the total value of the firm's securities, under some circumstances those policies may result in lower values for the firm's shares, but higher values for the firm's debt [bonds].[68]

The second cause for a divergence is less likely. Here, the firm issues new bonds which are not of a lower priority than the old bonds. It ignores corporate taxes, relies heavily upon perfect capital markets, and assumes that the firm's value will not change, regardless of its debt-equity ratio.[69]

Regarding managerial compensation, Gort contends, " . . . merge frequencies vary greatly among industries [and are] highly concentrated in some industries."[70] He continues:

> . . . if mergers are a consequence of the personal ambitions of managers to manage large firms, why is it, then, unless ambitious men tend to exist in certain industries, that you have concentrations of merger activity within certain industries?[71]

Still the case that firms maximize shareholder wealth is not

universally clear, according to Conn and Nielsen,[72] as well as others. Reid, in his book on mergers, discusses several studies which contend otherwise.[73] Those studies reviewed include Baumol's study which states:

> Indeed, in talking to business executives one may easily come to believe that the growth of the firm is the main preoccupation of top management.[74] . . . management's goal may well be to maximize 'sales' [total revenue] subject to a profit constraint.[75]

A subsequent test by McGuire, et. al., studied correlations between executive incomes, sales, and profits of 45 of the largest 100 industrial corporations from 1953-1959. The results indicated:

> . . . the evidence presented would seem to support the likelihood that there is a valid relationship between sales and executive incomes but not between profits and executive incomes.[76]

In another study, Roberts concluded the relationship between sales and executive compensation appeared to be stronger than the relationship between compensation and profits.[77]

Patton studied 420 companies in the period 1953-1964 and determined that company size was the chief determinant of top executive pay.[78] Additionally:

> Since sales growth is such an important variable in determining top management income, there is a basis for conflict between the personal interests of top management and the interests of shareholders."[79]

Manne has created such a scenario:

> Generally speaking, managers' incentives and interests coincide with their shareholders in every particular except one: They have no incentives as managers to keep management services for the company at the lowest possible price. To the extent that the same individuals are also shareholders, their motivation will reflect a conflict. Even if the market for corporate control is working perfectly, so long as the cost to the corporation of the incumbent manager's inefficiency is below the cost to an outsider of taking over control, the

> insiders will remain secure in the positions with high salaries. This may furnish some proof for the notion that executive compensation is a function of size.[80]

Dean and Smith are very critical of the Baumol and the McGuire, Chiu and Elbing studies. Regarding Baumol, they criticize his "uncritical acceptance" of executive interviews and their public statements that "growth has a new and independent status."[81] Dean and Smith assert that "in a time that values growth, annual reports and other corporate utterances will stress anything that can be used to show that the firm is in progressive alliance with the trend of the times."[82]

They also criticized the McGuire, Chiu, and Elbing study addressing the lack of standard definitions of management and compensation to mean the same thing for different size and industry groups.[83] Also:

> The management job is in part the efficient administration of a collection of assets; and the profitability of these assets, especially in the short run, will usually be determined far more by externals than by the special contributions of a current management."[84]

Much of the preceding was based on manager activities in the 1950s and 1960s. Ehrbar, in what may be indicative of different circumstances, discusses merger activity in the 1970s. He indicates shareholders have been suing directors for neglecting fiduciary duties.[85]

> Gerber's board is being sued by shareholders who believe they should have been the ones to accept or reject Anderson Clayton's offer last year. Courts historically have been hesitant to second-guess a board of directors, but Gerber's shareholders have a chance of winning their suit. The board spurred a friendly feeler from Unilever while it was fighting Anderson Clayton; the directors' motives seemed to be to keep the company independent rather than get the best possible deal for shareholders.[86] Similarly,

> Universal Leaf is being sued for thwarting Congoleum's offer, and Marshall Field is being sued over its successful defense of Carter Hawley Hale's takeover attempt. However the suits are decided, the prospect of having to answer shareholders in court has already begun to influence the behavior of outside directors.[87]

Such legal actions reinforce Manne's contention that mergers or a threat of takeover by more efficient management acts as an incentive for inefficient managers.[88]

* * * * * * * * * * * * * * * *

E. Literature Review - Shareholder Returns

Firms are acquired on the theoretical grounds of a "fit." The question is whether or not the acquisition produced the desired synergistic effect.

Dodd and Ruback assert:

> The effect of mergers upon the value of the firm has been a contentious issue in the literature and empirical investigations have presented conflicting results. Many of these studies made use of questionable methodologies and their results are neither consistent nor reliable.[89]

Most studies of post-merger returns behavior of the acquiring firm suggest that returns are normal or less than normal in the post-merger period and any gains accrue to shareholders of the acquired firms.

Mandelker's study is cited here because it is one of the more recent studies (1974), and uses the two factor market model [87]. He concludes that the acquiring firm's monthly returns are normal in the post-merger period and shareholders earn abnormal returns of approximately 14% on the average in the seven months preceding the merger.[90]

Dodd and Ruback contend that Mandelker did not consider what may be an important consideration in measuring any potential abnormal

returns to stockholders of acquiring firms.

> Mandelker reports that shareholders of acquired firms earn abnormal positive returns over the seven months before the merger month. If the mergers in his sample are preceded on average by a tender offer or similar announcement, the premerger gains could reflect the market reaction to the earlier release of this information.[91]

Using tender offer dates, Dodd and Ruback discovered:

> . . . in the month of the announcement, target firm stockholders earn large and significant abnormal returns of 20.58 percent for successful offers. . . .[92]

The paper also contains the first empirical assessment of the market reaction to unsuccessful takeover attempts. The stockholders of bidding firms which initiate unsuccessful tender offers neither gain nor lose--they earn normal returns in the offer period. Unsuccessful target firms, however, earn large significant positive abnormal returns of 18.96 percent in the month the offer is announced. Furthermore, the price change is permanent since they earn normal returns for five years after the offer.[93]

Mandelker does not indicate what percent of his sample experienced prior tender offers, but the potential for a bias exists. There probably are many more tender offers now than there were prior to Mandelker's study.

According to Ehrbar, in his discussion of recent characteristics of mergers:

> The current takeover wave got started in 1974 [the year Mandelker's dissertation was published], and has been building ever since. More and more of the takeovers seem to be hostile, i.e., opposed by the target's management.[94]

Ehrbar asserts that the targets are a lot larger in asset size than they used to be [95] and "Most important the bidders have been paying

higher premiums than ever."[96] Historically, according to Benjamin Graham, tender offers have been made at prices averaging around 20-50% above the market value of the target stock prices.[97] Merjos, in her study (1977), found premiums to be 40-50%.[98]

> Recently the premiums have been averaging more than 60%, and the contested deals have been even hotter. The average premium in the ten $100 million-plus contests last year was more than 80%. In a few cases the raiders paid more than double the market value.[99]

How can there be such a disparity between existing prices and either tender offer prices, or merger prices? Is there any evidence in the literature indicating that those premiums were warranted? Most studies conclude that the gains, if any, generally accrue to the shareholders of the acquired firm. The existence of positive postmerger gains accruing to shareholders of acquiring firms is less certain.

Conn and Nielsen, in an empirical study of an earlier model by Larson and Gonedes (L-G) [77] found a significant number of mergers resulted in losses to both acquirer and acquired firms.[100] However, the wealth loss was much greater for acquiring firms than acquired. "Rarely did the acquiring firm's stockholders gain while the acquired firm's stockholders lost."[101] Regarding the interests of the shareholders, " . . . at least 40% of the mergers [in their study] do not conform to the rationality assumption that the bargaining process is constrained by each firm maintaining at least its stockholders' wealth status in the period of the merger."[102] One flaw acknowledged by the authors in the study is that the L-G model made no provision for the possible change in the risk-return profile of the merger participants.[103] As the authors contend, "If a merger results in reduction of systematic risk that is unobtainable for existing stockholders . . . their risk return position

may actually improve even if return declines.[104]

Dodd [1976], in a study of Australian equities, found shareholders of companies receiving takeover offers benefited whether or not the acquisition was completed.*

> Irrespective of the outcome, [those] shareholders earned gains. . . .[105] On the other hand, shareholders of acquiring firms suffered significant losses after takeovers. It appears that any gains arising from the merger were won by the acquired firms at the expense of the acquiring firms.[106]

In a more recent study of NYSE firms in the 1970s, Dodd (1980) found results similar to those of his Australian study. Here the acquired firm earns returns of 13%, and the non-acquired firm earns almost 11%, even though their management vetoed the proposed takeover. If the potential acquirer called off the merger, prices returned to previous levels. Finally, losses of 7% accrued to stockholders of successful bidders in the post-merger period.[107]

Lev and Mandelker (LM), using a paired comparison sample and annual returns, concluded (1) there is no evidence of risk reduction from mergers and (2) the acquisition produced a decrease in the growth rate in the post-merger period, relative to non-merging firms, which he referred to as a "digestion effect."[108]

Other results in the study indicated there were no tax effects, and no evidence of accounting treatment of mergers influencing the profitability of merger. Instead the accounting treatments tended to

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*This paper also provides a fifty year summary of merger studies in the United States beginning with Dewing's study.

Dewing, Arthur S., "A Statistical Test of the Success of Consolidations." Quarterly Journal of Economics 36 (1921): 84-121.

understate the profitability of mergers.[109] Because of the use of annual returns, their study " . . . did not investigate short run effects."[110]

Both Reid (1975) and Honeycutt criticized the EM study. Reid because, "42% of the non-merger's [control group] had as many or more mergers . . . than the acquiring firms.[111] Honeycutt argues that an acquisition would change the primary industry classification of the acquiring firm, while the control firm would not change, reducing the value of a paired comparison.[112]

In another study, Reid found that companies growing internally grew at a rate of 60% versus 30% for companies actively involved in mergers during the period 1951-1961. His study involved 478 of the nation's largest corporations.[113] He attributed this finding to the substantial premiums over market value paid for assets acquired.[114]

Halpern concluded, in a study of mergers between large and small firms, that adjusted gains were positive to both groups and divided evenly.[115] His study of 78 mergers in the period 1950-1965 did not include firms actively acquiring other firms, nor did he make any attempt to separate buyers from sellers.

> . . . this distinction [separating buyers from sellers] is arbitrary and has no economic justification. Since we do not know which company initiated the merger negotiations, it is possible that it is the seller taking over the buyer.[116]

He also disregarded diversification arguments, citing investor diversification and attributed the positive gains to good "fits."[117]

Haugen and Langetieg studied 59 mergers in the period 1951-1958, using a 72 month time series and concluded:

> . . . a merger fails to produce economically significant changes in the distribution of rates of return to the stockholder. Our attention centers on the risk attributes

> of the distribution, and we do not address dollar benefits of combination which are capitalized in the stock price with the announcement and subsequent consummation of the combination.[118]

Hogarty studying 43 mergers in the period 1953-1964 were " . . . judged unsuccessful" to the acquirer using annual returns.[119] But, a few " . . . obtain very large returns, and the prospect of these large returns tempts other firms to engage in merger activity."[120]

In Langetieg's comprehensive three factor model (a zero beta with an industry factor and a matched non-merging control group) using monthly data seventy two months before and after a merger of 149 mergers, he observed returns of 12.92% to the acquired stockholders over the interval 6 months to 1 month prior to a merger. These results replicate Mandelker's study [87]. Regarding shareholders of acquiring firms, Langetieg found positive pre-merger returns:

> However, the gain is clearly too small to conclude that enhancements of stockholder welfare is the sole motive for merger. . . . perhaps another motive . . . managerial welfare may have been the instrumental cause of the merger.[121]

One empirical study supports the managerial motive. The explanation is the difference in risk perception of managers and stockholders. Stockholders can diversify asset portfolios, but managers do not have portfolios of employers. Managers may acquire firms not to enhance profits but rather to make the firm less risky, making jobs more stable.[122]

Melicher and Harter found that prices of acquiring companies are "bid-up" before rather than after merger benefits, especially when the acquired company was more than 1/2 the size of the acquiring company, [measured by total assets]."[123]

Nielsen and Melicher found no support for " . . . instantaneous or real financial synergy."[124] When financial gains were obtained, it occurred in instances where acquiring firms were able to pay below premiums for their acquisitions.[125] Bradley's study of one-hundred sixty one successful tender offers produced " . . . compelling evidence for a synergy theory of tender offers."[126] Perhaps Bradley's results are contradicted though by the initial experiences of tendering stockholders from thirty firms which experienced sizeable share price reductions in the post-tender period 1969-1970.[127]

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F. Conclusion

The evidence generally indicates that market price appreciation of merged firms takes place seven to thirty months prior to the event. The gains going primarily to the acquired firms suggests little support for the monopoly theories since there was rarely evidence that both parties profited. One recent article contends that as many as seventy percent of all mergers are unsuccessful [110].

Some evidence exists to support the managerial theory, that there is a conflict between shareholders and management. Weston and Rice [130] among others, conclude:

> The inefficient utilization of economic resources by the prior management leads to their being acquired by firms with a prior record of above average performance. Hence the evidence leans in the direction of efficiency and/or synergy as the explanation . . .[128]

One survey of one hundred seventy five chief financial officers involved in 1978 mergers indicated their perception was the horizontal mergers were more successful than vertical or conglomerate mergers.[129]

The fact that the acquisitions have had "subnormal" performance previous to the merger coupled with the efficiency explanation provides the incentive to determine that such subpar performance will be reflected in the firm's financial statements.[130]

To summarize this chapter, it was necessary to discuss the theories of mergers as motives appearing in the literature, as well as other motives advanced by both arbitrageurs and by mergers staffs. By understanding the motives for mergers, it may become possible to predict them. If firms are acquired because of their financial characteristics, such characteristics should be reflected in the financial statements of the acquired firm.

The purpose of this study is to generate three models which use financial ratios to predict mergers.

In the next chapter, various ratios are examined which purportedly measure incentives for mergers and hence provide predictive content.

Chapter II

Footnotes

1. See: "Asset Redeployment: Everything Is For Sale Now," Business Week, 24 August 1981, p. 71, for a discussion of incorrect future discount rate to be used on forecasted future cash inflows.

   See: William M. Carley, "Airline Service Breakdown Persists Long After Pan Am, National Merge," Wall Street Journal, 10 March 1981, p. 25.

   > "During one November week, 154,000 calls weren't answered. 'We'll never know how much revenue we lost.' says William Waltrip, executive vice president of Pan Am."
   >
   > "In buying National, Pan Am got four DC10s it didn't need, and hasn't been able to sell them because of a glut of used aircraft on the market. Pan Am also has a brand new $45 million DC10 sitting on the ground at the McDonnell Douglas plant near Los Angeles. The plane, which isn't needed now, had been ordered by National."

   Also, see: Thomas Petzinger, "To Win a Bidding War Doesn't Ensure Success of Merged Companies." Wall Street Journal, 1 September 1981, pp. 1, 12.

2. J. Fred Weston and Edward M. Rice, "Discussion," Journal of Finance 31 (May, 1976): 745.

3. Ibid.

4. W. W. Alberts and J. E. Segall, The Corporate Merger (Chicago: University of Chicago Press, 1966), p. 276.

5. Gershon Mandelker, "Risk and Return: The Case of the Merging Firms," Journal of Financial Economics 1 (December, 1974): 305.

6. Thomas E. Copeland and J. Fred Weston, Financial Theory and Corporate Policy (Menlo Park: Addison Wesley, 1979): 423.

7. Wilbur G. Lewellen, "A Pure Financial Rationale for the Conglomerate Merger,: Journal of Finance 26 (May, 1971): 522.

8. Copeland and Weston, p. 423.

9. Charles W. Haley and Lawrence D. Schall, The Theory of Financial

Decisions, 2nd ed. (New York: McGraw Hill Book Company, 1979): 447.

10. Henry G. Manne, "Mergers and the Market for Corporate Control," Journal of Political Economy 73 (April, 1965): 110.

11. Ibid, p. 111.

12. Ibid.

13. Ibid, p. 113.

14. John Lintner, "Expectations, Mergers and Equilibrium in Purely Competitive Securities Markets," American Economic Review 61 (May, 1971): 110.

15. George Pinches and Kent A. Mingo, "A Multivariate Analysis of Industrial Bond Ratings," Journal of Finance 28 (March, 1973): 15.

16. Lewellen, "A Pure Financial Rationale," p. 522.

17. Copeland and Weston, p. 426.

18. Haley and Schall, p. 446.

19. Donald Lee Stevens, "A Multivariate Analysis of Financial Characteristics of Acquired Firms in Industrial Mergers" (Ph.D. dissertation, Michigan State University, 1972), p. 19.

20. James Tobin and William C. Brainard, "Asset Markets and the Cost of Capital," Cowles Foundation Paper No. 440 (New Haven: Cowles Foundation for Research in Economics at Yale University, 1977): 235.

21. Ibid, pp. 236-237.

22. Ibid, pp. 254-255.

23. Ibid, p. 262.

24. Seymour Zucker, "The Q-Ratio: Fuel for the Merger Mania," Business Week, 24 August 1981, p. 30.

25. Ibid.

26. Henry W. Chappell, Jr. and David C. Cheng, "Expectations, Tobin's q and Investment: A Note," Journal of Finance 37 (March, 1982): 231.

27. Zucker, p. 30.

28. Tobin and Brainard, p. 254.

29. Adam Meyerson, "Merger Mania and the High Takeover Premiums," Wall Street Journal, 20 July 1981, p. 14.

30. Tobin and Brainard, p. 254.

31. Zucker, p. 30.

32. Meyerson, p. 14.

33. Chappell and Cheng, p. 232.

34. Tobin and Brainard, p. 249.

35. Ibid.

36. Chappell and Cheng, p. 233.

37. Zucker, p. 30.

38. Lewellen among others believed some investors were deceived by misvaluations of mergers in the 1960s. See Lewellen, pp. 522-523.

39. Baker, et al, believe that more conservative accounting resulting from the passage of APB 16 and 17, coupled with other factors reduced merger activity but fostered more soundly conceived mergers. See: H. Kent Baker, Thomas O. Miller, and Brian J. Ramsparger, "An Inside Look at Corporate Mergers and Acquisitions," MSU Topics 29 (Winter, 1981): 49.

40. Hai Hong, Robert S. Kaplan, and Gershon Mandelker, "Pooling vs. Purchase: The Effects of Accounting for Mergers on Stock Prices," The Accounting Review 53 (January, 1978): 44.

41. Ibid, p. 31.

42. Mandelker, pp. 307, 330.

43. Robert Ferguson and Phillip Popkin, "Pulling Rabbits Out of Hats in the Oil Business - and Elsewhere," Financial Analysts Journal 38 (March-April, 1982): 25.

44. Heim Levy and Marshall Sarnatt, "Diversification, Portfolio Analysis and the Uneasy Case for Conglomerate Mergers," Journal of Finance 25 (September, 1970): 801.

45. Alberts and Segall, pp. 262-272.

46. Haley and Schall, p. 446.

47. Mark E. Rubinstein, A Mean-Variance Synthesis of Corporate Financial Theory. ed. Stewart C. Myers, Modern Developments in Corporate Financial Theory (New York: Praeger Publishers, 1976), p. 47.

48. Ibid, p. 51.

49. Levy and Sarnatt, "Diversification, Portfolio Analysis," p. 801.

50. Dennis E. Logue and Phillippe A. Naert, "A Theory of Conglomerate Mergers: Comment and Extension," Quarterly Journal of Economics 87 (November, 1970): 665-666.

51. Robert A. Haugen and Terrence C. Langetieg, "An Empirical Test for Synergism in Merger," Journal of Finance 30 (September, 1975): 1004.

52. Lawrence Rout, "Buying American: Weak Dollar, Stocks Spur Foreigners to Seek Acquisitions In The United States," Wall Street Journal 21 August 1979, p. 1.

53. "The Great Takeover Binge," Business Week, 14 November 1977: 178-179.

54. "A Financial Empire In The Making," Business Week, 9 March 1981: 87.

55. "Market Commentary: Mergers and Acquisitions - How To Buy An American Company," Euromoney, November, 1976, p. 141.

56. A. F. Ehrbar, "Corporate Takeovers Are Here to Stay," Fortune, 8 May 1978: 91.

57. James Carberry, "Many REITs Stage Comeback, Aided By An Attraction of Foreign Investors," Wall Street Journal, 6 August 1979, p. 6.

58. Rout, p. 1.

59. "Market Commentary," Euromoney, p. 141.

60. Dennis C. Mueller, "A Theory of Conglomerate Mergers," Quarterly Journal of Economics 83 (November, 1969): 644.

61. Victor Zonana, "Planning A Plant: How A. H. Robins Co. Made Decision to Build a Chemical Facility," Wall Street Journal, 22 October 1975, p. 1.

62. Mueller, pp. 646-647.

63. Copeland and Weston, p. 429.

64. Logue and Naert, p. 664. 65. Ibid, p. 665.

66. Wilbur G. Lewellen and Elaine Huntsman, "Managerial Pay and Corporate Performance," American Economic Review 60 (September, 1970): 711-716.

67. Haley and Schall, p. 478.

68. Ibid, p. 482. 69. Ibid, p. 478.

70. Michael Gort, "An Economic Disturbance Theory of Mergers," Quarterly Journal of Economics 83 (November, 1969): 625.

71. Ibid.

72. R. L. Conn and J. F. Nielsen, "An Empirical Test of the Larson-Gonedes Exchange Ratio Determination Model," Journal of Finance 32 (June, 1977): 754-756.

73. Samuel Richardson Reid, Mergers, Managers, and the Economy (New York: McGraw-Hill Book Company, 1968): 135.

74. William J. Baumol, "On the Theory of the Expansion of the Firm," American Economic Review 52 (December, 1962): 1078.

75. Ibid, p. 1085.

76. Joseph W. McGuire, John S. Y. Chiu, and Alvas O. Elbing, "Executive Incomes, Sales, and Profits," American Economic Review 52 (September, 1962): 760.

77. D. R. Roberts, Executive Compensation (New York: The Free Press of Glencoe, 1959).

78. Arch Patton, "Deterioration In Top Executive Pay," Harvard Business Review 43 (November-December, 1975): 106.

79. Ibid, p. 113.

80. Henry G. Manne, "Mergers and the Market for Corporate Control," Journal of Political Economy 73 (April, 1965): 117.

81. Joel Dean and Winfield Smith, The Relationships Between Profitability and Size, ed. W. W. Alberts and J. E. Segall, The Corporate Merger (Chicago: University of Chicago Press, 1966): 8.

82. Ibid.

83. Ibid, p. 7.

84. Ibid.

85. A. F. Ehrbar, "Corporate Takeovers Are Here to Stay," Fortune, 8 May 1978, p. 96.

86. Ibid.

87. Ibid.

88. Manne, p. 113.

89. Peter Dodd and Richard Ruback, "Tender Offers and Stockholder Returns, An Empirical Analysis," Journal of Financial Economics 5 (December, 1977): 351.

90. Mandelker, p. 303.

91. Dodd and Ruback, P. 352.

92. Ibid.

93. Ibid.

94. Ehrbar, p. 91.

95. Ibid. Also, while there are not nearly as many mergers created in the 1970s, the dollar value of the latter are almost equal to that of the former. See "The Great Takeover Binge," p. 176.

96. Ehrbar, p. 91.

97. Ibid.

98. Anna Merjos, "Takeover Targets," Barrons, 15 May 1978, p. 14.

99. Ehrbar, p. 91.

100. Conn and Nielsen, pp. 755-756.

101. Ibid, p. 755.

102. Ibid, p. 754.

103. Ibid, p. 758.

104. Ibid.

105. Peter Dodd, "Company Takeovers and the Australian Equity Market," Australian Journal of Management 1 (October, 1976): 24.

106. Ibid.

107. Idem, "Merger Proposals, Management Discretion, and Stockholder Wealth," Journal of Financial Economics 8 (March, 1980): 105.

108. Baruch Lev and Gershon Mandelker, "The Microeconomic Consequences of Corporate Mergers," Journal of Business 45 (January, 1972): 97.

109. Ibid, p. 102.

110. Ibid, p. 103.

111. Samuel Richardson Reid, "The Microeconomic Consequences of Corporate Mergers: Comment," Journal of Business 48 (April, 1975): 280.

112. T. Crawford Honeycutt, "The Microeconomic Consequences of Corporate Mergers: A Comment," Journal of Business 48 (April, 1975): 267.

113. "Growing From Within May Pay Off Faster," Business Week, 17 September, 1966, p. 44.

114. Ibid, p. 46.

115. Paul J. Halpern, "Empirical Estimates of the Amount and Distribution Gains to Companies in Mergers," Journal of Business 46 (October 1973): 570.

