JAMES TOBIN'S q RATIO

AS AN EVALUATION METHOD

OF MERGERS AND ACQUISITIONS

By

ANTHONY W. LEMASTER

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Central State University

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Report Approved:

H P Brewer
_____
Thesis Advisor

W. Gary Simpson
_____
Head of the Department of Finance

_____
Director of Graduate Studies

ame: Anthony W. Lemaster   Date of Degree: December, 1984

nstitution: Oklahoma State University

ocation: Stillwater, Oklahoma

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cope of Study: This study investigates James Tobin's q ratio as a
    possible method of evaluating mergers and acquisitions. Previous
    literature on merger objectivity and evaluation methods are
    reviewed and their relevancy to this study is discussed. Using
    data from Standard and Poor's Compustat tapes and the Financial
    Accounting Standards Board's tapes, q was calculated for recently
    acquired firms, acquiring firms, and randomly selected firms.
    Three hypotheses were set forth and conclusions were drawn upon
    those hypotheses based upon this study.

indings of the Study: The q ratios of acquired firms in this study
    were substantially less than those of randomly selected firms and the
    acquiring firms. No evidence was provided that acquiring firms have
    higher q's than the random firms. Conclusions indicated that q may
    be considered as a viable element in merger evaluation.

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I.   INTRODUCTION

One hundred years ago the United States experienced the industrial revolution. The early industrialists expanded their plant capacity as far as they physically could and then engaged in cut-throat practices with their competitors. Most economic battles were solved by combination arrangements in the form of the now infamous trust. These trusts abused all segments of the business community as well as the general public. Trusts soon were both feared and hated by most Americans. Congress responded to the situation with legislation to prevent the continuation of such trusts by passing the Sherman Anti-trust Act was passed in 1890.

As the industrialists were no longer able to form trusts, they soon resorted to a new form of combination, the holding company. The holding companies were soon back to the old tricks of the trust and in 1914, Congress passed the Clayton Act which prohibited holding companies that threatened competition. But the enterprising industrialists soon found a loophole in the Clayton law and began to acquire assets and stocks of competitors. Such was the beginning of major mergers and acquisitions which had been of little prevalence before.

Fearing the business structure of pre-World War II Germany, which some believed was responsible for Hitler's rise to power, Americans began to view business cartels as politically dangerous. Thus, in 1950, the Cellar-Kefauver Amendment was passed. With the help of the Warren Court in the 1960's, risk-adverse firms were guided away from acquisitions of competitors and toward acquisitions of unrelated business. Such a legal environment fostered the growth of conglomerate mergers.

In 1982, there were reports of 2,321 mergers involving a transactional value of $66 billion. In 1983, that number increased to 2,365 mergers or partial mergers of U.S. based companies[2]. Recent flurries of mergers in the oil industry has prompted threats of legislation limiting mergers within that industry. Criticism abounds regarding the unproductiveness of mergers and acquisitions. Mergers and acquisitions are common, newsworthy business events. While a great deal of empirical research has transpired concerning the productiveness of mergers, no definite conclusions have been produced.

In their quest for efficiency and market effectiveness, firms will often merge. One firm's acquisition of another has become commonplace within the last seventy years. The primary objective of any merger is to increase, in some mannner, the financial position of the acquiring firm. Three types of mergers exist: horizontal, vertical, and conglomerate. The horizontal merger is a merger of firms whose products are viewed by buyers as virtually identical, i.e., the products have a high cross-elasticity of demand. The vertical merger is an acquisition of a supplier or customer wherein the product of one firm is input for or marketed by the other firm. A conglomerate merger is any that is neither vertical nor hortizontal and the products of the acquiring and acquired firm are not competitive or vertically related. The primary focus of this paper is the conglomerate merger.

Conglomerate mergers can be viewed as representative of all mergers, for three major reasons. First, the same motives exist for all mergers regardless of their form of organization. Basically, all mergers are motivated by profit, power, or capital gain, and it can be assumed this is the case regardless of the form by which the merger is consummated. The second reason is that all mergers must be viewed in their economic

context and, "all mergers must be tested by the same standard whether they are classified as hortizontal, vertical, conglomerate, or other."3 The third reason conglomerates are viewed as representative of all mergers is that the subset of all mergers are included with the conglomerate merger; thus, the definition or label of the process is relative.