116. Ibid, p. 557.

117. Ibid, p. 573.

118. Haugen and Langetieg, p. 1003.

119. Thomas F. Hogarty, "The Profitability of Corporate Mergers," Journal of Business 43 (July, 1970): 322.

120. Ibid, p. 326.

121. Terence Langetieg, "An Application of a Three-Factor Performance Index to Measure Stockholder Gains From Merger," Journal of Financial Economics 6 (December, 1978): 382.

122. Yakov Amihud and Baruch Lev, "Risk Reduction as a Managerial Motive for Conglomerate Mergers," The Bell Journal of Economics 12 (Autumn, 1981): 606.

123. Ronald W. Melicher and Thomas R. Harter, "Abstract: Stock Price Movements of Firms Engaging in Large Acquisitions," Journal of Financial and Quantitative Analysis 7 (March, 1972): 1474.

124. James F. Nielsen and Ronald W. Melicher, "A Financial Analysis of Acquisition and Merger Premiums," Journal of Financial and Quantitative Analysis 8 (March, 1973): 146.

125. Ibid.

126. Michael Bradley, "Interfirm Tender Offers and the Market for Corporate Control," Journal of Business 40 (October, 1980): 346.

127. "The Morning After - Most of the Stockholders Who Accepted Those Fancy Tender Offers Now Have Reason to Regret Their Taste," Forbes, 1 February 1970, pp. 15-16.

128. Weston and Rice, p. 746.

129. Baker, Miller,and Ramsparger, p. 56.

130. Stanley Block, "The Merger Impact on Stock Price Movements," MSU Business Topics 17 (Spring, 1969): 11.

CHAPTER III

The Plan of Research

A. Rationale for the Use of Financial Ratios

Analysts find financial ratios to be appealing for several reasons. 1) Financial information is publicly available for analysis of publicly traded corporations because of Federal security disclosure regulations. 2) Financial ratios provide measurements of a firm's growth in earnings and asset size, debt capacity, efficiency, and dividend policy. 3) Ratios compare a given firm's performance within an industry, or to firms within other industries because the ratios are designed to provide comparability by relating the above attributes to the size of the firm measured by sales, earnings, asset size, or number of shares of common stock outstanding. 4) Numerous investment advisory services rely extensively upon various financial ratios.

Given that financial ratios are popular, widely used, and readily available, how successful are they as an analytic device?

In appraising ratio usefulness to investors, O'Connor found that univariate ratio analysis would not be useful in differentiating between common stocks primarily because of the semi-strong form of the efficient markets pricing mechanism. " . . . even on a multivariate basis ratios might be found to be of questionable usefulness in the prediction of return rankings for common stocks."[1]

Beaver believes the evidence "overwhelmingly" suggests a difference in the ratios of failed and non-failed firms,[2] that the ratios can be useful in the prediction of failure for at least five years before the failure,[3] and that the most commonly used ratios would possess little utility because they are most often manipulated by management.[4] Beaver also suspects that a multi-ratio analysis can predict better than the single ratios, but his results did not verify that hypothesis.[5] Neter criticized Beaver's sample design suggesting that the non-failed firms sample be as large as possible for more precise information.[6]

Horrigan contended that, regarding bond ratings, "ratios are not likely to be efficient predictors of dependent variables which shift in a random pattern over time such as stock market prices, because the financial ratios tend to be highly correlated over time.[7] However, he did conclude that the general approach ought to be that of a multiple regression, rather than a univariate analysis, and that accounting data and financial ratios have been found to be useful for determination of corporate-bond ratings. The multivariate approach used by Pinches and Mingo [111] in their bond rating study provided further support for his conclusion.

Lev [13] has cautioned users of financial ratios in the application of financial ratios. Summarizing these limitations he cautions against univariate analysis, misaveraging ratios, misinterpreting ratio changes, and other faulty uses of percentages.

The conclusion is that it seems the use of multivariate discriminant analysis on financial ratios provides better results in terms of predictive abilities than presumed. There are explanations for

this, which are discussed in part C of this chapter.

B. Ratios Included in This Study

The purposes of this section of the paper are threefold: 1) review financial ratios used in the previous studies by S[illegible], Stevens, and Belkaoui; 2) present an additional set of ratios; and 3) discuss their expected importance in light of the preceding discussion of the theory of mergers.

Table 3-1

Ratios Studied

	Financial Ratio	Ratio	Author Employing
Profitability	FR1	Earnings Before Interest and taxes / Total Assets	S
	FR2	Cross Profits / Sales	S
	FR3	Earnings Before Interest and Taxes / Sales	S
	FR4	Net Income / Sales	S
	FR5	Earnings Before Taxes /Sales	S
	FR6	Net Income / Stockholders Equity	B,S
	FR7	Net Income / Total Assets	B,S
	FR18	Cash Flow / Net Worth	B
	FR19	Cash Flow / Total Assets	B
Leverage:	FR8	Long Term Debt / Market Value Common Equity	S
	FR9	Long Term Debt / Book Value Common Equity	
	FR10	Long Term Debt / Total Assets	S
	FR11	Total Liabilities / Total Assets	S
	FR20	Long Term Debt + Preferred Stock / Total Assets	B
Activity:	FR12	Sales / Total Assets	S
	FR13	Cost of Goods Sold / Inventory	S
	FR14	Sales / Quick Current Assets	S
Other:	FR15	Interest Expense / Cash Plus Marketable Securities	S
	FR16	Dividend Payout Percentage	SM,S
	FR17	Price / Earnings Ratio	SM,S

	FR21	Total Assets	
Liquidity:	FR22	Current Assets / Total Assets	B
	FR23	Cash / Total Assets	B
	FR24	Net Working Capital / Total Assets	B,S
	FR25	Quick Current Assets / Current Assets	B
	FR26	Current Ratio	B
	FR27	Acid Test Ratio	B
	FR28	Cash / Current Liabilities	B
	FR29	Current Assets / Sales	B
	FR30	Quick Current Assets / Sales	B
	FR31	Net Working Capital / Sales	B,S*

*The capital letter indicates which of the authors discussed used these ratios. B indicates the Belkaoui Study, SM indicates the Simkowitz-Monroe Study, and S indicates Stevens ratios used in his dissertation, published article, or in both.

The above ratios were selected because of their popularity in the literature. Quoting Belkaoui:[8]

> They represent the 'traditional' categories in ratio analysis: balance sheet ratios . . . income statement ratios . . . , and mixed ratios.
> . . . their possible relevance to the takeover phenomenon; . . . [and]
> . . . their appearance in the literature as indicators of the ability of a firm to avoid takeovers.

Additionally one other set of ratios is introduced. That set includes five ratios which examine specific attributes on a per share basis relative to the year-end closing price of the firm's common stock. The closing price is incorporated into the ratio because the price of the common stock should influence the likelihood of the acquisition of a company. Those ratios are illustrated in Table 3-2.

The sixth ratio, sales to fixed assets, reflects the impact of companies contending it is cheaper to buy existing assets than to build new assets.

Table 3-2

Additional Ratios Studied

FR32	Closing Price / Book Value Per Share
FR33	Closing Price / Cash Per Share
FR34	Closing Price / Net Working Capital Per Share
FR35	Closing Price / Quick Net Working Capital Per Share
FR36	Tax Loss Carry Forward Per Share / Closing Price
FR37	Sales / Net Fixed Assets

* * * * * * * * * * * * * * * *

C. Rationale for the Use of Discriminant Functions

There is substantial precedence for the methodology employed in the present study. Multivariate discriminant analysis (MDA hereafter) was first employed by the scientists Fisher [56] for taxonomic uses and Barnard [31] in measuring Egyptian skull sizes. The first financial application was by Durand [48] to differentiate between "good" and "bad" consumer loan applicants. Walter [128] classified firms into high and low price earnings ratio groups. Myers and Forgy [103] developed a numerical credit evaluation system. Smith [121] classified firms into standard investment categories. Pinches and Mingo [111] used MDA to determine bond ratings of long term debt. Altman [26] predicted corporate bankruptcies through financial ratio analysis. Since then Gabhart [134] used MDA to predict municipal government insolvency in Michigan, and Edmister [50] attempted to predict bankruptcies of small firms.

MDA has distinct advantages to other forms of analysis. First, in using MDA the researcher is able to analyze simultaneously the entire variable profile of an object to be tested rather than by univariate analysis. Univariate analysis is unable to provide two distinct advantages of MDA: (1) MDA calculates covariances between the financial ratios being tested and (2) also is capable of indicating which ratios are more important. Most MDA studies of a financial nature provide results which are dissimilar to results obtained from the use of univariate analysis. In most instances there are clear differences in the selection of most important ratios to predict an event. Examples of the superiority of MDA in the literature are so common it is not helpful to reference them here.

Another advantage of MDA, as opposed to multiple regression, is MDA's ability to use qualitative dependent variables such as bankrupt or solvent, good or poor credit risk, or is the firm an acquisition candidate.

What is MDA, and how has it been used in merger studies? It is a statistical technique which classified observations of several a priori groupings based on certain characteristics. A linear MDA is an attempt to derive a linear combination of these characteristics which best "discriminates" between two groups. The discriminant function is of the form $Z = b_o + b_1X_1 + b_2X_2 \ldots b_nX_n$ where b_o is a constant used to adjust for the grand means, (see Klecka [12], p. 443). b_i, ($i = 1 \ldots n$), are the discriminant coefficients of independent variable characteristics, X_i, ($i = 1 \ldots n$) , and Z is the value which is then used to classify the object into the two or more groups. See Altman, [26] Morrison [99], or Greene [7] for excellent discussions of MDA.

There have been previous attempts to use MDA to identify merger candidates. In Canada, Belkaoui [34] used discriminant functions on data from 1960 to 1968 on twenty-five industrial firms listed on the Toronto Stock Exchange.

In a larger study, Singh used MDA and financial ratios to predict mergers in the United Kingdom, from 1955-1967 [20,119].

In the United States, there were also two studies using MDA and financial ratios to identify merger candidates. These studies by Simkowitz and Monroe (SM) [118] and by Stevens [135], though done at about the same time, reached dissimilar conclusions. It is possible that the dissimilarities were attributable to the differing nature and methodologies of their studies. SM focused specifically on

conglomerate mergers and reached a ratio profile using a step wise regression procedure. Stevens' study of mergers was not confined to conglomerates, and he used a factor analysis to reduce the set of ratios to a best set. Both SM and Stevens called for follow-up studies in a different time period, to test for continuity of the best set of ratios.[9] An attempt to resolve the dissimilar conclusions reached by the two studies is overdue.

The new sample used in my study tests specifically for the existence of such best set continuity, and will assist in the determination of the better dimension reduction technique in this application, factor analysis or discriminant analysis.

D. Statistical Limitations of This Study

There has been considerable discussion on the necessary statistical assumptions and experimental design requirements using financial applications of MDA [52,70].

MDA requires that the discriminating variables have multivariate normal distributions and the variables have equal variance-covariance matrices within each of the groups. Morrison [99] and others have indicated the importance of the equal variance-covariance matrices; it is a prerequisite of the linear MDA model. The test for equality is Bartlett's Box M test, to be discussed in detail later. Rejection of the hypothesis that the matrices are equal suggests use of a quadratic MDA function, an extremely complex undertaking, which according to Singh, " . . . raise[s] very awkward problems and [has] proved rather intractable in practice."[10]

In a study by Marks and Dunn, the decision rule of unequal covariance matrices precluding a linear MDA function is clouded by

efficiency trade-offs with sample sizes. When sample sizes are small and the number of variables relatively large, linear rules may give more efficient estimates of the expected error rates than quadratic rules even when the population dispersions are unequal.[11] When sample sizes are large, Klecka believes MDA to be robust to violations of the equal covariance requirement [12].

The other considerations are misinterpretation of the significance of the coefficients of the independent variables, reduction in dimensionality, group definition problems, inappropriate a priori probabilities, misestimation of classification error rates, use of split samples, and misinterpretations of classification tables. All of these will be considered in great detail in Chapter IV which discusses the findings of this study.

E. Rationale for a Dimension Reduction

The chief purpose of a dimension reduction in this study is to eliminate those financial ratios which do not contribute to the MDA function's overall ability to classify merger or non-merger candidates. As Eisenbeiss observed: "This can be particularly important for problems in . . . finance when it is often possible to generate a large number of variables which need to be pared down to some manageable size."[11]

Such an approach is not at all uncommon. Both the Stevens and SM studies reduced substantially the number of ratios in their final model. SM began with twenty-four ratios, and eliminated twenty of them.[13] Stevens began with twenty ratios and eliminated sixteen of them in a factor analysis.[14]

Financial ratios of a firm tend to exhibit high correlations over

time. Because of this correlation, dimension reduction techniques are able to eliminate many of the ratios without losing much, if any, of the discriminating capabilities of the model. The difficult question is which ratios to use. Critics of the process by which one begins with many ratios, reducing their numbers to a few, fail to provide a rationale for using specific ratios, ex ante. For example, hypothesizing that above average profitability improves the probability of a firm's subsequent acquisition necessitates selecting one or more profitability ratios. Should the researcher select net income after taxes divided by common stockholders equity (return on equity)? Doing so disregards asset size (rate of return on assets), market value of common equity, and efficiency (rate of return on sales). As a result you must begin the study with all four ratios to determine which, if any, are most useful, eliminating any or all of them in a dimension reduction process.

Another example: Merger literature suggests that firms likely to be acquired have excessive liquidity. Which liquidity ratio is the best to use? Care must be exercised since some evidence suggests that managements manipulate the more popular ratios.[15] That may provide one explanation as to why neither current ratios nor acid-test ratios failed to discriminate in Altman's study of bankruptcies. "Of the three liquidity ratios evaluated, [net working capital to total assets, current ratio, and acid-test ratios], this one [net working capital] proved to be the most valuable."[16] "The working capital/total assets ratio showed greater statistical significance both on a univariate and multivariate basis."[17] Most financial texts emphasize acid test and current ratios.

Finally, arbitrarily deciding which ratios to use ex ante may

reduce the utility of an MDA's most desirable feature, its ability to classify data into subsets by analyzing its ratios simultaneously. The two most commonly used dimension reductions are factor analysis and stepwise regressions. Both of these techniques have several variations. The Statistical Package for the Social Sciences (SPSS) [12] has five variations of Stepwise methods. The SPSS factor analysis package contains at least nine combinations of factor analysis. Brief discussions of factor analysis are in SPSS [12] and Greene [7]. An extended discussion is in Harmon [10].

An important part of this study will be to use both procedures as part of an attempt to reconcile the differences between SM and Stevens' findings. One explanation for these contradictions could be the different treatment of the multicollinearity problem in the studies. It is not known whether differences in financial ratios due to differing statistical procedures will: 1) weaken the general worth of the financial model, or 2) diminish the usefulness of one of the dimension reduction techniques.

Footnotes

Chapter III

1. Melvin O'Connor, "On the Usefulness of Financial Ratios to Investors in Common Stock," The Accounting Review 48 (April, 1973): 351.

2. William H. Beaver, "Financial Ratios As Predictors of Failure," Journal of Accounting Research 4 (Supplement, 1966): 81.

3. Ibid, p. 102.

4. Ibid, pp. 79-81.

5. Ibid, p. 100.

6. John Neter, "Discussion of Financial Ratios as Predictors of Failure," Journal of Accounting Research 4 (Supplement, 1966): 114.

7. James O. Horrigan, "The Determination of Long-Term Credit Standing with Financial Ratios," Journal of Accounting Research 4 (Supplement, 1966): 48-49.

8. Ahmed Belkaoui, "Financial Ratios as Predictors of Canadian Takeovers," Journal of Business Finance and Accounting 5 (Spring, 1978): 95.

9. Michael Simkowitz and Robert J. Monroe, "A Discriminant Analysis Function for Conglomerate Targets," 6 Southern Journal of Business (November, 1971): 14.

   Donald Lee Stevens, "A Multivariate Analysis of Financial Characteristics of Acquired Firms in Industrial Mergers," (Ph.D. dissertation, Michigan State University, 1972): 116.

10. Ajit Singh, Takeovers; Their Relevance to the Stock Market and the Theory of the Firm, (Cambridge: Cambridge University Press, 1971), p. 91.

11. Robert A. Eisenbeiss, Problems in Applying Discriminant Analysis in Credit Scoring Models (Federal Reserve Bulletin, [1978]), p. 16.

12. Idem, "Pitfalls in the Application of Discriminant Analysis in Business, Finance and Economics," Journal of Finance 32 (June, 1977): 885.

13. Simkowitz and Monroe, "A Discriminant Analysis Function," pp. 9, 13, 14.

14. Stevens, "A Multivariate Analysis," pp. 152, 154, 157.

15. Beaver, "Financial Ratios as Predictors," pp.78-79.

16. Edward I. Altman, "Financial Ratios, Discriminant Analysis, and the Prediction of Corporate Bankruptcy," Journal of Finance 23 (September, 1968): 594.

17. Ibid.

Chapter IV

Data Analysis and Sample Design

A. Data Selection

This study investigates a sample of one thousand four hundred and fifty five companies which have been divided into four subsets of data. The first subset consists of two hundred thirty five firms which were acquired in the time period 1970 through 1976. This data was extracted from the Compustat Research File, a computer accessed data base consisting of up to twenty years of financial information pertaining to firms removed from the Compustat Industrial File [133]. Delistings from the Industrial File are caused by any of several financial events; the appropriate event here is the acquisition of a firm which, prior to the event, was included in the Industrial File.

The Industrial File is the source of the second data subset. It is also a computer accessed data base providing up to twenty years of financial data for several thousand publicly traded firms.

The second data subset consists of three hundred twenty three companies. This subset, the control group, was randomly sampled and was from the same time period as the data from the first subset.

The only modifications to the randomly sampled control group came as a result of two problems.

1. Because the control group was of the period 1970-1976, some of these firms were subsequently acquired. The control group has been

verified to ensure all merged firms have been deleted as of July, 1981.

2. Forty eight[1] companies were removed from the randomly sampled control group because their industries employed accounting methods which were incompatible with some of the ratios used in this study. These industries included banks, savings and loan institutions, insurance companies, and utilities. Consequently, a deficiency in this test is its inability to be generalized to include industries whose accounting definitions are inapplicable to some of the thirty seven financial ratios used in this test. Any test of those industries will require new ratios which will conform with those accounting procedures.

The third subset is a sample of fifty two firms whose mergers occurred in 1979. Information obtained from this subset is an important contribution to this study for several reasons:

The fourth subset is a sample of eight-hundred-forty-five non-acquired firms, used as a control group. Their financial data preceding 1979 is analyzed as a contrast to the third subset. The third and fourth subsets provide a test of the predictive power of the discriminant function generated from the combination of the first two subsets. Both the Stevens and SM studies recommended updates to test their model and to determine if the same ratios would be useful in any time period.

Second, rarely in MDA literature are there ex ante tests of a discriminant function. Generally data are separated into two groups, the first group is used to generate a discriminant function, and the latter group is then classified, expost. Then the model is then evaluated as to its predictive powers in an expost test. Joy and Tollefson and others have criticized such previous MDA applied studies stressing: "Ex post discrimination may provide a useful foundation for

explanation of the past, but it does not provide sufficient evidence for concluding that the future can be predicted."[2]

Finally, this study evaluates ratios cross-sectionally over time, annually for three years prior to the merger. One of the objectives of this study is to determine if a few ratios will be sufficiently important to appear in the discriminant functions from all three years prior to a target firm's ultimate acquisition. Three years is suggested because management may need considerable lead time to restructure its firm's financial characteristics to fend off potential acquirers, and three years also acknowledges Belkaoui's results [34].

There are other reasons for reducing the number of financial ratios used to isolate merger candidates aside from the principle of parsimony. Some articles have suggested that firms have obvious financial characteristics which make them vulnerable. "Management should realize: many if not most of the takeovers or tenders could have been foreseen by looking at the victim's published financial data."[3]

Vance claimed to have predicted seventeen of twenty one mergers by using four ratios. His ex post study focused on price-earnings levels, net working capital to total assets, long term debt to net worth, and earnings per share growth rates.[4] A deficiency of his study is that he did not test his model ex ante.

Other researchers disagree with Vance, advocating other key ratios, or that the merger selection candidate process cannot be generalized, in other words, each merger has unique aspects and therefore may not be easily predicted.[5]

A second objective of this study is to identify trends in the importance of ratios over the three year span prior to a target's

acquisition.

Finally, this study will comment on the timing and significance of the appearance of key ratios, update previous tests in other eras, and resolve the contradictions in the literature.

Twenty accounting measurements have been selected, including such items as sales, depreciation, long term debt, earnings per share, and market price for the common stock.

The twenty items were selected because of their expected importance in measuring the attractiveness of a potential acquisition. Using this accounting data, the thirty seven financial ratios identified in Chapter III were then calculated.

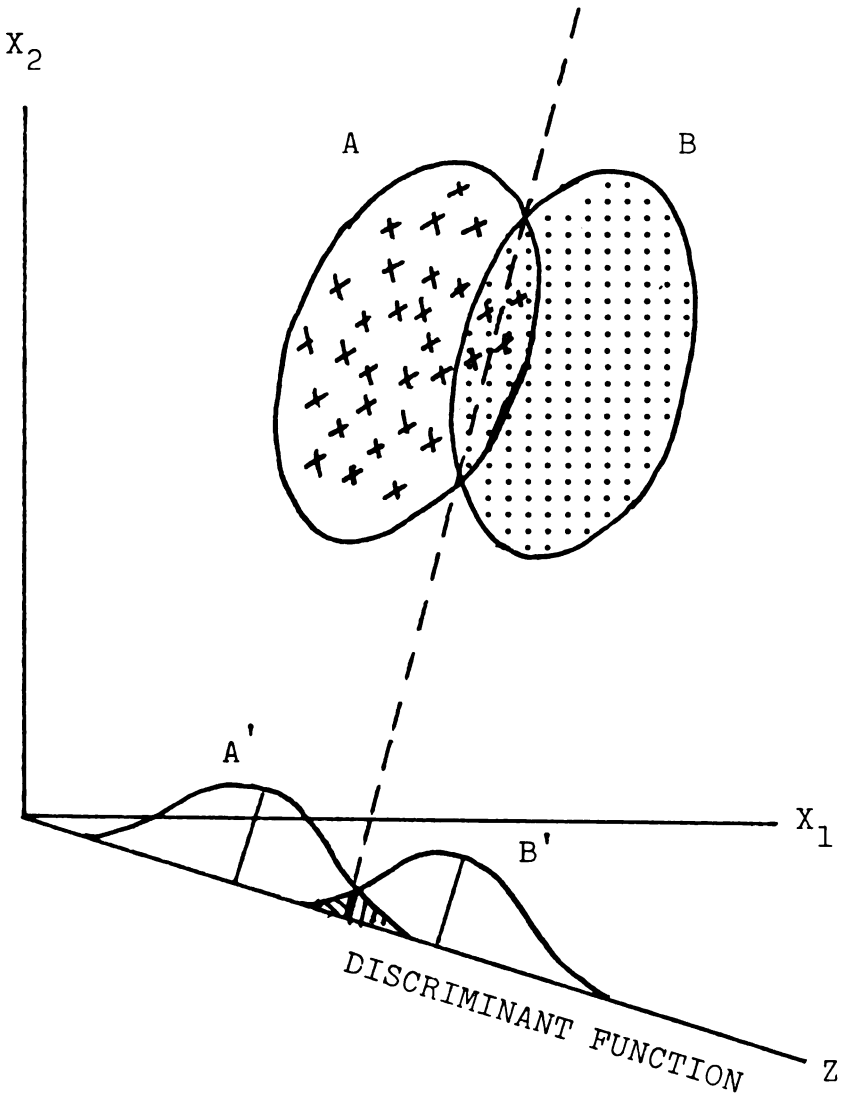
Because of the unique nature of this test, the cross sectional ratio analysis, three, two and one year(s) prior to a merger, a computer program written in Fortran IV was used to retrieve the accounting data from the first two subsets and calculate the thirty seven financial ratios.

Those ratios were accessed from a data file and, using a standard packaged program, were used to produce three discriminant functions. The discriminant analysis program was Subprogram Discriminant, written for the Statistical Package for Social Scientists (SPSS) [12].

A necessary assumption in the use of MDA is that the populations are multivariate normally distributed. If the two groups in this particular case have different means (centroids), but identical variance-covariance matrices, then a linear multiple discriminant analysis provides an optimal solution to the classification problem.

Figure 4-1 is an elementary graphical illustration of a two group analysis. A and B represent scatter diagrams of two groups, merged and

Figure 4-1



Graphical Illustration of Two-Group Discriminant Analysis from Hair, et al [8].

nonmerged firms. In addition we have two measurements, X_1 and X_2 for each member of the two groups. The ellipses drawn around groups A and B usually enclose a predetermined proportion of the observations, generally 95% or more of each group. Because the ellipses usually overlap, the objective is to draw a straight line which minimizes the amount of overlap. The new axis Z expresses the two-variable profiles of groups A and B as single numbers, the discriminant scores.

By finding a linear combination of the original variable X_1 and X_2, we can project the result as discriminant Z scores on a single axis. For a lengthier discussion of this see either [2] or [7].

It is important to emphasize that unless the variances and covariance matrices between the two groups are equal, you cannot construct a straight line to separate the two groups, because the ellipses, also referred to as centours, will lack equal shape and orientation, and unequally shaped centours may weaken one's conclusions.

Inability to create a linear discriminant function suggests use of a quadratic discriminant function. Several authors have countered that large sample sizes will make linear discriminant functions robust to violations of the equal variance-covariance requirements.[6] In this particular study the requirements are subjected to that debate.

The null hypothesis: Ho: $\sigma_1^2 = \sigma_2^2$

Results shown in Table 4-1 show that the variance-covariance matrices are clearly unequal.

Table 4-1

Fisher's Box M Test
for Equal Covariances

TIME	STATISTICAL SIGNIFICANCE
LAG 2 (t-3)	.0000
LAG 1 (t-2)	0.
LAG 0 (t-1)	0.

Table 4-1 results were obtained through the Statistic 7 of the SPSS Subprogram DISCRIMINANT.

Given the large sample sizes, and their supposed contribution to the robustness of violations of the equal covariance requirement it was decided to temporarily disregard these Box M scores and assess their importance in the conclusion of this paper.

A more important statistical procedure is to split the total sample into two groups. One group is used to generate a discriminant function to be used to classify the members in the second group, the validation group, because use of a single combined sample imparts an upward bias in the overall classification success. In this test, the firm's Cusip number dictated the group. Even numbered Cusip firms were used to produce a discriminant function, and odd numbered Cusip firms were then used as the validation sample in this split sample technique. Readers may wish to read Morrison [99] Frank, Massey, and Morrison [57], Joy and Tollefson [70] or Eisenbeiss [52] for additional discussion on the problem of bias.

Table 4-2 (a)

Classification Results - Hold Out Group
Split Sample Analysis and Validation
IAG 2 (t-3)

		Actual	Predicted	
		# of cases	Merged # (%)	Non-Merged # (%)
Analysis Group	Even Merged	101	74 (73.3)	27 (26.7)
	Even Non-Merged	130	39 (30.0)	91 (70.0)

total classification = $(n_{11} + n_{22}) / n..$ = 71.4%

		Actual	Predicted	
Validation Group	Odd Merged	105	55 (52.4)	50 (47.6)
	Odd Non-Merged	128	41 (32.0)	87 (68.0)

total classification = (55 + 87) / 233 = 60.9%

Results between the two sets of tests are consistent with the bias discussion. The reader should note the lower total classification success produced by the odd numbered merged firms in the validation group when compared to the even numbered merged firms in the analysis group (52.4% vs. 73.3%). Also note the slightly lower total classification success, 60.9%, in the validation (hold out) group compared to the analysis group, 71.4%. The 71.4% produced in the analysis group incorporates the bias inherent in the process of using a sample twice, once for a discriminant function, and then using the same data in a classification process. The actual total classification success is the 60.9%, the success of classifying observations not used in the generation of the discriminant function.

The next step in the classification process is to determine if the 60.9% could have been obtained by a random process. There are three methods used to test for statistically acceptable classification accuracy. Total classification $\left[(n_{11} + n_{22}) / n..\right]$ is one of the three measures of classification, and is considered to be superior to the other two measures, maximum chance and proportional chance classifications.

Maximum chance is a naive model which assigns all observations to the largest group, which in this study is non-merged firms.

Maximum chance in the IAG 2 model in Table 4-2(a) is:

$$\left[(n_{21} + n_{22}) / n..\right] = \left[(41 + 87) / 233\right]$$

$$= .549$$

= frequency of non-merged firms

The maximum chance procedure avoids the central issues of identifying both merged and non-merged firms. It may be useful if

sample sizes are clearly unequal, but that is not the situation in this part of the study.

The other classification measure, proportional chance, does attempt to identify merged firms. Observations are randomly assigned to either group with probabilities equal to group frequencies. The model for this, using LAG 2 is

$$p = \left\{[(n_{11} + n_{12}) / n..]^2 + [(n_{21} + n_{22}) / n..]^2\right\}$$
$$p = \left\{[(55 + 50) / 233]^2 + [(41 + 87) / 233]^2\right\}$$
$$p = 0.505$$

The objective is to test total classification success against maximum chance or proportional chance results.

The test statistic used to establish that a discriminant function used on a validation sample produces results better than pure chance is:

$$Z = \frac{C - p}{\left[\frac{p(1-p)}{n..}\right]^{1/2}}$$

where C = total classification success

$$\left[(X_{11} + X_{22})/(X..)\right]$$

and p = probability of success

n.. = total sample size

if p = maximum chance, then $p = (n_{2.} / n..) = .549$

or if p = proportional chance, then

$$p = \left[(n_{1.}/n..)^2 + (n_{2.}/n..)^2\right] = .505$$

Z has a t-distribution with n-1 degrees of freedom.

To test the LAG 2 model first against maximum chance,

$$Z = \frac{.609 - .549}{\left[\frac{(.549) \times (.451)}{233}\right]^{1/2}} = 1.8404$$

and

$t(120)(.05) = 1.658$

$t(\infty)(.005) = 1.645$

$t(120)(.025) = 1.98$

$t(\infty)(.025) = 1.96$

So the model is significant at least at the .05 level.

Testing the LAG 2 model against the proportional chance model,

$$Z = \frac{.609 - .505}{\left[\frac{(.505) \times (.495)}{233}\right]^{1/2}} = \frac{.104}{.0328} = 3.175$$

which is significant at .005.

LAG 2 is superior to random chance in classifying merged from non-merged firms, evaluated either by maximum chance or by proportional chance classification methods.

LAG 1 and LAG 0 model total classification results were then tested. They are illustrated in Table 4-2(b) and Table 4-2(c), respectively.

Table 4-2 (continued)

4-2(b)

LAG 1 (t-2)

Classification Results - Hold Out Group,

		Actual	Predicted	
		# of cases	Merged # (%)	Non-Merged # (%)
Analysis Group	Even Merged	105	75 (71.4)	30 (28.6)
	Even Non-Merged	131	42 (32.1)	89 (67.9)
	total analysis classification rate = 69.5%			
Validation Group	Odd Merged	109	60 (55.0)	49 (45.0)
	Odd Non-Merged	128	40 (31.2)	88 (68.8)
	total validation classification rate = 62.4%			

Maximum chance significance = 2.5946;

significant at = .001

Proportional chance significance = 3.7256;

significant at = .0005

Table 4-2 (Continued)

Table 4-2 (c)

LAG 0 (t-1)

Classification Results - Hold Out Group

Split Sample Analysis and Validation

		Actual	Predicted	
		# of cases	Merged # (%)	Non-Merged # (%)
Analysis Group	Even Merged	101	72 (71.3)	29 (28.7)
	Even Non-Merged	119	35 (29.4)	84 (70.6)

total classification = $(n_{11} + n_{22}) / n.. = 70.9\%$

		Actual	Predicted	
Validation Group	Odd Merged	108	54 (50.0)	54 (50.0)
	Odd Non-Merged	123	33 (26.8)	90 (73.2)

total classification = $n_{11} + n_{22}) / n.. = 62.3\%$

Maximum chance significance = 2.2542; significant at (.025)

Proportional chance significance = 3.1614; significant at (.005)

LAG 2 through LAG 0 models all demonstrate significant success in classifying merged from non-merged firms. Because of this success further analysis is warranted.

The discriminant functions generated were then used as an ex ante predicting model to identify from the third subset the fifty two mergers subsequently occurring in 1979.

Table 4-2 illustrates the three discriminant functions produced in this merger study. Overall classification success is 60.94%, 62.45%, and 62.34% respectively three, two, and one year prior to the merger.

The next step in the process was to establish that an MDA application would successfully separate merged from non-merged figures. Table 4-3 illustrates that success. The process used was Method Direct, an application of Subprogram DISCRIMINANT in SPSS. Method Direct evaluates all thirty-seven ratios utilized herein, rejecting only those ratios which do not contribute at all to the classification process. It is not a dimension reduction technique.

Table 4-3

Descriptive Statistics
Method Direct

Discriminant Functions[7]

Standardized Coefficients

LAG2		LAG1		LAG0	
LAG2FR1	-.06191	LAG1FR1	.23132	LAG0FR1	.46408
LAG2FR2	.33838	LAG1FR2	.48432	LAG0FR2	2.09418
LAG2FR3	-.42686	LAG1FR3	-.44488	LAG0FR5	-1.71721
LAG2FR4	.09824	LAG1FR6	.31565	LAG0FR6	-.47854
LAG2FR5	.07141	LAG1FR8	-.10632	LAG0FR7	-.91661
LAG2FR6	.10458	LAG1FR9	.46799	LAG0FR8	-.25137
LAG2FR7	-.52180	LAG1FR10	.31807	LAG0FR9	-.21649
LAG2FR8	.20954	LAG1FR11	-.05036	LAG0FR10	.03996
LAG2FR9	-.14383	LAG1FR12	-.42457	LAG0FR11	.05392
LAG2FR10	-.38742	LAG1FR13	.08670	LAG0FR12	.27689
LAG2FR11	.05038	LAG1FR14	-.45712	LAG0FR13	-.14447
LAG2FR12	-.26097	LAG1FR15	.22716	LAG0FR14	-.30573
LAG2FR13	-.08102	LAG1FR16	.30748	LAG0FR15	-.25537
LAG2FR14	.00406	LAG1FR17	.22564	LAG0FR16	-.83105
LAG2FR15	-.31616	LAG1FR21	.74891	LAG0FR17	.72494
LAG2FR16	-.13294	LAG1FR22	.41224	LAG0FR21	-.62331
LAG2FR17	.17755	LAG1FR23	.00488	LAG0FR22	-.13028
LAG2FR21	-.66853	LAG1FR25	.09492	LAG0FR23	.01702
LAG2FR22	-.10038	LAG1FR26	-.67727	LAG0FR25	-.19638
LAG2FR23	-.28129	LAG1FR27	.88073	LAG0FR26	.37503
LAG2FR25	.15351	LAG1FR28	.14003	LAG0FR27	-.54000
LAG2FR26	-.25912	LAG1FR32	-.38629	LAG0FR28	.18902
LAG2FR27	.04462	LAG1FR35	-.21180	LAG0FR29	.25369
LAG2FR28	-.00841	LAG1FR36	.23947	LAG0FR30	-.18651
LAG2FR29	-.33457			LAG0FR31	.42720
LAG2FR30	-.13142			LAG0FR32	.12521
LAG2FR31	.11064			LAG0FR33	.13809
LAG2FR32	.21876			LAG0FR34	.08092
LAG2FR33	.46396			LAG0FR35	-.04396
LAG2FR34	.29540			LAG0FR36	-.36503
LAG2FR35	-.10608			LAG0FR37	.26622
LAG2FR36	-.11580				
LAG2FR37	-.02250				

WILKS Lambda[8]			Chi Square[9]	(Significance)	
Lag 2	Lag 1	Lag 0	Lag 2	Lag 1	Lag 0
.8223	.8740	.8144	85.21 (.0000)	61.29 (.0000)	87.16 (.0000)

The three discriminant functions are all successful in classifying merged and non-merged firms given their Wilks Lambdas, Chi Square Statistics and their resulting significance levels. Therefore, further analysis, using the data and this methodology is warranted.

B. Characteristics of the Data

The data analyzed in this test came from publicly traded firms which are, or were previously sufficiently large, to be included in the Compustat Industrial File at some time during the 1970's.

To illustrate, Table 4-4 compares accounting data between merged and non-merged firms:

Table 4-4

SIZE CHARACTERISTICS COMPARISON

Averages and 95% Confidence Intervals

Between Merged and Non-Merged Firms

(Lag 0)

	Merged	Non-merged
Sales	$195 million	$595 million
95% CI	($144-$246 million)	($477-$711 million)
Total Assets	$143 million	$699 million
95% CI	($100-$175 million)	($569-829 million)
Net Income Before Extraordinary Items	$6 million	$30 million
95% CI	(<$40>-$135 million)	(<$287>-$397 million)

Clearly, merged firms tend to be smaller, measured by sales and assets. Income tended to be less for merged firms, but there is not a clear separation here.

Chapter IV

Footnotes

1. The breakdown was as follows:

SIC Code 4911-4931:	21 cases
6021-6027:	16 cases
6120:	4 cases
6312:	6 cases
3714:	1 case

2. Maurice O. Joy and John O. Tollefson, "On the Financial Applications of Discriminant Analysis," Journal of Financial and Quantitative Analysis 10 (December, 1975): 727.

3. Jack O. Vance, "Is Your Company A Take-Over Target?" Harvard Business view, May-June, 1969, p. 93.

4. Ibid, p. 94.

5. For example, read Greenhill's remarks in "The Profit Potential in Spotting Takeovers," Business Week, 24 October 1977, p.100.

6. For example, see William R. Klecka, "Discriminant Analysis," Chapter 23, Statistical Package for the Social Sciences, 2nd ed., ed. Norman H. Nie, C. Hadley Hull, Jean G. Jenkins, Karin Steinbrenner and Dale H. Bent (New York: McGraw-Hill, 1975): 435.

7. The IAG 2 discriminant function reports standardized coefficients (each coefficient is divided by its standard deviation) generated from financial information three years prior to acquisition of the firms in the sample group.

8. Wilks Lambda is an inverse measure of the discriminating power of the financial ratios in the discriminant functions which have not yet been removed by the discriminant functions.

9. The Wilks Lambda is distributed as a Chi Square statistic. Chi square significance levels of .0000 are highly significant.

Chapter V

Findings of the Study

A. Distad's Reduced Dimension Model Using Discriminant Analysis

Aside from the principle of parsimony, application of the thirty-seven ratio discriminant function discussed in Chapter IV would be a cumbersome technique to isolate merger candidates. Therefore a statistical screening process which removes financial ratios that do not contribute significantly to the classification process is warranted. The objective is to reduce the number of variables to a few "key" ratios. Because there are several dimension reduction techniques, one of the important aspects of this paper is to determine whether various dimension reduction techniques produce conflicting sets of best ratios. Stevens, using factor analysis, and Simkowitz and Monroe (SM), using MDA, contributed studies of financial characteristics of merged firms during the 1960's, but the two studies produced conflicting results. Stevens suggested one possible explanation was the differing statistical methodology. These methods are two of the most commonly employed dimension reduction techniques used with discriminant analysis.

First using a stepwise discriminant function, the key ratios for the 1970's test of the new mergers were reduced to the following:

Table 5-1

Reduced Dimension Descriptive Statistics

Reduced Discriminant Functions, Standardized Coefficients

LAG2 (t-3)		LAG1 (t-2)		LAGO (t-1)	
LAG2FR3	.56385	LAG1FR1	.42015	LAGOFR1	.36002
LAG2FR4	-.63142	LAG1FR6	.27666	LAGOFR5	-.25137
LAG2FR7	.56227	LAG1FR9	.45711	LAGOFR7	-.70662
LAG2FR10	.30075	LAG1FR15	.52839	LAGOFR8	-.27681
LAG2FR12	.30911	LAG1FR16	.30978	LAGOFR9	-.18124
LAG2FR15	.33268	LAG1FR17	-.21650	LAGOFR14	-.15791
LAG2FR21	.70744	LAG1FR21	.80609	LAGOFR15	-.21962
LAG2FR23	.26278	LAG1FR22	.16558	LAGOFR16	-.94180
LAG2FR26	.20596	LAG1FR26	.21434	LAGOFR17	.86217
LAG2FR29	.29725	LAG1FR32	-.34656	LAGOFR18	-.42766
LAG2FR32	-.20991	LAG1FR33	-.55826	LAGOFR21	-.66200
LAG2FR33	-.49384	LAG1FR34	.28098	LAGOFR25	-.25428
LAG2FR34	-.26886	LAG1FR35	-.18838	LAGOFR27	-.12971
		LAG1FR36	.21101	LAGOFR36	-.37273
				LAGOFR37	.27617

WILKS Lambda			Chi Square		(Significance)	
Lag 2	Lag 1	Lag 0	Lag 2	Lag 1	Lag 0	
.8324	.8615	.8243	(.0000)	(.0000)	(.0000)	

Table 5-2

Distad's Reduced Dimension Classification Matrices

Table 5-2(a)

Lag 2
(t-3)

Actual	Predicted	
	Merged	Non-Merged
	# (%)	# (%)
Merged	121 (55)	99 (45)
Non-Merged	57 (21)	213 (79)

Overall Classification Success: 68%

Maximum Chance Classification Significance: 5.786 vs. 3.373 at (.0005)

Proportional Chance Classification Significance: 7.748 vs. 3.373 at (.0005)

Type I Error Rate: 45%

Type II Error Rate: 21%

Table 5-2(b)

Lag 1

(t-2)

Actual	Predicted	
	Merged # (%)	Non-Merged # (%)
Merged	107 (47)	119 (53)
Non-Merged	63 (24)	200 (76)

Overall Classification Success:	63%
Maximum Chance Classification Significance:	4.02 vs. 3.373 at (.0005)
Proporational Chance Classification Significance:	5.57 vs. 3.373 at (.0005)
Type I Error Rate:	53%
Type II Error Rate:	24%

Table 5-2(c)

Lag 0

(t-1)

Actual	Predicted	
	Merged # (%)	Non-Merged # (%)
Merged	122 (56)	96 (44)
Non-Merged	44 (18)	200 (82)

Overall Classification Success:	70%
Maximum Chance Classification Significance:	7.39 vs. 3.373 at (.0005)
Proportional Chance Classification Significance:	8.51 vs. 3.373 at (.0005)
Type I Error Rate:	44%
Type II Error Rate:	18%

Use of a stepwise discriminant function, Rao V from the SPSS Subprogram DISCRIMINANT has produced a set of three models, LAG 2 through LAG 0, and variables which have been reduced to thirteen, fourteen, and fifteen respectively from the original thirty-seven ratios. All three models are significant at very high levels (.0000).

The next procedure is to employ a factor analysis, the version used here was the SPSS Subprogram FACTOR.

B. Distad's Reduced Dimension Model Using Factor Analysis

The objective of a factor analysis is to explore the possibility of dimension reduction by constructing a set of new variables on the basis of interrelations exhibited among the original thirty seven financial ratios included in this study.

Using factor analysis, Stevens' original variable list was reduced from twenty ratios to four or five ratios. One objective of this paper is to attempt to update his work using factor analysis as a comparison with an MDA originated dimension reduction process.

The factor analysis process transforms a set of variables into a new set of variables which are uncorrelated with each other. The new set of variables is a linear combination which accounts for more of the variance in the data than any other linear combination of variables.

The general model is:

$$Z_j = a_{j1}F_1 + a_{j2}F_2 + \cdots + a_{jn}F_n$$

Where: $j = 1,2,\ldots,n$ observed variables

Z = variable j, in this case FR_j

F_n = uncorrected components, each as a linear combination of the n original variables

a_{ji} = factor loading (the standardized multiple

regression coefficient of variable j on factor i)

The SPSS Subprogram FACTOR was used for this test, factor loadings were established using the principal components method (PA1), and these factors were rotated by the varimax method. The principal components process was selected because it is most commonly used; Cooley and Lohnes believe the varimax solution is superior to other rotation procedures.[1]

Table 5-3(a) is the LAG 0 factor rotation and percent of variance accounted for by each of the factors. In addition the table presents the cumulative percent of variance by the sum of the factors. Tables 5-3(b) is the LAG 1 analysis, and 5-3(c) is the LAG 2 analysis.

Table 5-3(a)

LAG 0 (t-1)

Factor Analysis, Eigenvalues and Percent of Variance

FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
1	7.26371	19.6	19.6
2	4.82608	13.0	32.7
3	3.73049	10.1	42.8
4	3.12730	8.5	51.2
5	2.24859	6.1	57.3
6	2.19263	5.9	63.2
7	1.68810	4.6	67.8
8	1.49703	4.0	71.8
9	1.28674	3.5	75.3
10	1.26364	3.4	78.7
11	1.06464	2.9	81.6
12	.97089	2.6	84.2
13	.88086	2.4	86.6
14	.85555	2.3	88.9
15	.77590	2.1	91.0
16	.62819	1.7	92.7
17	.60739	1.6	94.3
18	.44395	1.2	95.5
19	.38138	1.0	96.6
20	.31033	.8	97.4
21	.22492	.6	98.0
22	.17704	.5	98.5
23	.15511	.4	98.9
24	.11216	.3	99.2
25	.10357	.3	99.5
26	.07408	.2	99.7
27	.06516	.2	99.9
28	.01571	.0	99.9
29	.01001	.0	99.9
30	.00788	.0	100.0
31	.00414	.0	100.0
32	.00331	.0	100.0
33	.00202	.0	100.0
34	.00119	.0	100.0
35	.00025	.0	100.0
36	.00007	.0	100.0
37	.00006	.0	100.0

Table 5-3(b)

IAC 1

FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
1	6.68565	18.1	18.1
2	5.46766	14.8	32.8
3	3.52596	9.5	42.4
4	2.77583	7.5	49.9
5	2.35187	6.4	56.2
6	2.12020	5.7	62.0
7	1.77187	4.8	66.8
8	1.67231	4.5	71.3
9	1.59537	4.3	75.6
10	1.34395	3.6	79.2
11	1.05198	2.8	82.1
12	.96539	2.6	84.7
13	.80718	2.2	86.9
14	.77819	2.1	89.0
15	.68712	1.9	90.8
16	.54035	1.5	92.3
17	.50140	1.4	93.6
18	.44255	1.2	94.8
19	.40944	1.1	95.9
20	.31206	.8	96.8
21	.29347	.8	97.6
22	.24953	.7	98.2
23	.17089	.5	98.7
24	.14015	.4	99.1
25	.12760	.3	99.4
26	.08619	.2	99.7
27	.04902	.1	99.8
28	.03965	.1	99.9
29	.01334	.0	99.9
30	.00682	.0	100.0
31	.00601	.0	100.0
32	.00564	.0	100.0
33	.00244	.0	100.0
34	.00212	.0	100.0
35	.00073	.0	100.0
36	.00004	.0	100.0
37	.00002	.0	100.0

Table 5-3(c)

LAG 2

FACTOR	EIGENVALUE	PCT OF VAR	CUM PCT
1	5.95461	16.1	16.1
2	4.36382	11.8	27.9
3	3.48170	9.4	37.3
4	2.98920	8.1	45.4
5	2.12170	5.7	51.1
6	1.83964	5.0	56.1
7	1.63050	4.4	60.5
8	1.49344	4.0	64.5
9	1.48218	4.0	68.5
10	1.23012	3.3	71.9
11	1.15163	3.1	75.0
12	1.07878	2.9	77.9
13	.98308	2.7	80.5
14	.97279	2.6	83.2
15	.84283	2.3	85.4
16	.74254	2.0	87.5
17	.69299	1.9	89.3
18	.61199	1.7	91.0
19	.53597	1.4	92.4
20	.49777	1.3	93.8
21	.43507	1.2	95.0
22	.40603	1.1	96.0
23	.38518	1.0	97.1
24	.23003	.6	97.7
25	.19460	.5	98.2
26	.16506	.4	98.7
27	.14390	.4	99.1
28	.13587	.4	99.4
29	.08600	.2	99.7
30	.04726	.1	99.8
31	.04275	.1	99.9
32	.02412	.1	100.0
33	.00369	.0	100.0
34	.00216	.0	100.0
35	.00056	.0	100.0
36	.00038	.0	100.0
37	.00008	.0	100.0

The purpose of Table 5-3 is to show how many factors are necessary to explain the variance of the data. Hair et al have suggested an arbitrary cut off when sixty percent of the variance has been explained.[2] The SPSS default procedure is to cease factor rotations when eigenvalues fall below the one level, which is consistent with Kaiser,[3] the inventor of the varimax rotation. In this study any "cut off" procedure indicates a large number of factors are necessary. Hair et al's process necessitates six factors, and SPSS procedures advocate twelve factors. Because factor 1 explains more of the variance than any other factor it is considered to be more important than any other factor. A portion of factor 1 is illustrated in Table 5-4. The entire factor 1 list is in the appendix.