Conglomerate mergers have significant economic, political, and social consequences. In order to gain some insight into the welfare effects of conglomerate mergers, the Bureau of Economics of the Federal Trade Commission (FTC) published major reports in 1969 and 1980. The underlying theme of Economic Report on Corporate Mergers4, was that conglomerate firms reduce economic efficiency by hampering competition, by engaging in reciprocal dealings with their customers, reducing potential entry, and cross-subsidizing predatory effects that increase market concentration. Recently, The Economics of Firm Size, Market Structure, and Social Performance5 was published by the FTC. The thrust of this study examined how the conglomerate affects income distribution, worker satisfaction, political power, and community welfare. While these issues are important considerations, they are not the focus of this paper, but are presented to show the criticism and misunderstanding that exists among the American public and politicians concerning conglomerate mergers. Many Americans confuse the mergers of companies with the combination of firms that occured with the trust.

While corporate mergers and acqusitions involve many complex facets, the scope of this project is to review evaluation procedures and to provide an understanding of the objectivity of mergers. The purpose of this paper is to first review the literary base of corporate mergers, second, to review the prevailing models of merger evaluation, and third, to present an original model of merger evaluation based upon James Tobin's q ratio.

This project was carried out in the following procedures:

1. A review of relevant research that has investigated the objectivity of mergers and acquisitions. Presentation of relevant research for a basis of understanding of the merger evaluation methods presented

2. Presentation of current quantitative analytical methods for evaluation prospective merger and acqusitions

3. Discussion of James Tobin's q theory and the implications of this theory as a method of merger evaluation

4. Analysis of Tobin's q ratio as a method for evaluation of 39 companies that were acquired or merged in 1982 and 1983 based upon 1979-1981 data

5. Application of Tobin's q theory on 75 randomly selected firms to evaluate their potential for takeover

II. LITERARY REVIEW

Merger and Acquisition Objectivity

The purpose of a merger can basically be classified as (1) risk-adverse, (2) diversification oriented, (3) synergetically motivated, or (4) financially or economically ameliorated. These four classifications vary greatly among each other, but are not mutually exclusive or collectively exhaustive. Each of these objectives are discussed in the literary research and will be reviewed in this study.

Weston (1970) identifies three types of multi-industry firms: financial conglomerate, managerial conglomerates, and concentric firms. The financial conglomerates are those which exercise financial control and responsibility and do not participate in management. The managerial conglomerates are those which are managed by the parent company. Concentric companies involve carry-over management in activities of the segments of the firm between closely related functions. All three types have as an objective reduction of risk synergism.

Risk Reduction

Many mergers occur to reduce the risk to the acquiring firm. This is closely related to, but not synonomous with, the next reason of diversification which is a much broader area than risk reduction. Managers often seek risk reduction as a method of securing their own positions.

Amihud and Lev (1981) studied the managerial objective of risk reduction as a motive for conglomerate mergers. Two tests were used to test the hypothesis of managerial risk reduction. First, the actual number of mergers performed as a measure of propensity to diversify was used to find whether the intensity of mergers is associated with the type of control of the firm, i.e., owner controlled versus management

controlled. The second test was aimed at finding whether diversification, by whatever means, is associated with the type of firm control. The first test focused specifically upon mergers, while the second focused upon all risk-reducing measures.

Conclusions of this study were that risk reduction is not a motive for mergers from the stockholder's point of view, but it may be the motive for managers who are trying to reduce their own employment risk. Empirical findings were: (1) management controlled firms were engaged in more conglomerate mergers than owner-controlled firms, and (2) regardless of means of diversification, the management-controlled firms were found to be more diversified than owner-controlled firms.

Often, corporate control is an objective of mergers, and many large firms seek to increase the market share or business power through a merger. Halpern (1983) found that if corporate control is the rationale for the merger, then it was very likely that the target firm would have earned a significantly negative abnormal return some time before the merger occurred.