Table 5-4

LAC 0
Factor 1
Factor Loadings $\geq |.3|$
Distad's Test

Ratio	Loading
FR2	.98227
FR3	.98216
FR4	.98208
FR5	.97958
FR29	-.94864
FR30	-.92035
FR31	-.96235
FR34	-.63372
FR35	-.39371

Stevens used a cut off of $|.7|$ or more in his factor analysis.[4] Hair et al endorse $|.5|$ as a cut off.[5] Others contend a sliding scale, wherein factor loadings of $|.7|$ are extremely important, $|.5|$ or more are important, and factor loadings of $|.3|$ may be significant. Cooley

and Lohnes have used a cut off of $\geq |.35|$.[6]

Each factor is arranged in a row vector, and each of the financial ratios in that row vector represent the loading of that ratio on that factor. Therefore, the relation between any of the variables and any of the factors can be observed. Each row vector has the relationship that $\sum_{j=1}^{N} (a_{ji})^2 = 1$ where each a_{ji} has an analogous interpretation to the correlation coefficient. In Table 5-4 FR2 = a_{12} because it is in the first factor and it is the second variable; FR1's loading = .05327 and was not included in this excerpt, that is its coefficient was too small.

Given that FR2 has a loading of .98227, we know that $(.98227)^2$ = .96485, and 96.5 percent of FR2's total variance is explained in factor 1.

Table 5-4 serves another purpose. It shows that factor 1 includes nine of the thirty-seven original ratios. In spite of their high loadings, those nine ratios account for only approximately twenty percent of the variance, (see Table 5-3). The second factor, primarily a set of four leverage ratios, accounts for only an additional thirteen percent of the variance. A factor analysis will not successfully reduce the variable dimension in this particular application, no matter which cut off method is used. Using Hair's suggested cut off guide necessitates six factors, but six factors only reduce the dimension to thirty from the thirty-seven ratios. Using Kaiser's cut off, twelve factors, we explain eighty-four percent of the variance, but doing so requires thirty-five of the thirty-seven original ratios, using loadings $\geq |.5|$.

C. Analysis of Stevens' Factor Analysis Procedures

Stevens concluded he could reduce to ten ratios, the original

list of twenty. However, in observing his rotated factor matrix,[7] several ratios with factor loadings in excess of |.7| were omitted. He still had fifteen financial ratios with factor loadings $\geq$ |.5| after his first five rotations.

Though the cutoff process is quite subjective, he may have disregarded important financial ratios. In his first factor, his factor loadings in excess of $\geq$ |.5| were FR8 (.819), long term debt to market value of equity; FR15 (.962), interest to cash plus marketable securities; FR31 (.950), net working capital to sales; and FR10 (.920), long term debt to total assets. From this list he omitted FR8, and thereby discarded a ratio with a loading of .819, which most analysts would consider to be extremely important.

Stevens discarded his entire second factor in spite of its high factor loading scores. There the key ratios were FR2 (.880), gross profits to sales; FR3 (.946), income before taxes to sales; and FR4 (.889), net income after taxes. Instead, from the third factor he selected two of three profitability ratios though third factors are less significant than are second factors. In the third factor, the key ratios were FR1 (.895), earnings before interest and taxes to total assets; FR5 (.823) earnings before interest and taxes to sales; and FR6 (.868), net income after taxes to net stockholders' equity. Of those three, he omitted FR5 (.823) presumably because it had a lower factor loading. While these loadings are high, they are still less important than the omitted variables from the second factor.

For activity ratios he selected FR9 (.897), long term debt to stockholders equity; FR14 (.974), sales to quick current assets; and FR13 (.851), cost of goods sold to inventory. Most analysts consider

TR9, long term debt to equity to be a leverage ratio. More puzzling though is his decision to incorporate TP14, which did not appear until his ninth factor; his cut off was six rotations.

His liquidity ratios were net income to total assets (profitability ratio) and sales total assets (activity ratio). The two previously defined liquidity ratios, from his table 3.1 on page 38 of his dissertation were TP24 (.880-tenth factor), net working capital to total assets and TR31 (.950 - first factor) net working capital to sales, which he included in his list of leverage ratios.

Table 5-5 is a reproduction from page fifty two of Stevens' dissertation. It is his summary of factor analysis; the percent of variance by factor.

Table 5-5

Stevens' Factor - Percent Variance Table

Factor	Percent Variance	Cumulative Percent
1	21.79	21.79
2	17.40	39.20
3	13.28	52.49
4	7.27	59.77
5	5.61	65.38
6	5.31	70.69
7	5.23	75.92
8	5.21	81.14
9	5.18	86.32
10	4.87	91.19
(11-19 omitted)		
20	0.00	99.99

The purpose of Table 5-5 is to compare Stevens' Factor Analysis produced percent of variance results with this researcher's, which are shown in Table 5-3(a). Clearly it now takes more factors and ratios to use factor analysis in a financial ratio analysis of merger candidates.

Additionally, it now requires more factor dimensions and therefore more ratios to attain the level of cumulative variance explanations obtained by Stevens. To illustrate, Table 5-6 is a listing of factor loadings by factor for the first seven factors on my data. It was decided not to list all twelve factors, though seven only accounts for sixty-eight percent of the variance as revealed in Table 5-3(a).

Table 5-6

Distad 1970's Test
Factor Loadings For Financial
Ratios By Factor

LAG 0 (t-1)

Ratio	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
FR2	.982						
3	.982						
4	.982						
5	.980						
29	-.949						
30	-.920						
31	-.962						
33	-.634						
8		.555					
10		.947					
11		.893					
20		.946					
6			.955				
9			-.959				
18			.954				
23				.706			
24				.503**	.662		
25				.522**	.598		
26				.713			
27				.737			
28				.618			

Table 5-6 (Continued)

37		.558		
12		.767		
14		.497*		
22		.843		
1			.768	
7			.877	
18			.877	
16				.939
17				.907

*NOTE: factor loadings _ .5 are shown above; an exception was made for FR14. Ratios excluded included FR13,15,21,32,34,35 and 36.

**NOTE: FR24 and FR25 load on both factor four and five and are more difficult to interpret.

Table 5-6 shows that with only seven factors (yet only sixty-eight percent of the variance explained), there still are thirty ratios. To further reduce the number of ratios would be unwarranted given their high factor loadings. The problem also exists for LAG 1 and LAG 2 factor analyses (see Tables 5-7 and 5-8 for an illustration). Because of these problems, it was decided to abandon factor analysis as a possible dimension reduction technique in this specific application.

Table 5-7

Distad 1970's Test
Factor Loadings For Financial
Ratios By Factor

LAG 1 (t-2)

Ratio	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
FR1				.81368			
2	.97847						
3	.97812						
4	.97817						
5	.97063						
6		-.97491					
7				.85861			
8					.50612		
9		.96627					
10					.92224		
11					.79765		
12			.72177				
16*							.69680
17							.72960
18		-.97430					
19			.86832				
20					.92219		
22*			.89164				

Table 5-7 (Continued)

23				.59697
24		.68831		
25		.64324		
26				.73380
27				.75864
29	-.93222			
30	-.94253			
31	-.95571			
36		.76501		
37		.60497		

*NOTE: finacial ratios 13-15, 21, and 32-35 all had factor loadings less than an absolute value of .5.

Table 5-8

Distad 1970's Test
Factor Loadings For Financial Ratios
By Factor Rotation

LAG 2 (t-3)

Ratio	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7
FR1					.84392		
2	.95096						
3	.91723						
4	.94925						
5	.57890						
6							.96544
7					.70769		
8		.54030					
10*		.93298					
11		.79437					
18*							.96284
19					.72434		
20		.93325					
22*			.84940				
24*			.64452				
25			.84145				
26						.95445	
27						.92511	
29*				.92803			
30				.67461			
31				.73882			
36				.55835			
37			.61566				

*Financial ratios 9, 12-17, 21, 23, 28, 32-35 all had factor loadings whose absolute values were lower than .5.

There are two useful discussions remaining however: 1. To compare factor characteristics from my 1970's data test with those obtained by Stevens, and 2. To contrast factor analysis results with MDA acquired results.

D. Distad-Stevens Comparisons of Results Using Factor Analysis

Table 5-9

1. Stevens' Factor Characteristics Compared toDistad's Factor Characteristics

LAG 0 (t-1)

		STEVENS (1960's data)	DISTAD (1970's data)
Factor:	1	Leverage	Profitability Liquidity Market Price to Cash Per Share
	2	Profitability	Leverage
	3	Profitability	Profitability Leverage
	4	Profitability Activity	Liquidity
	5	Activity	Activity Liquidity
	6	Leverage	Profitability
	7	P/E Ratio	P/E and Dividend Payout

Table 5-10

2. Final MDA and Factor Analysis Key Ratios Compared, (From Tables 5-1 and 5-6.)

LAG 0 (t-1)

Ratio	Standardized Discriminant Function	Factor Rotation	Factor loading
TR1	+.360	6th	.768
5	-.251	1st	.990
7	-.707	6th	.877
8	-.277	2nd	.555
9	-.181	3rd	-.959
14	-.158	5th	.497
15	-.220	Did not appear	
16	-.942	7th	.939
17	+.862	7th	.907
18	-.428	6th	.877
21	-.662	Did not appear	
25	-.254	4th/5th	.522/.588
27	-.130	4th	.787
36	-.373	Did not appear	
37	.276	5th	.558

The key observation from Table 5-9 is that leverage and profitability ratios are the most important financial variables. Activity ratios do not appear to be of import in the t-1 models. P/E ratios and dividend payout percents were of comparable levels of importance in spite of the time gap between the two studies, but are of greater import than indicated by Stevens.

The second discussion is to contrast results derived from a factor analysis with those derived from a discriminant analysis model. Table 5-10 uses 1970's data tests performed by Distad and are unrelated to Stevens' earlier study.

From the preceding analysis we see that while MDA is of only limited significance in dimension reduction, it is clearly superior to

factor analysis in this application. Factor analysis was unable to significantly reduce the number of variables. Of perhaps as much importance is the extent of contradicting results of important variables selected via discriminant functions as opposed to the variables selected using a factor analysis, as illustrated in Table 5-10 on the preceding page.

E. Replication of the Stevens Models

After studying merger activity in the Sixties, Stevens cited the need for a follow-up study in a subsequent time period to determine if the financial ratios which reflect the attractiveness of a target vary over time.[8] The purpose of this section is to review his study and to provide the follow-up study.

He conducted two separate tests in his dissertation. The first discriminant function was an ex post test of forty mergers. From an original twenty ratios, Stevens reduced to four, the number of ratios in his final model. His discriminant function was:

$$Z = .005\ x_1 + .934\ X_2 + .064\ X_3 + .352\ X_2 \quad \text{(Equation 5-1)}$$

where the coefficients have been standardized and,

(FR7) X_1 = Net Income/Total Assets

(FR12) X_2 = Sales/Total Assets

(FR31) X_3 = Net Working Capital/Sales

(FR10) X_4 = Long Term Liabilities/Total Assets, and

x_i, i = 1-4 are ranked in ascending order of importance.[9]

Stevens' classification matrix was:[10]

Table 5-11

MDA: Classification Matrix, Observed Groups

Actual	Predicted		
	Acquired	Non-acquired	
	(%) #	(%)	
Acquired	(83) 33 (X_{11})	(17) 7 (X_{12}) =	40
Non-Acquired	(52) 21 (X_{21})	(48) 19 (X_{22}) =	40
	54	26	80

His overall classification success was 65%.

The Stevens replication conducted here was not as successful. Those results are in Table 5-12.

Three separate classifications were conducted, using financial data three, two, and one year prior to the merger. Overall classification scores were 54.4, 53.4, and 52.1% respectively, all significantly below his 65%.

Table 5-12

Distad's Replication of Stevens' Coefficients

	t-3 (IAG 2)	t-2 (IAG 1)	t-1 (IAG 0)	(Equation 5-1) Stevens Observed Groups (t-1)
Ratio FR7	-1.004	.599	.533	X_1 = .005
FR10	- .835	.805	.667	X_4 = .351
FR12	- .258	-.158	-.289	X_2 = .934
FR31	- .390	-.382	-.387	X_3 = .064
Overall Classification Success Rate:	54.44%	53.36%	52.05%	65%

One of the four most critical differences in the Stevens comparison is the lack of uniformity in the signs of the coefficients over time. A second difference is in the coefficients of the Stevens model. Why are the signs of the coefficients different in sign and magnitude? For example; consider sales to total assets, X_2 (FR12). As Stevens indicates:

> This ratio is an indication of how efficiently the assets of the firm are being employed with respect to the generation of sales. The higher the ratio value, the greater the efficiency of the assets in producing sales. The higher the ratio value, the greater the efficiency of the assets in producing sales. If acquired firms were systematically inefficient, with excess liquidity and under utilized assets, ratio X_2 would be lower for the acquired group than for the non-acquired group.[12]

It is puzzling to encounter the sign and magnitude of the coefficient for his sales to total assets ratio (+ .934). A researcher would hypothesize an absolute value somewhere near zero if the ratio was of limited significance, and would certainly hypothesize a negative sign if a weak ratio was significant. Ratios in my updated Stevens test were

negative for all three years, cross-sectionally, prior to the merger, and their absolute values were not extremely large, thereby conforming more to a hypothesized coefficient.

The third critical difference is the difference in the classification ratios' overall ability to properly categorize the two samples. Stevens produced a 65% classificaion rate, but using his ratios I was unable to repeat his success using data from another time period. For a comparison, refer again to Table 5-12.

The fourth critical difference is in misclassification costs. One such type of misclassification appears in Stevens' classification matrix in Table 5-11, and are summarized in Table 5-14.

Misclassification errors in this matrix format are separated into two type of errors (X_{12} and X_{21}). A Type I error, rejecting a correct hypothesis, is the incidence of acquired firms being misclassified as non-acquired firms (X_{12}). Stevens, using two samples of 40 firms each, correctly classified 83% of the acquired firms, (33/40). Hence, Stevens' model is successful in this respect with only a 17% failure rate. My attempt to replicate his model was not as successful. Refer to Table 5-14 for a comparison.

One economic effect of a Type I error is that arbitrageurs are deprived of an opportunity to achieve the risk adjusted superior returns which accrue to stockholders.

A second effect of a Type I error is that managers do not perceive their firms to be likely candidates and are unable to improve the operations of the firm sufficiently to either maximize shareholder returns or to thwart a takeover attempt. It is difficult to assess the impact of this type of error because one aspect of it is the incidence of

layoffs of both management and labor. Perhaps offsetting this aspect is that both management and labor may be shareholders, and they may be extremely well compensated given a takeover attempt, especially if the target is the benefactor of a bidding war between two or more potential acquirers.

A third economic effect of Type I errors is that firms possibly have been acquired unwisely or that the acquirer was motivated for reasons which are not embodied in the four financial ratios employed by Stevens. Again, the literature is replete with the incidence of unwise acquisitions occurring in the Sixties, measured ex-post.

A fourth effect of Type I errors is that firms seeking to acquire other firms for diversification benefits conclude, erroneously, that the target will not become an acquisition and acquirers forego any of the resulting benefits.

A Type II error is the second form of misclassification error. Such classification errors occur when a model suggests acceptance of a false hypothesis. In this application that event exists when the model incorrectly categorizes a merged firm as not likely to be merged, (X_{21}).

The major Type II misclassification cost occurs to arbitrageurs. They incur opportunity costs after committing funds to the purchase of shares of firms which were not subsequently acquired. Additionally, if the misclassified firms demonstrate the hypothesized below average performance, the arbitrageur is exposed to additional losses in the market place, resulting from falling share prices.

Here, Stevens' classification success with non-acquired firms was much lower. His model failed to categorize less than half of the 40 non-acquired sample, 19/40 = 48%, or ($X_{22}/X_{2.}$). And as a result, his

Type II error rate here was large, 21 of the 40 (52%) firms not acquired were incorrectly classified as merger target candidates.

Stevens suggested that though these firms may be candidates for acquisition, the market has not yet perceived them as such.[13] But, the probability that the market has not yet realized the attractiveness of the target as an acquisition is reduced given the results of my update of Stevens' test. Type II errors are shown to exist three years prior to a merger, and very little reduction of that form of misclassification is observed over time, according to my replications. My results appear in Table 5-14.

The effect of Type II errors in Stevens' model " . . . raised some doubt with respect to the usefulness of the model in an operational sense."[14]

* * * * * * * * * * * * * * * *

Because of the larger percent of Type II errors in his model, Stevens reformulated his data into "natural" groups of firms that were merged and those that were non-acquisitions. He referred to the latter as: " . . . eligible firms not yet acquired."[15]

That reclassification of his data produced the following discriminant function. Again, he used the same four ratios, which unfortunately does not tell us if the discriminant function for his "natural groups" contains the "best," or optimal, set of ratios.

The new discriminant function is:

"natural": $Z = .531\ X_1, - .573\ X_2 + .092\ X_3 - .619\ X_4$[16] (Equation 5-2), compared with his

"original": $Z = .005\ X_1, + .934\ X_2 + .064\ X_3 + .352\ X_4$ (Equation 5-1).

Again, X_1 = Net Income/Total Assets (FR7)

X_2 = Sales/Total Assets (FR12)

X_3 = Net Working Capital/Sales (FR31)

X_4 = Long Term Liabilities/Total Assets (FR10)

Using Equation 5-2 provides results such that the coefficients for X_2 and X_4 are nearer their hypothesized values. The coefficient for sales to total assets, X_2 (FR12), should be less than average because the firm is not properly utilizing its assets. The result provided from Equation 5-2 is much closer to the coefficient produced in my replication (in Table 5-12). The coefficient of long term liabilities to total assets, (X_4, FR10), should reflect lower than average debt levels as a percent of capitalization.

The new classification matrix (Table 5-13) indicates an improvement in overall success. Though classification success fell to 63% from 65% (see Tables 5-11, 5-12), there was a reduction in the extent of Type I and II errors.

Table 5-13

Stevens' New Classification of Merger Groups[17]

Actual	New Groupings Predict				
	Factor 1 (Likely to be Acquired)		Factor 2 (Not Likely to be Acquired)		
	(%)	#	(%)		
Acquired	(67)	26	(33)	13	39
Non-Acquired	(41)	15	(59)	22	37
		41		35	76

Overall classification success is: 63% = 26/76 + 22/76

Type II errors (41%) were much greater for Stevens as those levels occurring in my tests, shown in Table 5-14, below.

Type I error levels are much greater in my replications, using his ratios, on new data.

* * * * * * * * * * * * * * * *

Table 5-14

Comparisons of Type I and II Error Levels

Stevens

	Initial Study (Table 5-11)	New Classification (Table 5-13)
Type I Error (%)	17% (7/40)	33% (13/39)
Type II Error (%)	52% (21/40)	41% (15/37)

by Distad

	t-3 (IAG 2)	t-2 (IAG 1)	t-1 (IAG 0)
Type I Error (%)	81% (189/234)	93% (218/235)	91% (214/235)
Type II Error (%)	15% (42/273)	7% (18/271)	8% (20/253)

Stevens then ran a third test, generating a new discriminant function, but not restricting himself to the ratios derived from his original test. From that third test the following discriminant function was calculated:

$$Z = .052\ X_1 + .163\ X_2 + .079\ X_3 - .053\ X_4 - .236\ X_5 \quad \text{(Equation 5-3)}$$

where: X_1 = Dividend Payout (TR16)

X_2 = Net Income/Total Assets (TR7)

X_3 = Net Working Capital/Total Assets (TR24)

X_4 = Sales/Total Assets (TR12)

X_5 = Long Term Debt/Total Assets[18] (TR10)

It is not especially useful to compare the coefficients of this function with his two earlier versions. Because of the inclusion of the fifth ratio, the magnitude of the other four coefficients will be altered. However, only net income to total assets and sales to total assets of the original four ratios remain in the final discriminant function. Stevens failed to explain the different set of ratios in this model. Furthermore Stevens changed his best leverage ratio to long term debt to total assets from his original long term liabilities/total assets. His distinction between debt and liabilities is:

> The only items included in long term debt were actual long term instrument such as bonds and notes. Long term liabilities include in addition, various accounting entries such as deferred compensation, deferred taxes, etc.[19]

No explanation is given for the change, for the effect of the change, or why the new ratio was not employed in the original version of the model. The sign of the coefficient is negative, indicating below average leverage, which is consistent with his natural grouping

coefficient.

My efforts to replicate his third model were less successful.

Use of those five ratios produced a model which was significant at the .0763 level (92.37%). In comparing coefficients:

Stevens': $Z = .052\ X_1 + .163\ X_2 + .079\ X_3 - .953\ X_4 - .236\ X_5$ (Equation 5-3)

Distad's Replication of Stevens:

(IAG 0): $Z = -.538\ X_1 - .417\ X_2 + .361\ X_3 - .025\ X_4 - .665\ X_5$ (Equation 5-4)

Again, clearly there are differences in magnitude and signs of the coefficients.

Stevens indicated an overall classification rate as follows:

Table 5-15

Classification Matrices For Stevens' Reformulated Model

Stevens' Reformulated Model

Stevens Reformulated Model

Actual	Predicted				
	Attractive		Non-Attractive		
	(%)	#	(%)	#	
Attractive	(95)	39	(5)	2	41
Non-Attractive	(13)	4	(87)	31	35
		43		33	76

Distad's Replication

Actual	Predicted				
	Merged		Non-Merged		
	(%)	#	(%)		
Merged	(10)	23	(90)	212	235
Non-Merged	(7)	17	(93)	234	251
		40		446	486

	Stevens	Distad
Classification Accuracy	92%	53%
Type I Error	5%	90%
Type II Error	13%	7%

Clearly, my replication of Stevens' reformulated model was unsuccessful in identifying likely merger candidates, identifying less than ten percent of firms which were merged. It also produced a low total classification score using his model, contrary to the results he obtained from his test of mergers in the 1960s.

LAG 1 and LAG 2 classification rates in the replications produced a 54% overall classification success in both time periods.

In a subsequent article, Stevens introduced a fourth discriminant function from the same time period.[20] In this model,

$$Z = -.033\ X_1 + .987\ X_2 + .108\ X_3 + .111\ X^4 \quad \text{(Equation 5-5)}$$

arranged in ascending order of importance where:

X_1 = Net Working Capital to Total Assets (FR24)

X_2 = Sales/Total Assets (FR12)

X_3 = Sales/Total Assets (FR5)

X_4 = Long Term Liabilities/Total Assets (FR10)

Only X_2 and X_4 appear in the discriminant functions generated in the earlier model versions of his dissertation. In comparing the coefficients of X_2 and X_4 from the article and the dissertation we find:

Table 5-16

Stevens' Coefficient Comparison

Ratio	Original Model (EQN 5-1)	Natural Model (EQN 5-2)	Final Model (EQN 5-3)	Article Model (EQN 5-5)
X_2: Sales/Total Assets (TR12)	.934	-.573	-.953	.987
X_4: Long Term Debt (Liabs)/ Total Assets (TR10)	.352	-.619	-.236	-.111

Stevens' models tell us that sales to total assets ratios for firms being acquired are important, but there is a sharp contradiction considering coefficient signs. Only in Stevens' natural (Equation 5-2) and final (Equation 5-4) models are the coefficients as expected: target firms should be expected to be less efficient than those firms not considered to be as desirable for acquisition. It is possible that different ratios in the final discriminant function would account for coefficient magnitude variations, but there does not appear to be an explanation for the differing signs.

Furthermore, there does not appear to be any reconciling the positive coefficient calculated for long term liabilities (or debt) to total assets. In his equation 5-3, the coefficient using long term debt rather than long term liabilities was not materially different from his coefficient in equation 5-5. Again, I am unable to reconcile his positive coefficient (+.352) in equation 5-1.

The classification matrix from the model appearing in his article is:

Table 5-17

Stevens Model (Equation 5-5)

Actual	Predicted			
	Merged		Non-Merged	
	(%)	#	(%)	
Merged	(85)	34	(15)	6 = 40
Non-Merged	(45)	18	(55)	22 40
		52		28 = 80

Distad's Replication (LAG 0)

Actual	Predicted			
	Merged		Non-Merged	
	(%)	#	(%)	
Merged	(7)	16	(93)	213= 229
Non-Merged	(6)	15	(94)	238 253
		31		451= 482

Stevens		Distad
Classification Accuracy	70%	53%
Type I Error	15%	93%
Type II Error	45%	6%

To summarize Stevens' endeavors, he derived four different models; the first of which (Equation 5-1), using return on assets (TR7), total asset turnover (TR12), net working capital as a percent of sales (TR31), and long term debt as a percent of total assets (TR10) produced an overall classification success rate of 65%. This first model would have produced considerably better results if the Type II error level, 52 percent error rate, could be reduced. My three replications of his first model were less successful producing success rates in the 52-54 percent range.

The extent of the Type II error levels in Stevens' first model necessitated a second model, (Equation 5-2). His overall classification success dropped slightly to 63% from 65% and his Type II error level rate fell to 41% from 52%. The ratios used in his second test were those from his first model, but the regrouping by "natural" rather than by actual groups produced discriminant coefficients with conflicting signs and sharp differences in the magnitude of their absolute values.

Stevens' third model (Equation 5-3) was another discriminant function of the same data; the only differences were the inclusion of an additional ratio, dividend payout (TR16) and a redefinition of long term debt. In this third model long term debt disregarded various deferred liabilities including taxes and compensation. This third model demonstrated much higher classification success (92%) and dramatically lower Type I (5%) and Type II (13%) error rates. My efforts to replicate this third model were not as successful. My replication produced a 53% classification rate, and Type I (90%) and Type II (7%) error rates. His model, when applied to my sample in a different time span could not isolate mergers, classifying only 23 of 235 firms which had already been

acquired. Please refer to Table 5-15 for a more extensive discussion.

Stevens' final model (Equation 5-5) was constructed for a published article [123]. Using this model Stevens obtained a 70% classification success. He also attained Type I (15%) and Type II (45%) error rates. My attempt to replicate his model were less successful generally with the exception of a lower Type II error rate(6%). My replication produced an overall classification rate of 53% and a high Type I error rate (93%). In other words, his model classified only 16 of 229 firms which had already been acquired in my sample. A more detailed discussion of his model and my replication appear in Table 5-17.

It is important to emphasize that any conclusions reached as to the efficacy of Stevens' models in subsequent time periods is reduced to the limitations of my sample and replications. My replications indicated that his ratios, their coefficients, and his models did not demonstrate significant ex post classification success in any instance. Obviously it is necessary that his models be tested again in subsequent time periods, as well as mine, to ascertain their significance economically and statistically. More importantly, his models were also unable to predict mergers, ex ante, occurring in a subsequent time span. A more detailed discussion of that deficiency is provided in Chapter VII.

F. Analysis of the Simkowitz-Monroe Model

At approximately the same time as the Stevens [135] study, Simkowitz and Monroe (SM) completed a study of firms likely to be acquired by conglomerates [118]. Because the study was restricted to conglomerate acquirers it has received less attention here than that given the Stevens Study.

However, it needs to be considered because the S' study used a dimension reduced version of an MDA model which resulted in a set of "key" ratios unlike those derived in Stevens' reduced set of variables obtained using a factor analysis. In a subsequent article, Stevens wondered if the resulting dissimilar set of ratios was attributable to the differing dimension reduction techniques.

S' concluded that four financial ratios were most important. Listed in descending order of importance, they are: 1. low price to earning ratios, 2. low dividend payout rates, 3. low growth rates in equity, and 4. lower dollar levels of sales than their acquirer's sales levels.

One of the chief differences between the S' and Stevens studies was in the importance of price to earnings per share ratios (p/e). S' concluded that lower than average p/e ratios were the most important variable in classifying a firm likely to be acquired by a conglomerate in the 1960s. That is very consistent in the merger literature of that time as a motive for mergers as well as a characteristic of acquisitions. Stevens concluded otherwise in his test. His test was not confined to conglomerates, and nowhere in his four different discriminant functions was he able to statistically justify the inclusion of p/e's in his models.[14]

In my studies, p/e's (PR17) failed to enter the final discriminant function in LAG 2, but was -.2165 in LAG 1,and +.8622 in LAG 0.

Looking at those standardized coefficients, we see that p/e's are not important three years prior to a firm being acquired. However, two years in advance, p/e's become important, and because of the negative sign, we know that acquired firms have lower p/e's than non acquired

firms. Finally, one year prior to a merger, we see that acquired firms have p/e's higher than nonacquired firms. One plausible explanation for a change in the sign of coefficients here is the market has identified the potential acquisitions and forced up the price of the common stock in anticipation of a subsequent tender premium by a potential acquirer. Another possible explanation for a sharp increase in the p/e's of acquisitions is a decrease in earnings per share in the year preceding a merger, with no accompanying decreases in their stock prices.

Comparing the above to the results obtained in a factor analysis, the factor loading for p/e's is high (.8328) in the LAG 2 model, but does not appear until the eleventh rotation. For LAG 1, again, the loading is high (.7296) but does not appear until the seventh factor, which is also the case for the LAG 0 factor loading of LAG 0 (.9096). LAG 0 and LAG 1 loadings are illustrated in Tables 5-6 and 5-7.

I conclude that the strongest case for p/e's comes from discriminant analysis, because p/e's have limited importance using a factor analysis. The latter can be verified by checking Table 5-10 to see how little a reduction of variance is obtained through a seventh factor.

S' s second ratio was dividend payouts (R16), which was also Stevens' second most important ratio. They hypothesized that dividend payouts would be lower for acquired firms than for non acquired groups. Stevens' results rejected his hypothesis: the sign of the coefficient was positive, indicating that acquired firms in his study had higher dividend payouts (.052), as in equation 5-3.

My findings indicate that payouts are not important three years prior to an acquisition, of only moderately importance (.3098) two years

prior, and very important one year prior to a firm's being acquired (-.9418). The LAG 1 standardized coefficient should be considered more of an ex post classification. The key discriminant coefficient one year prior to the merger (LAG 0) is large and negative indicating acquired firms do have lower dividend payouts than do non acquired firms, which is consistent with their hypotheses. In a factor analysis, dividend payouts do not become significant until the seventh factor, at the earliest, again connoting little significance. S''s third ratio, growth rates in common equity, was hypothesized to be lower for acquired firms, which neither Stevens nor I tested. However, I did test return on net stockholders' equity (PR6). A discriminant coefficient with a negative sign might be similar to the S'' hypothesis. Using MDA, PR6 appeared in a final discriminant function only in LAG 1, with a standardized coefficient of .2767 which is not significantly large, but does not possess a negative sign. Because factor analysis results were inconclusive as well, I conclude that rates of return on stockholders' equity are not important in identifying potential acquisitions.

The fourth financial variable, dollar level of sales was not tested here, but observation of the data in Table 4-3 illustrates large differences in sales levels. Clearly, acquired firms are smaller when measured by sales.

G. Conclusion

My test supports two of the four ratios used by S''. Merged firms in my test had lower dividend payout ratios, and had lower dollar levels of sales. But I was unable to produce meaningful return on equity ratio results. Because he tested growth rates in return on equity, rather than return on equity, my test results may not contradict his

hypothesis.

Furthermore, the review of factor analysis in this section suggests that it does produce the differing set of key ratios as hypothesized by Stevens.

Footnotes

Chapter V

1. William W. Cooley and Paul R. Lohnes, Multivariate Data Analysis (New York: John Wiley and Sons, 1971): 145.

2. Joseph F. Hair et al, Multivariate Data Analysis With Readings (Tulsa: Petroleum Publishing Company, 1979): 232.

3. Cooley and Lohnes, p. 145.

4. Donald Lee Stevens, "A Multivariate Analysis of Financial Characteristics of Acquired Firms In Industrial Mergers," (Ph.D. dissertation, Michigan State University, 1972): 58, 59.

5. Hair et al, p. 234.

6. Cooley and Lohnes, p. 165.

7. Stevens, "A Multivariate Analysis," p. 53.

8. Ibid, p. 116.

9. Ibid, pp. 70-72.

10. Ibid, p. 76.

11. Ibid.

12. Ibid, p. 70.

13. Ibid, p. 78.

14. Ibid, p. 76.

15. Ibid, p. 78.

16. Ibid, p. 86.

17. Ibid.

18. Ibid, pp. 91-93.

19. Ibid, p. 93.

20. Donald Lee Stevens, "Financial Characteristics of Merged Firms, A Multivariate Analysis," Journal of Financial and Quantitative Analysis 8 (March, 1973): 154.

21. Ibid, p. 156.

Chapter VI

Validation of MDA In Merger Analysis

A. Discriminant Analysis Results Compared to Univariate Results

Empirical studies using MDA generally provide a comparison of key variables isolated using MDA with the univariate F test variable scores. The difference between the two forms of analysis is the MDA method analyzes variables simultaneously whereas the F tests are a sequential (univariate) form of analysis. Authors expect better results using MDA because the simultaneous analysis is expected to provide a better profile.

Table 6-1 illustrates those ratios which appeared in the final MDA model, their standardized discriminant coefficients, and then in comparison, each ratio's F test score and its resulting level of significance.

Data for this table is from SPSS using a RAO V MDA dimension reduction, and Statistic 6 of the Subprogram DISCRIMINANT.

Table 6-1

Distad's 1970's Data Test: Univariate Tests of Significance on MDA Selected Key Financial Ratios

6-1 (a)

LAG 2, (t-3)

(From Table 5-1)

Ratio	Discriminant Score	F Score	Significance
FR3	.5639	2.529	(.1125)
4	-.6314	1.770	(.1840)
7	.5623	4.427	(.0359)
10	.3008	1.026	(.3117)
12	.3091	.006	(.9401)
15	.3327	.300	(.5843)
21	.7074	30.340	(.0000)
23	.2628	7.799	(.0054)
26	.2060	1.891	(.1697)
29	.2973	1.631	(.2022)
32	-.2090	4.718	(.0304)
33	-.4938	10.16	(.0015)
34	-.2689	2.997	(.0841)

There were some contradictions in the LAG 2 comparison. Most conspicuous are FR12 (sales to total assets) and FR15 (interest expenses to cash and marketable securities) which have marginal importance in an MDA context but virtually no significance in a univariate context. Other ratios which have poor univariate F tests also tend to have low discriminant scores. These include FR10 (long term debt to total assets), 26 (current ratio), and 29 (current assets to sales). One surprising result is that while FR4 (net income to sales) has a large discriminant score it is only significant at the (0.1840) level. Finally, p/e ratio (FR17, 0.0301 significance), cash flow to total assets (FR19 0.0363) and cash to current liabilities (FR28, 0.0171) all were highly significant in a univariate analysis, but in a multivariate test failed to enter the final discriminant function.

Table 6-1(b) and 6-1(c) are LAG 1 and LAG 0 Versions of Table 6.

Table 6-1(b)
LAG 1, (t-2)

Ratio	Discriminant Score	F Score	Significance
FR1	.4202	1.122	(.2901)
6	.2767	1.448	(.2295)
9	.4571	.576	(.4481)
15	.5284	3.667	(.0561)
16	.3098	1.537	(.2157)
17	-.2165	.151	(.6978)
21	.8061	33.4	(.0000)
22	.1656	.276	(.5994)
26	.2143	1.372	(.2421)
32	-.3466	1.262	(.2618)
33	-.5583	.084	(.7721)
34	.2810	.3549	(.5516)
35	-.1884	2.638	(.1050)
36	.2110	1.017	(.3136)

The most striking observation in LAG 1 comparisons is that only one variable FR21, total assets, was clearly significant. Interest expenses to cash and marketable securities (FR15, 0.0561) would be categorized as marginal). The remaining ratios, though identified by MDA had no univariate significance.

Table 6-1(c)

LAG 0, (t-1)

Ratio	Discriminant Score	F Score	Significance
FR1	.3600	2.000	(.1580)
5	-.2514	1.392	(.2387)
7	-.7066	2.903	(.0891)
8	-.2768	4.230	(.0403)
9	-.1812	.900	(.3433)
14	-.1579	.009	(.9231)
15	-.2196	9.512	(.0022)
16	-.9418	2.698	(.1012)
17	.8622	.020	(.8887)
18	-.4277	2.710	(.1004)
21	-.6620	37.24	(.0000)
25	-.2543	.001	(.9749)
27	-.1297	.421	(.5168)
36	-.3727	2.395	(.1224)
37	.2762	2.494	(.1150)

The LAG 0 model is more complex. Long term debt to total assets, (FR10, 0.0249) significance) and total liabilities to total assets, (FR11, 0.0429) failed to enter the final discriminant function. Conversely p/e ratios (FR17) had a large discriminant coefficient (.8622) but virtually no univariate significance (0.8887). Only total assets (FR21) can be categorized as having both a high discriminant function and a high F score (-.662 and .0000).

The other ratios fall provide mixed results in terms of discriminant functions and F scores. For example, net income to total

assets and dividend percent payout (FR7 and 16) have high discriminant scores, but marginal F scores. Refer to table 6-1(c); F score significance levels are 0.0891 and 0.1012 respectively. Conversely, long term debt to market value equity, and interest expenses to cash and marketable securities, (FR8 and 15), have low discriminant coefficients (-.2763 and -.2196) but very good F scores; (0.0403 and 0.0022 respectively).

B. Conclusion

To summarize, LAG 0 has few clear contrasts or agreements and many ambiguities.

Recapitulating over all three models, univariate F tests are more restrictive, isolating fewer key ratios, thereby producing a model with lower classification success than attainable using a reduced dimension discriminant function. See Table 6-2 for an illustration.

Table 6-2

Key Ratios Selected Using

Univariate F Tests Significant To .05

LAG 2	LAG 1	LAG 0
FR7	FR15	FR8
17	21	10
19		11
21		15
23		20
28		21
32		
33		

Chapter VII

Implications and Uses

A. The Prediction of Mergers

Earlier in this test a reference was made to Joy and Tollefson's contention that there is a sizeable difference in results between ex post classification and ex ante prediction.[1] An ex post classification MDA based model "fits" a profile of variables, and weights those variables according to their importance in the maximal separation of two or more groups. Some of the variables may be coincidental, yet "fitted" and as a result be spurious in a predictive model unless that coincidental relationship between variables continues in the future.

It is important therefore to subject all the models tested in this paper to an ex ante predictive model, because it is the most important test of these models.

A sample of fifty firms, acquired in 1979, were classified by the discriminant functions generated by Stevens and by me. It is important to emphasize that the 1979 data subset was never used in the determination of any of the previously discussed discriminant models; to do so would impart an upward bias in the classification success in the ex ante prediction test and invalidate the results. Table 7-1 illustrates ex ante prediction rates.

1. Stevens' Models

Table 7-1

Ex Ante Prediction Models

7-1(a)

Stevens' Original Model: (EQN 5-1).

FR7,10,12,31.	LAG 2	5 of 39 mergers	= 13%
	LAG 1	2 of 38 mergers	= 5%
	LAG 0	1 of 37 mergers	= 3%

where FR7 = net income to total assets

10 = long term debt to total assets

12 = sales to total assets

31 = net working capital to sales

Table 7-1(b)

Stevens' Reformulated Model: (EQN 5-3).

FR7,10,12,16,24	LAG 2	7 of 40 mergers	= 18%
	LAG 1	1 of 39 mergers	= 3%
	LAG 0	1 of 38	= 3%

where FR7 = net income to total assets

10 = long term debt to total assets

12 = sales to total assets

16 = cash dividends as a percent of net income

24 = net working capital to total assets

Table 7-1 (c)

Stevens' Article Model: (FCN 5-5)

FR5,10,12,24	LAG 2	6 of 39 mergers	= 15%
	LAG 1	0 of 38 mergers	= 0%
	LAG 0	0 of 37 mergers	= 0%

where FR5 = net operating income to sales

10 = long term debt to total assets

12 = sales to total assets

24 = net working capital to total assets

7-1(d)

2. Distad's Models

Reduced Dimension (from Table 5-1)	LAG 2	15 of 39 mergers	= 39%
	LAG 1	8 of 38 mergers	= 21%
	LAG 0	9 of 34 mergers	= 26%

7-1(e)

Method Direct (from Table 4-3)	LAG 2	9 of 38 mergers	= 24%
	LAG 1	9 of 36 mergers	= 25%
	LAG 0	8 of 33 mergers	= 24%

The important contrast is that Stevens' models demonstrate significantly lower ex ante classification success than the more recent discriminant functions, which is consistent with the high level of type I error rates found in my 1970's data replication of his model, as shown in Table 5-14.

Stevens' FR5, earnings before interest and taxes divided by sales had consistently lower discriminant scores than another profitability ratio, FR7, his second ratio and one of my most important ratios, net income dividend by total assets.

Stevens' third ratio, FR10, a leverage ratio, long term debt divided by total assets, was not important in my tests, though this was Stevens' most important ratio. Two other leverage ratios, FR8, long term debt divided by the market value of common stockholders' equity and FR9, long term debt divided by book value net stockholders' equity, were of only marginal significance. I found FR15 to be a very important ratio, (interest expenses divided by cash and marketable securities). Stevens categorized FR15 as "other," but I categorized it as a leverage ratio because the extent of leverage measured by debt to assets or equity is not as important as the ability to pay annual interest expenses. In that context I consider FR15 to be an excellent leverage ratio.

Stevens' fourth ratio, sales divided by total assets (FR12) appeared once in the LAG 2 model. The only asset efficiency ratio of significance was FR37, sales divided by net fixed assets. The significance of FR37 may confirm my earlier hypothesis that acquired firms tend to have higher fixed asset turnover ratios (FR37) because they are using depreciated fixed assets which are worth more to an acquirer than their book value, or improperly valued natural resources.

Nevertheless, FR37 did not become significant until one year prior to an acquisition, LAG 0.

Stevens fifth ratio, FR16, dividend payout, was not an important ratio in this study, particularly in LAG 0 model.

FR24, net working capital divided by total assets, a liquidity ratio, never entered any of my discriminant functions.

The last ratio used by Stevens was FR31, net working capital to sales. That ratio apparently no longer is considered to be important. It had low discriminant scores in my original model and failed to appear in any of my dimension reduced final models. Again, assuming that ratio is classified as a liquidity ratio, it contributed nothing to the prediction of mergers.

Low returns on assets and low dividend payout rates remain important in the selection of merger candidates. After those two ratios, very little comparability exists over time. Leverage does not appear to be as important as the ability to pay interest expenses. Total asset turnover's importance has diminished as the focus now appears to be on the value of fixed assets. Also, unless compared to market price (FR33-35), liquidity ratios seem to have diminished in importance. One possible explanation for the diminished success of Stevens' ratios is that they have contributed to the efficiency of the merger process; therefore the ratios are no longer useful.

* * * * * * * * * * * * * * * *

Because Stevens examined financial ratios of acquired firms one year prior to their acquisitions, he could not have known that he might have obtained greater success using different ratios three years prior to a firm's acquisition. Only additional follow-up studies replicating

both Stevens' and my models can verify that possibility.

The ability of these three models to identify merged firms from that subset represents only a portion of a complete ex ante prediction endeavor. The models must also be able to correctly identify non-merged firms in the same time span, 1979. Furthermore, it is inappropriate to sample an equal number of non-merged firms because such a composition of samples is not representative of the level of merger activity in any year. In any given year, it is not possible to predict precisely the percent of all corporations acquired in the United States. Additionally, such a percent would lack validity for at least two reasons: 1. it would be distorted by the large number of firms too small to be tested in this study, and 2. because all acquired cases studied here were sufficiently large to warrant inclusion in the Compustat Industrial File, this test addresses acquisition size in dollars, rather than percent of acquisitions. However, some attempt to imbalance the two subsamples must be undertaken to acknowledge the large difference, even in years of extreme merger activity.

A random sample was extracted from the Compustat Industrial File, to serve as the control group, a list of firms still not acquired. This random sample was 843 cases, which was reduced to 823 cases to avoid the problem of firms with dissimilar accounting definitions. Also, because the SPSS program will not accept any company with missing accounting variables, there were finally 684, 653, and 553 cases in the control group providing accounting data for the years 1976, 1977, and 1978 respectively, (LAG 2 through LAG 0). Because this part of the test is not cross-sectional in nature, LAG 2 does equal 1976, three years prior to the acquisition, and so on for 1977 = LAG 1 and 1978 = LAG 0.

Again, it is not possible to predict percent levels of merger activity in any year, but I decided that 5.7% (39/684); 5.9% (33/653); and 6.1% (34/553) would be representative.

The only model used in this portion of the test was the Distad Reduced Dimension model because of its comparatively better predicting results in classifying acquired firms, as reported in Table 7-1(d). Other models appearing in Table 7-1 may better classify non-merged cases offsetting lower merger identification results, but in light of the results it is unlikely for such an event to occur.

Because neither the merged nor non-merged cases classified here were used in the determination of the discriminant models, and because they were selected randomly, I am assuming these cases are largely unbiased and are valid samples.

The following three matrices provide the results of the total classification success of each of the three discriminant functions.

Table 7-2

Ex Ante Classification Results,

Distad's Reduced Dimension Model

7-2(a)

LAG 2, 1976

Actual	Predicted				
	Merged		Non-merged		
	#	(%)	#	(%)	
Merged	15	(2.1)	24	(3.3)	39
Non-merged	60	(8.3)	624	(86.3)	684
					723

Type I Error Rate (24/39) = 61.5%

Type II Error Rate (60/684) = 8.8%

Total Classification Success: 88.4%

Maximum Chance Success: 94.6%; t = -7.37

Proportional Chance Success: 89.8%; t = -1.24

7-2(b)

LAG 1, 1977

Actual	Predicted				
	Merged		Non-merged		
	#	(%)	#	(%)	
Merged	8	(1.2)	30	(4.3)	= 38
Non-merged	178	(25.8)	475	(68.7)	= 653
					587

Type I Error Rate (30/38) = 78.9%

Type II Error Rate (178/653) = 27.3%

Overall Classification Success: 69.9%

Maximum Chance Success: 94.5%; t = -28.36

Proportional Chance Success: 89.8%; t = -16.96

7-2(c)

IAG 0, 1978

Actual	Predicted				
	Merged		Non-merged		
	#	(%)	#	(%)	
Merged	9	(1.5)	25	(4.3)	= 34
Non-merged	140	(23.9)	413	(70.3)	= 553
					587

Type I Error Rate (25/34) = 73.5%

Type II Error Rate (140/553) = 25.3%

Overall Classification Success: 71.9%

Maximum Chance Success: 94.2%; t = -23.11

Proportional Chance Success: 89.1%; t = -13.37

Results of ex ante classification are disappointing because of the very low t statistics, indicating that these three models cannot predict mergers.

However, these results are important for several reasons:

1. These endeavors reflect the results of the first attempt to predict mergers. Much of what has been previously written in the literature must be subjected to closer scrutiny because those tests were ex post classifications, and their conclusions were presumed to be valid in an ex ante application, which was clearly not so based on this first test. Acquisition candidates do not appear to always be obvious, and each case may be unique.

2. These results suggest that it is not possible to predict mergers using publicly available information. Or if it is possible, a model must use a set of financial ratios different than the thirty seven used here, which seems unlikely.

3. The classification rates and t scores reveal the "best" model for predicting mergers is the LAG 2, use of information publicly available three years prior to a firm's subsequent acquisition. Such a finding, if confirmed by subsequent studies should be a significant contribution.

4. This model has attempted to approximate the likelihood of merger in 1979, using a 5% sample of merged firms.

Results from this study suggest that additional studies may be warranted because of this large variation in size of the two samples. The LAG 2 model had an 88.4% overall classification rate, but this is distorted by the much larger sample of non-merged firms. The Type II error rate was less than nine percent (60/684), but because the

non-merged firms were 94.6% of the total test, it was impossible to exceed that maximum chance likelihood. To obtain a one tailed t test t score greater than 1.96 (α = .005, ∞ d.f.) required a 96.3% classification success. If the model had been able to predict all of the merged firms, the model still would have produced an unacceptable level of prediction because of a nine percent Type II error rate.

The classification matrix below is that which is required to obtain an α = .005, (t = 1.96, ∞ d.f.):

Table 7-3

Hypothetical Classification Matrix, LAG 2

Assuming a 94.6% Maximum Chance Rate, and

a 100% Success Rate Predicting Merged Firms

Actual	Predicted	
	Merged	Non-merged
Merged	39	0
Non-merged	29	655

Such a classification result is necessary to produce the 696/723 overall classification rate significant at .005. Those results require a model producing no Type I error rates and only a (29/684) 4.2% Type II error rate. Use of the proportional chance model provides less restrictive conditions, but is still a rigorous test when the sample sizes are so unequal. If the model again had perfect merger classification success (39/39), the number of non-merged firms misclassified as merged (Type II error) would have to decline only by 2

to 58 to produce a model significant at $\alpha = .005$, with ∞ d.f. at $t = 1.96$.

Finally, if it were possible to obtain a merged sample ten times as large as the above results, 150 merged, 240 misclassifications totalling 390 cases, the following results would be reported:

7-4

Hypothetical Enlarged Sample
Classification Matrix, LAG 2

Actual	Predicted		
	Merged	Non-merged	
Merged	150	240	= 390
Non-merged	60	624	= 684
			1074

Total Classification Success = 72.1%

Maximum Chance Classification Success = 63.7%; t = 5.71

Finally, equal sample sizes with proportional results for merged firms classification produces a larger difference in significance compared to maximum chance, t = 10.98.

Obviously, sample sizes affect the conclusions of these results greatly and must be dealt with carefully in subsequent studies.

B. Conclusions:

Results of this study indicate that even with the use of MDA on financial ratios, it is not possible to predict mergers, thus perhaps precluding any opportunities to isolate firms which will ultimately offer risk adjusted excess returns.

The next steps to be taken in future studies are to replicate the study using larger samples of both merged and non-merged firms, maintaining approximately a 3-7 percent sample of merged firms. The other study ought to be an analysis of the individual firms to ascertain if the premiums garnered from predicting 15 of 39 mergers were sufficient to offset any losses from an investment in the 60 of the 684 non-merged firms mistakenly classified as being merger candidates, and also to ascertain if those sixty firms were subsequently acquired.

Finally, it must be emphasized that this study is an initial inquiry. While preliminary results strongly suggest that it is not possible to predict mergers it will be necessary to replicate this test for confirmation. Most significantly, and surprisingly, the evidence suggests that the greatest likelihood of obtaining a working model should address the data available three years prior to a firm's acquisition.

The next chapter, the conclusion comments further upon the ratios, their coefficients, and their changes in magnitude and sign over time.

Footnotes

Chapter VII

1. Maurice O. Joy and John O. Tollefson, "On the Financial Applications of Discriminant Analysis," Journal of Financial and Quantitative Analysis 10 (December, 1975): 727.

Chapter VIII

Conclusions and Evaluations, Limitations and Future Research Suggestions

A. Summary of the Results

This study has been conducted to determine whether financial ratios can predict mergers.

A stepwise MDA model was employed in an attempt to reduce to a more manageable level, the number of ratios from the original thirty seven. The final models produced thirteen to fifteen ratios. Efforts to further reduce the dimensions of the model produced models with lower classification results.

The discriminant functions used to classify firms in the samples were significant at the .001 level to .0001 level and beyond, in ex post tests, but lacked significance in the ex ante tests.

Considerable care was taken to ensure that the necessary statistical precautions were employed in this application. Such precautions include split sample procedures and a hold out group used for an ex post classification. More importantly, those models were then used to conduct an ex ante prediction of mergers in a subsequent time period. This is the first ex ante predictive mergers test known to me. As presumed, results were lower for the ex ante test than for the ex post test.

The test was thorough, using data from two Compustat data files. Two hundred thirty five acquired firms were tested with three hundred and four non-acquired firms. It is presumed that these sample sizes are sufficiently large to make the study robust to the violation of the equal variance-covariance requirement asserted by Eisenbeiss [52]. No one has yet determined what are "large" sample sizes, only that large sample sizes will strengthen the design of any MDA designed experiment.

Mergers tested occurred in the period 1970 through 1976. The ex ante test was applied to a set of fifty mergers occurring in 1979 and also to a set of eight hundred forty five randomly selected non-acquired firms in 1979.

The fifteen ratios selected by the step wise MDA process, ranked by type of ratio, were:

Profitability Ratios

1. net operating income as a percent of total assets
2. net operating income as a percent of sales
3. net income after taxes as a percent of total assets
4. cash flow to book value tangible stockholders' equity
5. tax loss carry forward per share to market price per share of common equity

Liquidity Ratios

6. quick current assets as a percent of total assets
7. quick current assets as a percent of current liabilities

Leverage Ratios

8. long term debt as a percent of market value stockholders' equity

9. long term debt as a percent of book value tangible stockholders' equity
10. interest expenses as a percent of cash and marketable securities

Activity Ratios

11. sales to quick current assets
12. sales to net fixed assets

Market Ratios

13. dividends paid as a percent of earnings
14. price to earnings per share ratio

Other

15. total assets - not a ratio, a stratification measure

In spite of changing financial characteristics and a myriad of motives for merger, some of the hypothesized financial characteristics of acquisitions were confirmed. In Chapter 1 of this report, my hypotheses, which were consistent with the existing literature, were that an acquired firm tended to have excess liquidity, unutilized debt capacity, favorable earnings, and be priced in the markets at a level below the company's book value per share.

Acquired firms were profitable, but interestingly only operating profits were favorable. Net income and cash flows ratios were less than those of nonacquired firms, suggesting extraordinary or nonrecurring economic or accounting events depressing after tax profits.

Merged firms tended to be less levered and less liquid than nonacquired firms, but the differences were not major. One possible

exception to this was the large negative coefficients of IR33, market price to cash per share in the LAG 2 and LAG 1 models.

Activity ratios indicated that sales to quick current assets were lower for acquired firms. More interestingly, sales as a percent of net fixed assets were greater for acquired firms. The possibility there is the firm's assets have been depreciated more fully than for nonacquired firms which suggests their market value for assets is greater than their book values.

Acquired firms were not priced by the markets at levels below their book values. A "market to book" ratio failed to enter the final discriminant function. One possible explanation for this might be that speculators may have bid up the price of the equity previously in anticipation of a takeover. That is consistent with the literature reviewed in Chapter II. Further support for that explanation is provided by the higher than average P/E ratios shown by acquisitions one year prior to a merger.

Analyzing market value as a percent of book value in models three years and then two years prior to a merger, market is lower than book three years prior. Then two years until a merger, the ratio is no longer significant suggesting that stock prices appreciate as much as two years prior to a merger, which again is consistent with the literature.

The important results from this study are that financial ratios may yet be used to predict mergers, but it takes many more ratios to accomplish that objective than previously indicated. Furthermore, success rates are not as good as reported in previous tests for several reasons including:

1. previous tests never attempted to predict mergers,

2. economic, financial and accounting conditions have changed introducing the possibility of more motives for mergers.
3. the presence of arbitrageurs may affect market ratios and force management to develop strategies more rapidly to fend off potential acquirers, which will reduce the comparability of ratios significant in 1960s mergers to those useful for predicting mergers in the 1970s.
4. the absence of any qualitative criteria.

The remaining portion of this chapter elaborates upon the above conclusions and others of less significance.

B. Prediction of Mergers

Financial ratios can predict mergers, but the thirty-nine percent success rate produced using a dimension reduced model on financial ratios existing three years prior to the merger is a disappointing result. Suggestions for subsequent studies include testing other financial ratios not used here, obtaining larger test samples, and perhaps most interestingly, ascertaining whether stock prices began appreciating prior to the ratio model's prediction of a merger. Another interesting test is to rank the percent stock price gains of the identified candidates. Large premiums would enhance the predictive value of this model from the perspective of the arbitrageur. Simkowitz and Monroe, Belkaoui, or Stevens did not use ex ante predictive models so it is not possible to comment on their usefulness in that context. It is now known that my replications of Stevens' models in this instance, were unable to identify merger candidates either in an ex post classification, (see Tables 5-14, 5-15, and 5-17) or in an ex ante prediction, (see Table 7-1), when replicated on mergers data from

the 1970's.

Such a dramatic decline in the success of the Stevens models from results obtained in these replications necessitates an inquiry into any economic events transpiring since his 1960's study which might account for this presumed decrease in efficiency. There are several reasons for the reduced applicability of his models. His last model, equation 5-5, which is presumed to be his most successful model, included these key ratios:

(Equation 5-5) a. Profitability: FR5; earnings before interest and taxes to sales

b. Leverage: FR10, long term liabilities to total assets

c. Activity: FR12; sales to total assets

d. Liquidity: FR24; net working capital to total assets

a. Profitability

Currently other profitability ratios appear to be more significant than FR5. Those ratios include FR1, earnings before interest and taxes to total assets and FR7, net income to total assets. Explanations for the current importance of FR1 and FR7 are two fold: first, total assets appears to be more important than sales as a criteria of percent profitability. The large positive coefficients of FR1 suggest that acquired firms have larger operating income, or more likely, have lower book value total assets which supports the recently

advocated cheaper to buy than build theory. The second explanation is derived more from the negative coefficient FR7 which illustrates that acquired firms have less net income and fewer total assets than do non-acquired firms. The difficult part of the explanation is reconciling the higher than average operating income with the lower than average net income after taxes, (FR7).

Some accounting or economic event(s) reduces higher than average levels of net operating income to lower than average after-tax profits. Tax loss carryforwards are one possible explanation. FR36, the ratio of tax loss carryforward per share divided by the market price of the common stock, produces a +.21101 coefficient in LAG 1 which indicates a higher than average ratio. In LAG 0, the ratio's coefficient falls to a -.37273, suggesting a dramatic stock price increase between LAG 1 and LAG 0. It can be concluded that tax loss carryforwards are only one possible explanation. No tests for other nonrecurring accounting events were tested.

B. Leverage

Two other leverage ratios currently appear to be more important than FR10, long term liabilities to total assets. They are FR9, long term debt to the book value of tangible common stockholders' equity and FR15, interest expense as a percent of cash plus marketable securities. FR10's reduced reliability is probably due to the declining comparability of book values to market values of both debt and equity. Market values of debt are likely to be smaller than book values because of rising interest rates throughout the 1970's. There is considerable evidence to suggest that market values of assets in some industries are greater than their book values. Because these variations would not

offset each other, FR10, a ratio using both book value long term debt to book value total assets would be of diminished economic significance.

FR15 suggests that the extent of a debt to assets ratio is not as important as the ability to have sufficient liquidity to meet interest expense requirements. Because the coefficients of FR9 and FR15 change over time it is necessary to explain them. FR9 has coefficients of .457 and -.181 in the LAG 1 and LAG 0 models. The .457 coefficient suggests a higher than average debt to tangible equity ratio than firms not likely to be acquired. Because the numerator, long term debt, is not likely to change rapidly, it appears that the subsequent decline in the LAG 0 model to -.181 is attributable to an increase in the denominator, the book value of the equity. However, because of the small coefficient, the LAG 0 ratio has reduced significance.

FR15 has coefficients of .333, .528 and -.220 (LAG 2 through LAG 0 respectively), suggesting a deteriorating ability to fund interest expenses, until LAG 1 when the acquired firm increased its cash, retired debt or a combination of both. The cash accumulation possibility may be the result of a takeover defense.

c. Activity

Activity ratios no longer appear to have much significance, with one very important exception, fixed assets turnover, a ratio not tested by Stevens because it was not important in the rising stock market characteristic through the 1960's. That ratio is sales divided by the net book value of fixed assets. That ratio is justly criticized because it fails to separate firms with new fixed assets operating at high levels of efficiency from firms operating less efficiently using older more heavily depreciated assets. In a multivariate context firms whose

market value of fixed assets is greater than their book value should be isolated as potential acquisitions assuming the cheaper to buy than build philosophy is valid.

In this test, it was presumed that the buy versus build contention was a motive for mergers. Acquisitions were hypothesized to possess higher fixed asset turnovers because either: 1. their fixed assets possess replacement values which are greater than are their book values, or 2. included in the accounting designation fixed assets are physical assets, including natural resources, whose market values are greater or at some future date can be expected to be greater than are the current book values as stated on the potential acquisition's balance sheet.

Fixed assets turnover, IR37, when using TDA was found to be of some importance, though not significantly so until the year immediately preceding a takeover, when its coefficient was +.276 (from Table 5-1). Though IR37 is a contributor in the isolation of merger candidates it does not appear in the reduced dimension models until LAG 0. It is not known whether that information would be of any use to either financial managers or to arbitrageurs because of its time lag and coefficient size.

d. Liquidity

Liquidity ratios are no longer useful in the selection of potential acquisitions. The ten liquidity ratios tested here appeared infrequently in the reduced dimension discriminant models, their coefficients' absolute values tended to be low, and their signs alternated over time, suggesting little if any economic significance. There was only one exception to the above: IR29, current assets to sales, had a +.29725 in LAG 2. Because of the marginal magnitude of the

coefficient and because it did not reappear in the IAG 1 or IAG 0 models, it may lack significance.

Perhaps the most logical explanation for a sharp decline in the importance of liquidity ratios is attributable to the changes in the domestic economy since the 1960's. Because of greater than average inflation in the 1970's, cash or near cash assets tended to diminish in value relative to physical assets such as inventories or fixed assets during that time span. Variable FR26, current ratios, which includes inventories in the current assets calculation was generally more significant than was the acid test ratio, FR27, which does not include inventories in its determination. In spite of inventories being included, current ratios were not significant. Their coefficients were .206 and .214 in IAG 2 and IAG 1, and the ratio did not appear at all in the reduced dimension IAG 0 model.

Another explanation for the decline in the importance of liquidity is that in the 1960's firms acquired other firms because of the latter's liquidity which assisted the acquirer's financing of the merger. Those acquisitions tended to be financed by equity or debt. Such a motive for merger or such financing arrangements are no longer prevalent; currently a more common scenario finds the acquirer borrowing, being supported by venture capital from insurance companies, or being financed by foreign capital to purchase a firm with incorrectly valued long term assets. Firms no longer need to acquire other firms for their excess liquidity. Acquiring firms either possess cash to purchase other firms or can readily acquire it.[1]

While new discriminant functions generated from merger data of the 1970's produce better results than that obtained from replications of

1960's models, the models produced lower than anticipated results. Ex post classifications, though statistically significant, showed overall classifications success of 68.16, 62.78, and 69.7%, respectively, LAG 2 through LAG 0. These results appear in Table 8-1.

Table 8-1

Final Classification Matrices

Table 8-1(a)

LAG 2

CLASSIFICATION RESULTS - LAG 2

ACTUAL GROUP		NO. OF CASES	PREDICTED GROUP MEMBERSHIP Group 1	Group 2
GROUP	1	220	121	99
			55.0 %	45.0 %
GROUP	2	270	57	213
			21.1 %	78.9 %
GROUP	3	39	15	24
			38.5 %	61.5 %

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED - 68.16, Ex Post.

Table 8-1(b)

LAG 1

CLASSIFICATION RESULTS - LAG 1

ACTUAL GROUP		NO. OF CASES	PREDICTED GROUP MEMBERSHIP Group 1	Group 2
GROUP	1	226	107	119
			47.3 %	52.7 %
GROUP	2	263	63	200
			24.0 %	76.0 %
GROUP	3	38	8	30
			21.1 %	78.9 %

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED - 62.78, Ex Post.

Table 8-1(c)

LAG 0

CLASSIFICATION RESULTS - LAG 0

ACTUAL GROUP		NO. OF CASES	PREDICTED GROUP MEMBERSHIP Group 1	Group 2	
GROUP	1	218	122 56.0 %	96 44.0 %	TYPE I ERROR
GROUP	2	244	44 18.0 %	200 82.0 %	
GROUP	3	34	9 26.5 %	25 73.5 %	

PERCENT OF GROUPED CASES CORRECTLY CLASSIFIED - 69.70, Ex Post.

Ex ante prediction successes from the new models are considerably lower than hypothesized. The prediction test for the dimension reduced model was superior to any other model, but also produced lower than anticipated results. Those results appear in Tables 7-1 and 7-2.

The differences in results between ex post classifications and ex ante predictions, as hypothesized by Joy and Tollefson[2] are of considerable magnitude.

The dimension reduced discriminant models, LAG 2 - LAG 0, illustrated in Table 5-1, produced overall classification success rates of 68, 63, and 70%, respectively (see Table 5-2a, b, and c) and did so with very high levels of statistical significance.

Vance[3] claimed to be able to predict seventeen of twenty one mergers in the late 1960s, using published financial statements. However his criteria contradict the evidence produced here using a much larger time span and sample size. More importantly, Vance never tested his hypothesis using an ex ante prediction test.

Improved classification results from the new models demonstrate that the 1960's motives are even less valid. The new models will predict more successfully if the Type I error rates can be reduced.

As illustrated in Table 8-1, Type I error levels for my new models are 45, 52.7 and 44% respectively, LAG 2 through LAG 0.

Type I error rates are attributable to at least two sources: 1. The model is using ratios which do not fully embody all motives for mergers. It is possible that the thirty-seven ratios used at the onset do not incorporate all of the quantitative motives for mergers, but it is more probable that nonquantitative motives for mergers have a considerable influence on the likelihood of acquisition. 2. Motives

for mergers include unique company by company circumstances either of a quantitative or qualitative nature, which may supercede any general set of quantitative ratio criteria.

Type II error rates are low in this test. This indicates that the model is rarely incorrect once it has classified a firm as a likely acquisition.

In essence, the model is successful in that it does predict mergers; however it fails to select enough of the firms which ultimately are acquired to improve its statistical significance.

What can be generalized from this study regarding the characteristics of the financial ratios studied?

Ratios that seem to have significantly large coefficients and appear often in all three models (LAG 2 - LAG C) are:

FR1 : EBIT / Total Assets (FR1)

FR7 : Rate of Return on Assets (FR7)

FR15: Interest / cash and marketable securities (FR15)

FR16: Dividend Payouts, Percent of F.P.S. (FR16)

FR17: P/E Ratios (FR17)

FR36: Price / Tax Loss Carry Forward Per Share (FR36)

Summarizing the above ratios, we find higher than average operating profits, lower than average earnings after taxes and extraordinary items, declining dividend payouts, increasingly larger p/e ratios suggesting declining net income as well as price appreciation and slightly higher than average leverage, (but only in the context of interest expense as a percent of cash and near cash (items), to the chief determinants in the prediction of mergers.

C. Confirmation of the Ratio Hypotheses

In Chapter I a set of hypotheses was formulated based upon a review of the literature. Those hypotheses were that an acquisition would be: a. less levered, b. have greater liquidity, c. possess greater earnings prospects, and d. would be priced lower relative to its book value per share than are firms not likely to be acquired.

Conclusions based upon this study are not entirely in accord with the hypothesized results.

a. I conclude that acquired firms are not less or more levered than non-acquired firms, leverage simply is not a discriminating criteria, except for ER15, which reflects a firm's ability to pay its interst expenses; the extent of debt may be irrelevant, what is important is the firm's ability to finance its indebtedness.

Acquired firms do tend to be more heavily levered, but it is misleading to accept that statement without further investigation. The only leverage ratios providing significant results were book value long term debt to market value common stockholders' equity, ER8, and book value long term debt to tangible book stockholders' equity, ER9. It would be useful to test for market value long term debt to market value common equity in that market value debt is almost invariably less than the book value of that debt. Using market values for both debt and equity might suggest that acquired firms are not more heavily levered. One other ratio which Stevens categorized as "other" could be classified as a liquidity ratio, but I elected to treat it as a leverage ratio; it is interest to cash and marketable securities, ER15. Results show that book value debt to book value tangible common stockholders' equity, ER9, was insignificant as were long term debt (ER10), or total liabilities

(FR11), to total assets.

b. It appears that firms have average liquidity; it is incorrect to hypothesize either illiquidity or excessive liquidity. The condition of a firm's liquidity simply was not a determining factor in the selection of candidates for acquisitions in the 1970's.

c. Acquired firms do possess above average profitability as originally hypothesized, however, the above average profitability, FR1, is operating profits as a percent of total assets. Profits after taxes as a percent of total assets, FR7, produces lower than average ratios than for the non-acquired firms.

Again, the dichotomy between above average operating profitability to the below average after tax profitability suggests one or more of several nonrecurring accounting events which have made the firm more susceptible to a subsequent takeover.

Of the seven profitability ratios tested, only the two described above were important.

An analyst focusing on earnings of earnings per share growth, and disregarding operating income would have incorrectly hypothesized that acquisitions possess lower than average profitability. Use of any other profitability ratios would have led an analyst to conclude that profitability was inconsequential in isolating candidates.

d. Assets worth more than their stated book value suggests that a firm's book values are understated relative to their market value, assuming that the market pricing mechanism is functioning and all information is available.

Conversely an alternate possibility is that the market pricing mechanism is not functioning and asset values and market values are in

disequilibrium.

Acquired firms do appreciate in value after announcement of their being merged, however the greatest price appreciation occurs months prior to that announcement date. The coefficients of FR32, market value to book value are -.20991 and -.34566, in LAG 2 and LAG 1 respectively. The LAG 1 coefficient of -.34656 tells us that the market price of the acquired firm has deteriorated even further than in LAG 2 relative to the book value of the firm. The imbalance between market value of the firm per share to book value per share of the firm is eliminated in the LAG 0 model which indicates that market price to book value is no longer of any value in isolating potential merger candidates. In essence, at some point in time twelve to twenty-four months prior to a merger the stock price reacted to the imbalance but not sufficiently so to prevent a merger. The greatest returns to the arbitrageur came one to two years prior to the merger, which is consistent with most of the empirical findings reviewed in Chapter II.

In an attempt to further analyze the relationship of market price per share to book value per share, I then separated total assets into certain subsets, which I considered to be attributes. I hypothesized that firms not only had greater liquidity, but also hypothesized that certain attributes could not be identified simply by looking at book value per share. I also felt these attributes, FR33, cash per share; FR34, net working capital per share; and FR35, a restricted net working capital per share (current assets less inventories and less current liabilities, per share) ought to be examined in the context of their value relative to their market prices per share. While the conventional liquidity ratios appeared to be of limited significance, one liquidity

relative to market price of equity is of greater import. TR33, the market price of the equity to cash per share does have significantly lower than average coefficients, -.9784 and -.55826 LAG 2 and LAG 1 respectively, which indicates that acquired firms have greater liquidity than do their non-acquired counterparts or that other influences have simultaneously reduced market prices to create these significantly negative coefficients.

TR34, market price per share to net working capital per share has coefficients of -.26886 in LAG 2, + .28098 in LAG 1, but does not appear in the LAG 0 model. The low magnitude of the coefficients suggests they appear to be of little importance. TR35 only appeared in the LAG 1 model; its coefficient sign was appropriate, but its magnitude suggests that it is not very valuable in the selection process (-.18838).

Concluding the discussion on market price of equity to book value of assets, it appears there clearly is a disequilibrium between them which is eliminated at some time twelve to twenty-four months prior to a firm's acquisition.

There is also evidence that acquired firms either: 1. Have more cash than non-acquired firms relative to their equity market price per share, or 2. that these acquired firms have lower market prices per share because of other circumstances which dominate the cash effect. Because of: 1. Large negative coefficients for TR33, market price to cash per share, 2. The reduced extent of interest expenses as a percent of cash and mar etable securities, and 3. The clearly documented price appreciation of takeover candidates preceding the announcement of their acquisition, the evidence supports the higher level of cash position of the acquisitions.

D. STATISTICAL SIGNIFICANCE OF MODELS

Considerable research has been written citing financial misapplications of MDA in recent years [52,57,70,99]. A considerable effort was made to comply with suggestions offered in those studies. Tests were conducted for equal variance-covariance matrices, and split sample hold out validation techniques were employed. Various chance classification methods were used upon the validation sample and the ex post tests all produced results significant at tie .05 level or better, (see Tables 4-2a, b and c).

This test then employed the first ex ante merger prediction model, (to the best of the author's knowledge) but produced lower than expected results.

* * * * * * * * * * * * * * *

E. DIMENSION REDUCTION

Table 7-1 illustrates that it is possible to reduce to a lower number, the thirty-seven ratios used at the onset. Unfortunately attempts to reduce the models to four or five ratios were unsuccessful. Several attempts not reported in this paper using smaller sets of ratios were unsuccessful.

Why is it no longer possible to produce the four or five ratio models derived by Stevens or by Simkowitz and Monroe? There are several possible explanations. Stevens may have had methodological problems first using factor analysis and then using a discriminant model on variables extracted, perhaps erroneously, from that factor analysis. Stevens also may have rejected some important ratios. S&M appear to have avoided those types of errors yet obtained a five ratio model.

Another possible explanation is offered: The entire process of

mergers appears to be much more complex now because there are many more motives for acquisition. Simultaneously, because of bidding wars, arbitrageurs have become more competitive.[4] They may have successfully discounted many of the quantitative measures, and may now be focusing on non-quantitative measures. If the quantitative measures have not been discounted, it is still necessary to use more ratios than those used in this study to reduce the Type I error levels observed.

1. Factor Analysis

Table 5-7 perhaps best illustrates a surprising result, that factor analysis as unable to successfully reduce the thirty seven ratio dimension initially introduced. Seven factors only explained sixty eight percent of the variance but need thirty ratios to accomplish that. A greater number of factors is theoretically justified, but that increased the number of required ratios to thirty five of the original thirty seven ratios.

Factor analysis also produced results which conflicted with MDA. Table 5-10 contrasts important financial ratios selected by use of MDA and those ratios identified by use of factor analysis. Most importantly, key MDA ratios were generally insignificant until the fourth through seventh factors which illustrates an obvious disparity in results.

The difference in best sets of ratios derived from the two alternating statistical procedures should help reconcile the differences in "test" sets of ratios obtained by Stevens and Si.

2. Sequential Univariate Analysis

Tables 6-1(a-c) and 6-2 illustrate two important considerations in the decision to use MDA rather than F tests performed sequentially in an

analysis of variance. First, there were numerous contrasting results, key ratios selected using MDA had low univariate F levels of significance, and 2., univariate F test results tended to restrict the number of ratios used. Indeed, Table 6-2 indicates that at = .05 the number of ratios selected sequentially by F scores was eight, two, and six ratios, LAG 2 - LAG 0 respectively.

* * * * * * * * * * * * * * * *

F. Ratio Selection Over Time

Because of the dynamics of the economy, industry and company characteristics, firms' values change over time, and presumably those changes are reflected in cwapany financial statements. Ultimately any financial ratio analysis must consider those changes.

Previous mergers studies have focused on the accounting data available immediately prior to a firm's acquisition. Conclusions formed from those ratios are likely to be incorrect, especially ratios using stock prices. Stock prices appreciate months, perhaps two to three years prior to its acquisition. Financial managers may restructure the firm's financial characteristics months to years in advance in an attempt to thwart would-be acquirers. Countering this, acquirers are trying to accelerate the merger process reducing the time available to potential acquisitions to defend themselves by increasing the premiums. Read Welles [129] for an extended discussion of arbitrageurs. Read Rotbart [114] for a discussion of a failure to defend against acquisition. The implication of the above is these effects may have reduced the comparability of ratios useful in isolating candidates in the 1960s.

Perhaps the best illustration of the dynamics of the

pre-acquisition process is to study the ratio coefficients in Table 5-1. Those ratios generally reflect financial strength, but progressing across time, cross sectionally LAG 2 to LAG 0, you observe a deterioration of the ratios. By LAG 0 practically all the ratios have negative coefficients which in most cases connotes below average performance levels.

G. Limitations

Limitations in this test include the lack of ratios compatible to certain industries including financial institutions and gas or electric utilities. Therefore results from this test may be inapplicable to those types of industries.

Of a more important nature, it has been established in this test that ratios probably are unable to predict mergers, except perhaps the LAG 2 model, especially if the sample sizes reflect the probability of acquisition in general. Also, the financial ratios used to predict mergers are different than those ratios used in tests conducted in the 1960s. At this time it is not certain that future economic or legal circumstances will be able to improve the value of these models.

H. Future Research Suggestions

One of the motives for this test was a response to suggestions from Stevens and Monroe and Simkowitz to update their studies. Clearly someone should ultimately replicate my results for purposes of comparison.

A test for industry effects needs to be completed. Such a test was planned at the onset of this test, but rejected because sample sizes were too small to produce statistically significant results.

A third necessary test is to evaluate the predictive ability of

this model over time. Can nonquantitative factors improve the ability of these models to predict mergers, and if so which factors? Also, a test to observe when stock prices begin increasing for potential acquisitions is warranted. Finally, the ex ante prediction rates raise the possibility of two sorts of acquisitions, some become candidates three years prior, but others do not become vulnerable until one year prior. A test ought to investigate that possibility.

What have we learned? We know that financial ratios may not be able to predict ex ante. Such a test has never been done before. It is difficult to assess the magnitude of such a result without investigating premiums offered existing shareholders and when prices of acquired firms' stock began to increase. Because of the LAG 2 model results, there is some evidence that a financial ratio based model may serve as a predictor of an upcoming financial event.

Because the LAG 2 model produced the highest ex ante prediction success, and because market price sensitive ratios did not appear to begin changing until the LAG 1 model it still may be possible to obtain by hedging, risk adjusted excess profits, which in this application would be an exception to the semi-strong form of the efficient markets hypothesis; that there is no publicly available financial information which can assist an investor pursuing those excess profits. However, results in the aggregate suggest the likelihood of this is remote.

What we have learned needed to be empirically tested. Motives for mergers have changed since the 1960s. Higher interest rates and greater economic uncertainty have increased the demand for physical assets and the market value of debt has decreased. During periods of rising prices physical assets appear likely to appreciate in value based on the 1970s

experience.

Can we predict in a different environment? Perhaps, if inflation will subside, natural resources type assets and depreciable fixed assets will diminish in importance, interest rates will fall reducing financial risk, and managers of firms will believe it is cheaper to build than it is to buy. Subsequent tests should provide differing sets of key ratios.

It is important to realize that no model will ever explain rationally all of the motivations for merger activity. There are several reasons for this. First, managers will not always act in a manner which maximizes shareholder returns. This was discussed extensively in Chapter II, but reiterating here Buffett contends that most managers place themselves by their sales level ranking on the Fortune 500.[5] He also suspects many of those managers do not . . . know where his corporation places on the list which Fortune just as faithfully compiles ranking the same 500 corporations by profitability.[6]

Finally acquirers may be over optimistic in their projections of an acquisition's future cash inflows or of their ability to more efficiently manage another firm. Most of the evidence brought forth in Chapter II indicates that firms pay excessive sums for their acquisitions. Buffett likens this to the "princess and the toad" story.

> Many managements apparently were overexposed in impression able childhood years to the story in which the imprisoned handsome prince is released from a toad's body by a kiss from a beautiful princess. Consequently they are certain their managerial kiss will do wonders for the profitability of Company T(arget).[7]
>
> . . . investors can always buy toads at the going price for toads. If investors instead bankroll princesses who wish to pay double for the right to kiss the toad, those kisses had better pack some real dynamite. We've observed many kisses, but few miracles. Nevertheless, many managerial

princesses remain serenely confident about the future potency of their kisses - even after their corporate backyards are knee-deep in unresponsive toads.[8]

Footnotes

Chapter VIII

1. "Asset Redeployment - Everything Is For Sale Now," Business Week, 24 August 1981, p. 68.

2. Maurice O. Joy and John O. Tollefson, "On the Financial Applications of Discriminant Analysis," Journal of Financial and Quantitative Analysis 10 (December, 1975): 727.

3. Jack O. Vance, "Is Your Company a Take-over Target?" Harvard Business Review, May-June, 1969, p. 94.

4. A humorous, but important article assessing the current state of the arbitrage "game" is in

   Chris Welles, "Inside America's Arbitrage Game," Institutional Investor, International Edition, August, 1981, pp. 214-216.

5. Warren E. Buffett, Annual Report (Omaha: Berkshire-Hathaway, Inc., [1981]), p. 4.

6. Ibid.

7. Ibid.

8. Ibid.

BIBLIOGRAPHY

TEXTS

1. Alberts, W. W. and Segall, J. E. The Corporate Merger. Chicago: University of Chicago Press, 1966.

2. Cooley, William W. and Lohnes, Paul R. Multivariate Data Analysis. New York: John Wiley & Sons, 1971.

3. Copeland, Thomas E. and Weston, J. Fred. Financial Theory and Corporate Policy. Menlo Park: Addison-Wesley, 1979.

4. Dean, Joel and Smith, Winfield. The Relationships Between Profitability and Size. Edited by William W. Alberts and Joel E. Segall. The Corporate Merger. Chicago: University of Chicago Press, 1966.

5. Durand, David D. "Risk Elements in Consumer Installment Financing." Studies in Consumer Installment Financing. New York: National Bureau of Economic Research, 1941.

6. Finn, Jeremy. A General Model For Multivariate Analysis. New York: Holt, Rinehart and Winston, 1974.

7. Green, Paul E. Analyzing Multivariate Data. Hinsdale, Illinois: Dryden Press, 1978.

8. Hair, Joseph F. Jr.; Anderson, R. E.; Tatham, R. L.; and Grablowsky, B. J. Multivariate Data Analysis With Readings. Tulsa: Petroleum Publishing Company, 1979.

9. Haley, Charles W. and Schall, Lawrence D. The Theory of Financial Decisions 2nd ed. New York: McGraw-Hill Book Company, 1979.

10. Harman, Harry H. Modern Factor Analysis. Chicago: University of Chicago Press, 1967.

11. Harris, Richard J. A Primer of Multivariate Statistics. New York: Academic Press, 1975.

12. Klecka, William R. "Discriminant Analysis," Chapter 23. Statistical Package for the Social Sciences, 2nd ed. Edited by Norman H. Nie, C. Hadley Hull, Jean G. Jenkins, Karin Steinbrenner and Dale H. Bent. New York: McGraw-Hill, 1975.

13. Lev, Baruch. Financial Statement Analysis: A New Approach. Englewood Cliffs, New Jersey: Prentice-Hall, 1974.

14. Morrison, Donald F. Multivariate Statistical Methods. New York: McGraw-Hill, 1976.

15. Rao, C. R. Linear Statistical Inference and Its Applications. New York: John Wiley & Sons, 1965.

16. Reid, Samuel Richardson, Mergers, Managers, and the Economy. New York: McGraw-Hill Book Company, 1968.

17. Roberts, D. R. Executive Compensation. New York: The Free Press of Glencoe, 1959.

18. Rubinstein, Mark E. A Mean-Variance Synthesis of Corporate Financial Theory. Edited by Stewart C. Myers. Modern Developments in Corporate Financial Theory. New York: Praeger Publishers, 1976.

19. Scherer, F. M. Industrial Market Structure and Economic Performance. Chicago: Rand McNally College Publishing Company, 1970.

20. Singh, Ajit. Takeovers; Their Relevance to the Stock Market and the Theory of the Firm. Cambridge: Cambridge University Press, 1971.

21. Tatsuoka, Maurice M. Multivariate Analysis. New York: John Wiley & Sons, 1971.

22. Weston, J. Fred. Determination of Share Exchange Ratios in Mergers. Edited by William W. Alberts and Joel E. Segall. The Corporate Merger. Chicago: University of Chicago Press, 1966.

REPORTS - PUBLISHED

23. Buffett, Warren E. Annual Report. Omaha: Berkshire Hathaway, Inc., [1981].

ARTICLES

24. "Adding Foreign Stocks For a Safer Mix." Business Week February 27, 1978.

25. "A Financial Empire In the Making." Business Week, March 9, 1981, p. 87.

26. Altman, Edward I. "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy." Journal of Finance 23 (September, 1968): 589-609.

27. _____, and Eisenbeiss, Robert A. "Financial Applications of Discriminant Analysis: A Clarification." Journal of Financial and Quantitative Analysis 13 (March, 1978): 185-195.

28. Amihud, Yakov and Lev, Baruch. "Risk Reduction As A Managerial Motive for Conglomerate Mergers." The Bell Journal of Economics 12 (Autumn, 1981): 605-617.

29. "Asset Redeployment: Everything Is For Sale Now." Business Week, (August 24, 1981): 68-74.

30. Baker, H. Kent; Miller, Thomas O.; and Ramsparger, Brian J. "An Inside Look at Corporate Mergers and Acquisitions." MSU Topics 29 (Winter, 1981): 49-57.

31. Barnard, M. M. "The Secular Variations of Skull Characteristics in Four Series of Egyptian Skulls." Annals of Eugenics VI (1935): 352-371.

32. Baumol, William J. "On the Theory of the Expansion of the Firm." American Economic Review 52 (December, 1962): 1078-1087.

33. Beaver, William H. "Financial Ratios As Predictors of Failure." Journal of Accounting Research 4 (Supplement, 1966): 71-111.

34. Belkaoui, Ahmed. "Financial Ratios as Predictors of Canadian Takeovers." Journal of Business Finance & Accounting 5 (Spring, 1978): 93-107.

35. Beman, Lewis. "What We Learned From The Great Merger Frenzy." Fortune, April, 1973, pp. 70-73, 144, 148-150.

36. Bettner, Jill. "Foreign Stocks Catch On With Small Investors; Gains Are Bigger Lure Than Diversification." Wall Street Journal, 20 April 1981, p. 42.

37. Block, Stanley. "The Merger Impact on Stock Price Movements." MSU Business Topics 17 (Spring, 1969): 7-12.

38. Bradley, Michael. "Interfirm Tender Offers and the Market for Corporate Control." Journal of Business 40 (October, 1980): 345-376.

39. Brick, John R. and Thompson, Howard E. "The Economic Life of an Investment and the Appropriate Discount Rate." Journal of Financial and Quantitative Analysis XIII (December, 1978): 831-846.

40. Carberry, James. "Many REITs Stage Comeback, Aided By an Attraction of Foreign Investors." Wall Street Journal, 6 August 1979, p. 6.

41. Carley, William M. "Airline-Service Breakdown Persists Long After Pan Am, National Merge." Wall Street Journal, 10 March 1981, p. 25.

42. Chappell, Henry W., Jr. and Cheng, David C. "Expectations, Tobin's q, and Investment: A Note." Journal of Finance XXXVII (March, 1982): 231-236.

43. Conn, R. L. and Nielsen, J. F. "An Empirical Test of the Larson-Gonedes Exchange Ratio Determination Model." Journal of Finance XXXIII (June, 1977): 749-760.

44. Dodd, Peter. "Company Takeovers and the Australian Equity Market." Australian Journal of Management 1 (October, 1976): 15-35.

45. _____. "Merger Proposals, Management Discretion, and Stockholder Wealth." Journal of Financial Economics 8 (March, 1980): 105-137.

46. _____ and Ruback, Richard. "Tender Offers and Stockholder Returns, An Empirical Analysis." Journal of Financial Economics 5 (December, 1977): 351-373.

47. "DuPont's Costly Bet on Conoco." Business Week, July 20, 1981, pp. 52-54.

48. Durand, David. Risk Elements in Consumer Installment Lending, Studies in Consumer Installment Financing, No. 8, National Bureau of Economic Research, Inc., New York, 1941.

49. Dyson, R. T. "Mergers Are Not Growth." Business Week, August 10, 1981, p. 98.

50. Edmister, Robert O. "An Empirical Test of Financial Ratio Analysis for Small Business Failure Prediction." Journal of Financial and Quantitative Analysis 7 (March, 1972): 1477-1493.

51. Ehrbar, A. F. "Corporate Takeovers Are Here to Stay." Fortune, May 8, 1978, pp. 91-100.

52. Eisenbeis, Robert A. "Pitfalls In the Application of Discriminant Analysis In Business, Finance, and Economics." Journal of Finance 32 (June, 1977): 875-900.

53. _____. Problems in Applying Discriminant Analysis in Credit Scoring Models." Federal Reserve Bulletin, January, 1978, pp. 14-28.

54. Ellert, J. C. "Mergers, Antitrust Law Enforcement, and Stockholder Returns." Journal of Finance XXXI (May, 1976): 715-732.

55. Ferguson, Robert and Popkin, Philip. "Pulling Rabbits Out of Hats in the Oil Business—and Elsewhere." Financial Analysts Journal 38 (March-April, 1982): 24-26.

56. Fisher, R. A. "The Use of Multiple Measurements in Taxanomic Problems." Annals of Eugenics VII (1936-1937): 179-188.

57. Frank, Ronald E.; Massy, William F.; and Morrison, Donald G. "Bias In Multiple Discriminant Analysis." Journal of Marketing Research 2 (August, 1965): 250-8.

58. Gort, Michael. "An Economic Disturbance Theory of Mergers." The Quarterly Journal of Economics LXXXIII (November, 1969): 624-642.

59. "The Great Takeover Binge." Business Week, November 14, 1977, pp. 176-184.

60. "Growing From Within May Pay Off Faster." Business Week, September 17, 1966, pp. 44-46.

61. Haley, Charles W. and Schall, Lawrence D. "Problems With the Concept of the Cost of Capital." Journal of Financial and Quantitative Analysis XIII (December, 1978): 847-870.

62. Halpern, Paul J. "Empirical Estimates of the Amount and Distribution Gains to Companies in Mergers." Journal of Business 46 (October, 1973): 554-575.

63. Haughen, Robert A. and Langetieg, Terence C. "An Empirical Test for Synergism in Merger." Journal of Finance 30 (September, 1975): 1003-1014.

64. Higgins, Robert C. and Schall, Lawrence D. "Corporate Bankruptcy and Conglomerate Merger." Journal of Finance 30 (March, 1975): 93-113.

65. Hogarty, Thomas F. "The Profitability of Corporate Mergers." Journal of Business XLIII (July, 1970): 317-327.

66. Honeycutt, T. Crawford. "The Microeconomic Consequences of Corporate Mergers: A Comment." Journal of Business 48 (April, 1975): 267-274.

67. Hong, Hai; Kaplan, Robert S.; and Mandelker, Gershon. "Pooling vs. Purchase: The Effects of Accounting for Mergers on Stock Prices." The Accounting Review LIII (January, 1978): 31-47.

68. Horrigan, James O. "The Determination of Long-Term Credit Standing With Financial Ratios." Journal of Accounting Research 4 (Supplement, 1966): 44-62.

69. "Ira Harris: Chicago's Big Dealmaker." Business Week, June 25,

1979, pp. 70-78.

70. Joy, O. Maurice and Tollefson, John O. "On the Financial Applications of Discriminant Analysis." Journal of Financial and Quantitative Analysis 10 (December, 1975): 723-739.

71. _____. "Some Clarifying Comments On Discriminant Analysis." Journal of Financial & Quantitative Analysis 13 (March, 1978): 197-200.

72. Kaiser, H. F. "The Varimax Criterion For Analytic Rotation In Factor Analysis." Psychometrika 23 (September, 1958): 187-200.

73. Kamerschen, David R. "A Theory of Conglomerate Mergers: Comment." Quarterly Journal of Economics LXXXVII (November, 1970): 668-673.

74. Keown, Arthur and Pinkerton, John M. "Merger Announcements and Insider Trading Activity: An Empirical Investigation." Journal of Finance XXXVI (September, 1981): 855-869.

75. Kohers, Theodor and Conn, Robert L. "The Effect of Merger Announcements on Share Prices of Acquiring Firms." Review of Business & Economic Research XII (Fall, 1976): 55-62.

76. Langetieg, Terence. "An Application of a Three-Factor Performance Index to Measure Stockholder Gains From Merger." Journal of Financial Economics 6 (December, 1978): 365-383.

77. Larson, K. D. and Gonedes, N. J. "Business Combinations: An Exchange Ratio Determination Model." The Accounting Review 44 (October, 1969): 720-728.,

78. Lenzer, Robert. "Buy High Sell Higher." Barrons, 7 March, 1977, pp. 11, 26.

79. Lev, Baruch & Mandelker, Gershon. "The Micro-economic Consequences of Corporate Mergers." Journal of Business 45 (January, 1972): 85-104.

80. _____. "Rejoinder to Reid & Honeycutt." Journal of Business 48 (April, 1975): 281-2.

81. Levy, Haim and Sarnat, Marshall. "Diversification, Portfolio Analysis and the Uneasy Case for Conglomerate Mergers." Journal of Finance 25 (September, 1970): 795-802.

82. _____. "International Diversification of Investment Portfolios." American Economic Review LX (September, 1970): 668-675.

83. Lewellen, Wilbur G. "A Pure Financial Rationale for the

Conglomerate Merger." Journal of Finance XXVI (May, 1971): 521-537.

84. _____, and Huntsman, Elaine. "Managerial Pay and Corporate Performance." American Economic Review LX (September, 1970): 710-720.

85. Lintner, John. "Expectations, Mergers and Equilibrium in Purely Competitive Securities Markets." American Economic Review LXI (May, 1971): 101-111.

86. Logue, Dennis E. and Naert, Philippe A. "A Theory of Conglomerate Mergers: Comment and Extension." Quarterly Journal of Economics LXXXVII (November, 1970): 663-667.

87. Mandelker, Gershon. "Risk & Return: The Case of the Merging Firms." Journal of Financial Economics 1 (December, 1974): 303-335.

88. Manne, Henry G. "Mergers and the Market for Corporate Control." Journal of Political Economy LXXIII (April, 1965): 110-120.

89. "Market Commentary: Mergers and Acquisitions - How to Buy An American Company." Euromoney, November, 1976, p. 141.

90. Marks, Sidney and Dunn, Oliver Jean. "Discriminant Functions When Covariance Matrices Are Unequal." Journal of the American Statistical Association 69 (June, 1974): 555-559.

91. McGuire, Joseph W.; Chiu, John S. Y.; and Elbing, Alvas O. "Executive Incomes, Sales, and Profits." American Economic Review 52 (September, 1962): 753-761.

92. Melicher, Ronald W. and Harter, Thomas R. "Abstract: Stock Price Movements of Firms Engaging in Large Acquisitions." Journal of Financial & Quantitative Analysis 7 (March, 1972): 1469-1475.

93. "Merger Leaks Abound, Causing Many Stocks to Rise Before the Fact - Moves to Keep Plans Secret Often Fail; But Proving Wrongdoing Is Difficult - Using Relatives, Swiss Banks." Wall Street Journal, 12 July 1978, p. 1.

94. Merjos, Anna. "Takeover Targets." Barron's, 15 May 1978, pp. 9, 12, 14, 32, 34, 35.

95. Metz, Tim and Joseph, Raymond A. "Carborundum Stake May Be Bonanza For Broker Who Foresaw Bidding War." Wall Street Journal, 28 November 1977, p. 20.

96. Meyerson, Adam. "Merger Mania and the High Takeover Premiums." Wall Street Journal, 20 July 1981, p. 14.

97. Monroe, Robert J. "Comment: Financial Characteristics of Merged Firms: A Multivariate Analysis." Journal of Financial and Quantitative Analysis 8 (March, 1973): 163-165.

98. "The Morning After - Most of the Stockholders Who Accepted Those Fancy Tender Offers Now Have Reason to Regret Their Haste." Forbes, February 1, 1970. pp. 15-16.

99. Morrison, Donald G. "On the Interpretation of Discriminant Analysis." Journal of Marketing Research 6 (May, 1969): 156-163.

100. Mossin, J. "Equilibrium in A Capital Asset Market." Econometrica 34 (October, 1966): 768-83.

101. Mueller, Dennis C. "A Theory of Conglomerate Mergers." Quarterly Journal of Economics LXXXIII (November, 1969): 643-659.

102. _____. "A Theory of Conglomerate Mergers: Reply." Quarterly Journal of Economics LXXXIV (November, 1970): 674-679.

103. Myers, H. and Forgy, E. W. "Development of Numerical Credit Evaluation Systems." Journal of the American Statistical Association 50 (September, 1963): 797-806.

104. Myers, Stewart C. "Procedures for Capital Budgeting Under Uncertainty." Industrial Mangement Review 9 (Spring, 1968): 1-19.

105. Neter, John. "Discussion of Financial Ratios As Predictors of Failure." Journal of Accounting Research 4 (Supplement, 1966): 112-118.

106. Nielsen, James F. and Melicher, Ronald W. "A Financial Analysis of Acquisition and Merger Premiums." Journal of Financial and Quantitative Analysis 8 (March, 1973): 139-148.

107. O'Connor, Melvin C. "On the Usefulness of Financial Ratios to Investors in Common Stock." The Accounting Review XLVIII (April, 1973): 339-352.

108. Patton, Arch. "Deterioration in Top Executive Pay." Harvard Business Review 43 (November-December, 1965): 106-118.

109. Pekar, Peter Paul. "Mergers and Acquisitions: Improving the Odds." Cash Flow 1 (May, 1980): 47-53.

110. Petzinger, Thomas Jr. "Troubled Couplings: To Win A Bidding War Doesn't Ensure Success of Merged Companies." Wall Street Journal, 1 September 1981, pp. 1, 12.

111. Pinches, George, and Mingo, Kent A. "A Multivariate Analysis of Industrial Bond Ratings." Journal of Finance 28 (March, 1973): 1-18.

112. "The Profit Potential In Spotting Takeovers," Business Week, 24 October 1977, pp. 100-102.

113. Reid, Samuel Richardson. "The Microeconomic Consequences of Corporate Mergers: Comment." Journal of Business 48 (April, 1975): 275-280.

114. Rothart, Dean. "Marathon Oil Executives Sharply Criticized For Not Building Better Takeover Defenses." Wall Street Journal, 21 August 1979.

115. Rout, Lawrence, "Buying American: Weak Dollar, Stocks Spur Foreigners to Seek Acquisitions in the U.S." Wall Street Journal, 21 August 1979, pp. 1, 13.

116. Scott, Elton. "On the Financial Applications of Discriminant Analysis: A Comment." Journal of Financial and Quantitative Analysis 13 (March, 1978): 201-5.

117. Shao, Maria. "Mining Companies Become Targets of Oil Industry's Drive to Diversify." Wall Street Journal, 11 March 1981, p. 25.

118. Simkowitz, Michael and Monroe, Robert J. "A Discriminant Analysis Function For Conglomerate Targets." Southern Journal of Business 6 (November, 1971): 1-16.

119. Singh, Ajit. "Takeovers, Economic Natural Selection, and The Theory of the Firm: Evidence from the Post-war United Kingdom Experience." The Economic Journal 85 (September, 1975): 497-515.

120. Smith, C. A. B. "Some Examples of Discrimination." Annals of Eugenics 13 (1946-1947): 272-282.

121. Smith, Keith V. "Comment: A Financial Analysis of Acquisition and Merger Premiums." Journal of Financial and Quantitative Analysis VIII (March, 1973): 159-162.

122. Solnik, Bruno H. "Why Not Diversify Internationally Rather Than Domestically?" Financial Analysts Journal 30 (July/August, 1974): 48-54.

123. Stevens, Donald L. "Financial Characteristics of Merged Firms, A Multivariate Analysis." Journal of Financial and Quantitative Analysis 8 (March, 1973): 149-158.

124. Tobin, James and Brainard, William C. "Asset Markets and the Cost of Capital." Cowles Foundation Paper No. 440. New Haven: Cowles Foundation For Research in Economics at Yale University.

1977, pp. 235-262.

125. "The Trend Toward Buying Quiet Companies." Business Week, 22 November 1976, pp. 112, 116.

126. Vance, Jack O. "Is Your Company A Take-Over Target?" Harvard Business Review (May-June, 1969): 93-98.

127. Von Furstenberg, George M.; Malkiel, Burton G.; and Watson, Harry S. "Expectations, Tobin's q, and Industry Investment." Journal of Finance XXXIV (May, 1979): 549-561.

128. Walter, James E. "A Discriminant Function for Earnings Price Ratios of Large Industrial Corporations." Review of Economics and Statistics XLI (February, 1959): 44-52.

129. Welles, Chris. "Inside America's Arbitrage Game." Institutional Investor, International Edition, August, 1981, pp. 213-231.

130. Weston, J. Fred and Rice, Edward M. "Discussion." Journal of Finance XXXI (May, 1976): 743-747.

131. Zonana, Victor. "Planning a Plant: How A. H. Robins Co. Made Decision to Build A Chemical Facility." Wall Street Journal, 22 October 1975, p. 1.

132. Zucker, Seymour. "The Q-Ratio: Fuel for the Merger Mania." Business Week. 24 August 1981, p. 30.

COMPUTER ACCESSED DATA BASES

133. Compustat. Standard and Poors Corp., Englewood, Colorado.

UNPUBLISHED MATERIAL

134. Gabhart, David R. L. "An Inquiry In Construction of An Accounting Predictor of Future Municipal Financial Insolvency." Ph.D. dissertation, Michigan State University, 1977.

135. Stevens, Donald L. "A Multivariate Analysis of Financial Characteristics of Acquired Firms In Industrial Mergers." Ph.D. dissertation, Michigan State University, 1972.

APPENDIX I

Subfile 1, Merged Group

Acquired Firms

A J INDS INC
ABERDEEN PETROLEUM CORP
ADMIRAL CORP
AEROJET GENERAL CORP
AEROVOX CORP
AIRPAX ELECTRONICS
AIRWICK INDS
ALCON LABORATORIES
ALLIED ARTISTS PICTURES CORP
ALLIED CONTROL CO INC
ALLIED MILLS INC
ALLIED THERMAL CORP
ALLISON STEEL MFG CO
ALUMINUM SPECIALTY
AMCC INDS INC
AMERICAN BANK NOTE CO
AMPCO METALS INC
AMTEL INC
ANACONDA CO
ANDY GARD CORP
ARMOUR + CO
ARWOOD CORP
ASSO PRODUCTS INC
ATLAS CHEMICAL INDS
AURORA PRODUCTS
AVIS INC
AVIS INDUSTRIAL CORP

BAKER INDS INC
BALI CO
BANFF OIL LTD
BASIN PETROLEUM CORP
BICKFORDS INC
BIG BEAR STORES CL A
BOOK-OF-THE-MONTH CLUB INC
BRIDGE STREET INC
BRITISH-AMERICAN TOBACCO CO
BURROUGHS (J P) + SON INC
BUSH UNIVERSAL INC
BYERS (A M) CO

C F AND I STEEL
CALVERT EXPLORATION
CANADIAN EXPORT GAS + OIL
CANOGA INDS
CARBON INDS INC
CARBORUNDUM CO
CASE (J I) CO
CENTURY ELECTRIC CO
CERRO CORP
CHANCE (A. B.) CO
CHEMETRON CORP
CHEMICAL EXPRESS

CHEMWAY CORP
CLARKE-GRAVELY
CLARKSON INDS
COFFEE-MAT CORP
COLLEGE-TOWN
COLLINS RADIO CO
COLONIAL SAND + STONE CO INC
COMMERCIAL SOLVENTS CORP
COMPUTEST CORP
CONSULTANTS + DESIGNERS
CONSYNE CORP
CONTINENTAL STEEL CORP
COOK ELECTRIC CO
COPPER RANGE CO
CORINTHIAN BROADCASTING CORP
CORCNET INDS INC
COX CABLE COMMUNICATIONS INC
CREATIVE MGMT ASSOC
CRECLE PETROLEUM
CUDAHY CO
CURTIS NOLL CORP
CUTTER LABORATORIES
DHJ INDS INC
DEVON APPAREL
DIXILYN CORP
DORIC CORP
DYNELL ELECTRONICS CORP
EASON OIL
ECKERD DRUGS
EGAN MACHINERY
ELCO CORP
EMENEE CORP
EMPORIUM CAPWELL CO
ESSEX INTL INC
FACTOR MAX CO
FEDERAL PACIFIC ELEC CO
FLAVORLAND INDS
FRYE INDS INC
GARBER (A L) INC
GENERAL BATTERY CORP
GERIATRICS INC
GLEN ALDEN CORP
GLOBE SECURITY SYSTEMS
GLOUCESTER ENGINEERING
GRAND UNION CO
GRANITE CITY STEEL CO
GRASS VALLEY GROUP INC
GREAT SCOTT SUPERMARKETS
GREYHOUND COMPUTER
GROCERY STORE PRODUCTS CO
GUERDON INDS INC
H AND B AMERICAN CORP
HAMMOND CORP
HANOVER SHOE INC
HARMAN INTL INDS
HARVEY INC
HEAD SKI CO INC
HELENA RUBINSTEIN INC
HER MAJESTY INDS
HERFF JONES CO
HIGBIE MFG CO
HOERNER WALDORF CORP
HOFFMAN ELECTRONICS CORP
HOLOPHANE CO INC
HOSKINS MFG CO
HOWMET CORP
HUGHES + HATCHER INC
HYCON MFG CO
HYGRADE FOOD PRODUCTS CORP
I-T-E IMPERIAL CORP
INCOTERM CORP-CL A

INMONT CORP
INTERMECCO INC
INTL COURIERS
INTL MINING CORP
INTL SALT CO
INTERSTATE UNITED CORP
INVESTORS ROYALTY CO INC
JONES + LAUGHLIN STEEL CORP
KATZ DRUG CO
KAYSER-ROTH CORP
KEEBLER CO
KELSEY HAYES CO
KENDALL CO
KENTUCKY FRIED CHICKEN CORP
KEWANEE INDS
KINGSFORD CO
KINGSTIP INC
KLIKLOK CORP
KNICKERBOCKER TOY
LCA CORP
LTV AEROSPACE CORP
LVO CORP
LANVIN-CHARLES OF THE RITZ
LATROBE STEEL CO
LE GRAN CORP
LEADERSHIP HOUSING INC
LEATH + CO
LEHIGH PORTLAND CEMENT CO
LEONARD REFINERIES INC
LEWIS BUSINESS PRODUCTS
LIBBY. MCNEILL + LIBBY
LOGISTICS INDS
LONDONTOWN CORP
LONE STAR BREWING
LONGINES-WITTNAUER WATCH CO
MPB CORP
MADISON SQUARE GARDEN
MAGNA OIL CORP
MAGNAVOX CO
MAMMOTH MART
MANPOWER INC
MARQUETTE CO
MARTIN MARIETTA ALUM INC
MASONEILAN INTL
MAUL BROTHERS INC
MCCORD CORP
MCINTOSH CORP
MEDALLION LEISURE CORP
MENASCO MFG CO
MIDWEST OIL CORP
MILES LABORATORIES INC
MISSOURI BEEF PACKERS INC
MISSOURI PORTLAND CEMENT CO
MODERN MAID FOOD PRODUCTS
MOHAWK AIRLINES INC
MOLYCORP INC
MONROE AUTO EQUIPMENT CO
MUTER CO
NATIONAL GENERAL CORP
NEW YORK SHIPBUILDING CORP
NEWBERRY (J J) CO
NORTH AMERICAN CAR CORP
NORTH AMERICAN SUGAR INDS
NORTHEAST AIRLINES INC
OTIS ELEVATOR CO
PACIFIC INTERMOUNTAIN EXPRES
PAN OCEAN OIL
PANCEL-BRADFORD INC
PARKE DAVIS + CO
PEPI INC
PICKWICK INTL

PIERCE GOVERNOR INC
PIONEER PLASTICS CORP
PIZZA CORP OF AMERICA
PIZZA HUT INC
PLOUGH INC
POLYMER CORP
PUTNAMS (G P) SONS
PYLE NATIONAL CO
RACON INC-CEL
RED OWL STORES INC
REED TOOL CO
REYNOLDS SECURITIES INTL INC
RHEINGOLD CORP
RICO ARGENTINE MINNG
RIDDER PUBLICATIONS INC
RIEGEL PAPER CORP
RIVIANA FOODS INC
ROCKWELL MFG CO
ROOSEVELT RACEWAY INC
RUCKER CO
SW INDUSTRIES
SAFETRAN SYSTEMS CORP-CL A
SANGAMO ELECTRIC CO
SATURN AIRWAYS
SCHENLEY INDS
SCOTT OM SONS
SCRIVNER INC
SEABOARD PLYWOOD + LUMBER CO
SEABROOK FOODS
SHENANDOAH CORP
SHATTUCK DENN MINING CORP
SHENANDOAH OIL CORP
SHERWOOD MEDICAL INDS
SHULTON INC
SIEGEL (HENRY I) CO INC
SIMON + SCHUSTER
SIMPLEX WIRE AND CABLE CO
SKELLY OIL CO
SKY CITY STORES INC
SLICK CORP
SOLA BASIC INDS INC
SOUTHWEST AIRMOTIVE
SPARTANS INDS
STANDARD KOLLSMAN INDS
STANDARD PACKAGING CORP
STANDARD-THOMSON CORP
STANRAY CORP
STATHAM INSTRUMENTS INC
STEIN HALL + CO
STERNCO INDS
TAMAR ELECTRONICS IND
TEMPLE INDS INC
TEXSTAR CORP
TIMPTE INDS
TRANSPORT POOL CORP
TUFTCO CORP
TURBODYNE CORP
U.S. NATL RESOURCES
U.S. REDUCTION
URIS BUILDING CORP
UTAH INTERNATIONAL INC
VCA CORP
VLN CORP
VAL D'OR INDS
VEEDER INDS INC
VETCO INC
VICTOR COMPTOMETER CORP
WAGNER ELECTRIC
WALWORTH CO
WARNER CO
WEATHERHEAD CO

WESTERN NUCLEAR INC
WHEELABRATOR CORP
WHITE CROSS STORES INC
WILL ROSS INC
WILSON CERTIFIED FOODS INC
WILSON-SINCLAIR CO
WILSON SPORTING GOODS CO
YONKERS RACEWAY INC
YOO-HOO CHOCOLATE BEVERAGE
YOUNGSTOWN STEEL DOOR CO
NATIONAL INDS

APPENDIX II

Subfile 2, Control Group,

Non-acquired Firms

U S SUGAR CORP
AMAX INC
FEDERAL RESOURCES
HECLA MINING CO
PACIFIC TIN CONS CORP
TEXASGULF INC
PHELPS DODGE CORP
GULF RESOURCES + CHEMICAL
BURNS (R.L.) CORP
CANADIAN MERRILL LTD
CANADIAN SUPERIOR OIL
DELHI INTL OIL CORP
GREAT BASINS PETROLEUM
HOUSTON OIL + MINERALS CORP
INEXCO OIL
RESERVE OIL + GAS
SCURRY-RAINBOW OIL LTD
UNIVERSAL RESOURCES
CHIEFTAIN DEVELOPMENT CO LTD
GLOBAL MARINE INC
READING + BATES CORP
SCOFE INDUSTRIES INC
NEWPARK RESOURCES
SABINE CORP
CENTEX CORP
GENERAL BUILDERS CORP
DYNALECTRON CORP
FLUOR CORP
HALLIBURTON CO
FISCHBACH + MOORE INC
WALLACE (SAM P.) INC
NORTON SIMON INC
ESMARK INC
MICKELBERRY CORP
TFI COS INC
TOBIN PACKING CO INC
UNITED BRANDS
VERIT INDUSTRIES
CARNATION CO
HEINZ (H.J.) CO
SMUCKER (J.M.) CO
CONAGRA INC
SEABOARD ALLIED MILLING
RALSTON PURINA CO
AMALGAMATED SUGAR CO
FANNY FARMER CANDY SHOPS INC
CORENCO CORP
ANHEUSER-BUSCH INC
CARLING OKEEFE LTD
BROWN-FORMAN DISTILLERS-CL B
HEUBLEIN INC

WALKER(HIRAM) GOODRHM + WORT
COCA-COLA BOTTLING CO OF NY
PEPCOM INDUSTRIES
PEPSICO INC
AMERICAN BRANDS INC
BAYUK CIGARS INC
CULBRO CORP
COURTAULDS LTD
FAB INDUSTRIES INC
FAIR-TEX MILLS
GAYNOR-STAFFORD INDS
HUYCK CORP
INTL STRETCH PRODS
LIBERTY FABRICS OF N Y INC
NATIONAL SPINNING CO
RUSSELL CORP
SPRINGS MILLS INC
SHAW INDUSTRIES INC
ANGELICA CORP
CLUETT, PEABODY + CO
HOUSE OF RONNIE
JONATHAN LOGAN INC
MUNSINGWEAR INC
OUTDOOR SPORTS INDUSTRIES
STANWOOD CORP
BOISE CASCADE CORP
CHAMPION INTERNATIONAL CORP
MASONITE CORP
COMMODORE CORP
NATIONAL HOMES CORP
REDMAN INDUSTRIES INC
TIDWELL INDUSTRIES
KIMBERLY-CLARK CORP
POTLATCH CORP
APL CORP
FORT HOWARD PAPER
PAPERCRAFT CORP
STONE CONTAINER CORP
SIMPLICITY PATTERN CO
HARPER ROW PUBLISHERS
ARCATA CORP
BOWNE + CO INC
HARLAND (JOHN H.) CO
WILLIAMHOUSE REGENCY INC
ALLIED CHEMICAL CORP
NEW ENGLAND NUCLEAR CORP
REICHHOLD CHEMICALS INC
ICN PHARMACEUTICALS INC
LILLY (ELI)+ CO
SEARLE (G.D.) + CO
SMITHKLINE CORP
STERLING DRUG INC
JOHNSON PRODUCTS
REVLON INC
GUARDSMAN CHEMICALS INC
FIRST MISSISSIPPI CORP
ALCOLAC INC
DEXTER CORP
KIN-ARK CORP
ASAMERA OIL CORP
CHARTER CO
CITIES SERVICE CO
HOLLY CORP
HOWELL CORP
IMPERIAL OIL LTD-CL A
TESORO PETROLEUM CORP
TEXACO INC
WALTER (JIM) CORP
AEGIS CORP
ALLIANCE TIRE + RUBBER CO

GOODRICH (B.F.) CO
U S RUBBER RECLAIMING CO
RICHARDSON CO
BARRY (R G)
STRIDE RITE CORP
U S SHOE CORP
SETON CO
ANCHOR HOCKING CORP
BROCKWAY GLASS CO
LONE STAR INDUSTRIES
SOUTHDOWN INC
VULCAN MATERIALS CO
ALLEGHENY LUDLUM INDS
AMPCO-PITTSBURGH CORP
BLISS + LAUGHLIN INDS
INTERLAKE INC
NATIONAL STEEL CORP
NORTEK INC
NORTHWESTERN STEEL + WIRE CO
REPUBLIC STEEL CORP
TUBOS DE ACERO DE MEXICO S A
HARSCO CORP
CONSOLIDATED REFINING
HANDY + HARMAN
KENNAMETAL INC
ACTION INDUSTRIES INC
EASCO CORP
NORRIS INDUSTRIES INC
STANLEY WORKS
STARRETT (L.S.) CO
ATCO INDS
BUILDEX INC
HOOVER UNIVERSAL INC
INTERNATIONAL CONTROLS CORP
LAMSON + SESSIONS CO
CLABIR CORP
CRANE CO
KEYSTONE INTERNATIONAL
INTL GENERAL INDUSTRIES
KEYSTONE CONS INDUSTRIES INC
SYNALLOY CORP
YATES INDUSTRIES INC
COMBUSTION ENGINEERING INC
OUTBOARD MARINE CORP
ROPER CORP
PORTEC INC
REXNORD INC
CAMCO INC
MARATHON MFG CO
CINCINNATI MILACRON INC
CORDON INTL
DOVER CORP
IONICS INC
AMERICAN PRECISION INDS
BINKS MFG CO
IMC MAGNETICS CORP
MEI-PRO CORP
CONTROL DATA CORP
SPEED-O-PRINT BUS MACHINES
APPLIED MAGNETICS CORP
DIGITAL EQUIPMENT
MEMOREX CORP
STORAGE TECHNOLOGY CORP
TAB PRODUCTS
VENCO CO
EMERSON ELECTRIC CO
ELTRA CORP
MCGRAW-EDISON CO
UV INDUSTRIES INC
ELECTRONICS CORP OF AMERICA

AMERICAN CONTROLLED INDS
HEALTH-MOR INC
MAYTAG CO

SCOVILL INC
SINGER CO
SUNBEAM CORP
TAPPAN CO

DCRC-TEST CORP
LAFAYETTE RADIO ELCTRNC CORP
MATSUSHITA ELECTRIC INDL-ADR
LYNCH COMMUNICATION SYSTEM

FEDERAL SIGNAL CORP
HARRIS CORP
JOHNSON (E.F.) CO
MOOG INC

AVX CORP
AMPEX CORP
AVNET INC
CTS CORP

ESPEY MFG + ELECTRONICS CORP
INTL RECTIFIER CORP
PLESSEY CO LTD
SEMTECH CORP

SIGMA INSTRUMENTS
BALDOR ELECTRIC
ECHLIN MFG CO

HUBBELL (HARVEY) INC-CL B
FORD MOTOR CO
BORG-WARNER CORP
CORE INDUSTRIES INC

EATON CORP
FDI INC
SMITH (A.O.) CORP
TRW INC

EXECUTIVE INDUSTRIES
GRUMMAN CORP
ROCKWELL INTL CORP
THIOKOL CORP

WINNEBAGO INDUSTRIES
FISHER SCIENTIFIC CO
SPECTRA-PHYSICS
MEASUREX CORP

POLAROID CORP
TALLEY INDUSTRIES INC
SWANK INC
BRUNSWICK CORP

HASBRO INDUSTRIES INC
SHAKESPEARE CO
HILLENBRAND INDUSTRIES
KANSAS CITY SOUTHERN INDS

MISSOURI PACIFIC CORP
RIO GRANDE INDUSTRIES
GOLDEN CYCLE CORP
LEASEWAY TRANS CORP

YELLOW FREIGHT SYSTEM
DELTA AIR LINES INC
SEABOARD WORLD AIRLINES
EMERY AIR FREIGHT CORP

MOUNTAIN STATES TEL + TEL
PACIFIC NORWEST BELL TELEPHON
ROCHESTER TEL CO
UNITED TELECOMMUNICATIONS

AMERICAN BROADCASTING
TAFT BROADCASTING CO
ALLEGHENY POWER SYSTEM
BOSTON EDISON CO

COLUMBUS + SOUTHERN OHIO
COMMONWEALTH EDISON
GULF STATES UTILITIES CO
HAWAIIAN ELECTRIC CO

HOUSTON INDUSTRIES INC
PUBLIC SERVICE CO OF IND
SOUTHWESTERN PUBLIC SERV CO
UTAH POWER + LIGHT

COLUMBIA GAS SYSTEM
CONSOLIDATED NATURAL GAS CO
BROOKLYN UNION GAS CO
NICOR INC

IOWA ELECTRIC LIGHT + PWR
IOWA-ILLINOIS GAS + ELEC
IOWA PUBLIC SERVICE CO
LOUISVILLE GAS + ELECTRIC

MADISON GAS + ELECTRIC CO
MISSOURI PUBLIC SERVICE CO
ORANGE + ROCKLAND UTILITIES
WISCONSIN ELECTRIC POWER

GREENMAN BROTHERS INC
STERLING ELECTRONICS
COMMERCIAL METALS CO

CHADWICK-MILLER INC
KETCHUM + CO
SAV-A-STOP INC
SUPER VALU STORES INC

FOREST CITY ENTERPRISES INC
CARSON PIRIE SCOTT + CO
GLOSSER BROTHERS INC
GOOD (L.S.) CO

KINGS DEPT STORES
SCOA INDUSTRIES INC
K MART CORP
WOOLWORTH (F.W.) CO

BORMANS INC
HANNAFORD BROTHERS CO
SUNSHINE-JR STORES
THOROFARE MARKETS

THRIFTIMART INC
GRAND AUTO INC
GAP STORES INC
KENWIN SHOPS INC

ROCKOWER BROTHERS INC
LEVITZ FURNITURE CORP
CHURCHS FRIED CHICKEN INC
DENNYS INC

FRISCHS RESTAURANTS INC
KAPOK TREE INNS
PAY LESS DRUG STORES NW
REVCO D. S. INC

G A I CORP
COLE NATIONAL CORP
MORGAN (J.P.) + CO
U S TRUST CORP

FIRST CHICAGO CORP
FIRST NATL BOSTON CORP
HARRIS BANKCORP INC
FIRST EMPIRE STATE CORP

MIDLANTIC BANKS INC
NATIONAL CENTRAL FINL CORP
CITIZENS + SOUTHERN NATL BK
DOMINION BANKSHARES CORP

FIRST KENTUCKY NATIONAL
FIRST NATL HLDG CORP ATLANTA
FIRST UNION CORP (N.C.)
SOUTH CAROLINA NATL CORP

TENNESSEE VALLEY BANCORP
CLEVETRUST CORP
COMMERCE BANCSHARES INC
FIRST WISCONSIN CORP

BANCAL TRI-STATE CORP
FINANCIAL CORP OF AMERICA
FINANCIAL FEDERATION
GIBRALTAR FINANCIAL CORP

GOLDEN WEST FINANCIAL CORP
AMERICAN INVESTMENT CO
PAINE WEBBER INC
WITTER(C.) REYNOLDS ORG INC

AETNA LIFE + CASUALTY CO
COLONIAL LIFE + ACCIDENT INS
COMBINED INS CO OF AMER
GOVERNMENT EMPLOYEES LIFE

INDEPENDENT LIFE + ACCIDENT
LAMAR LIFE CORP
PROVIDENT LIFE + ACCIDENT

USLIFE CORP
AMERICAN INTERNATIONAL GROUP
CNA FINANCIAL CORP
LINCOLN AMER CORP N Y

CORROON + BLACK CORP
HALL (FRANK B.) + CO
CANAL-RANDOLPH CORP
CULLWELL, BANKER + CO

AMREP CORP
CANAVERAL INTL CORP
DELTONA CORP
HORIZON CORP

SHAFELL INDUSTRIES
BANKAMERICA REALTY INVESTORS
CONNECTICUT GEN MTG + RLTY
HUBBARD REAL ESTATE INV

INSTITUTIONAL INVESTORS TR
MASSMUTUAL MTG + RLTY INVS
SELIGMAN + LATZ INC
PRUDENTIAL BLDG MAINTENANCE

COMPUTER INVESTORS GROUP
ON-LINE SYSTEMS
AMERICAN DISTRICT TELEGRAPH