Many times financial risk aversion is the purpose of mergers. Levine and Aaronovitch (1981) found that other than size and capital market assessment, the acquiring firm did not differ significantly from the acquired firm in its financial structure. This study concluded mergers to be strategic decisions as opposed to methods for immediate economic gain. In the same study, Levine and Aaronovitch asserted that the larger the firm, the smaller the variation of profitability than the smaller firms, so that investment in large firms involves less risk. This topic is closely related to a later discussion involving financial synergism.

Financial risk diversion is accomplished by acquistion of firms with negatively-correlated cash flows. Through this method, the firm's cash stream is held constant; thus, the reduction in financial hazard is achieved. A study by Jagpal and Brick (1982) found that homogeneous risk aversion occurs if, and only if, the profit streams are negatively cor-related. When risk-aversions are heterogeneous, conglomerations may be feasible even when the profit streams are positively correlated.

Some studies have found that little advantage lies in the diversif-ication effect; instead, the advantage is achieved in the financial markets. A study by Levy and Sarnat (1970) concluded that in a perfect capital market, an economic advantage cannot be achieved by a purely conglomerate merger. This study indicates that despite the stabilizing diversification effect, a conglomerate merger does not necessarily create opportunities for risk diversification over and beyond what was already possible to an individual investor before the merger. By in-creasing the size of the firm, however, a merger may create opportun-ities for risk diversification over and beyond what was already possible to an individual investor before the merger. By increasing the size of the firm, however, a merger may create financial advantages, such as access to capital markets available only to larger firms. It is obvious that the possibility of simultaneous losses by all components of a merger are less than an individual investor's probability. Thus, the conclusion is drawn that the real benefits received from mergers are due to capital cost economies from less risk.

Diversification

Mergers which are diversification oriented are those which occur to increase the efficiency of the acquiring firm by diversifying the product line, smoothing the cash flow, compensating business and

economic cycles, and allowing entry into new industries in which entry might otherwise be prohibited. Lewellen (1971) contends that intra-industry mergers, which involve firms whose earning streams are closely correlated, may occur to realize operating efficiencies. Conglomerate mergers , however, often occur to smooth out earning streams and acquire additional debt capacities received in a merger.

A study by Smith and Schreiner (1969) measured diversification efficiencies by examining how close the portfolios of conglomerates and mutual funds were to the efficient frontier of investment opportunities available at the end of 1967. Using the Sharpe (1966) measure of excess portfolio return divided by the standard deviation of the returns, a measure was calculated for examination of diversification for each conglomerate and mutual fund in the study. With this measure, eight mutual funds and nineteen conglomerates were ranked. The top four ranked were mutual funds and thereafter both were conglomerates and mutual funds. The average measure of diversification efficiency was 0.602 for the mutual funds, somewhat higher than the average value of 0.428 for the conglomerates. Thus, by the Smith and Schreiner test, on the average, mutual funds achieved greater efficiencies of diversification than the conglomerates.

Whether or not mergers do in fact provide the acquiring firm with a greater diversification is manifest in the financial statements of that firm. It is to no avail for a firm to diversify and yet not accomplish economic and financial gain. While not investigating the financial markets advantages asserted by Levy and Sarnat, Weston and Mansingka (1971) compared the financial performance of a conglomerate with a randomly selected control group. The conclusions of this study

were that little if any difference exists in the profitability of
the conglomerates and the control group.

A study by Lev and Mandelker (1972) focused on the differences in
the acquiring firm in the period before and after the merger. This study
was cross-sectional in nature and compared the characteristics of the
acquired firm with those of the acquiring firm before the merger. This
study concluded that characteristics of the combined firm are not sig-
nificantly different from those of acquiror. Thus, from this study, the
acquired firm has taken on the attributes of the acquiror in the union
of the two firms.

Mergers often allow the acquiring firm to enter a new industry with
less effort and capital as well as allowing the firm to acquire new
method or product ideas from the acquired firm's research and develop-
ment department. Chakrabarti and Burton (1983) examined the technolo-
gical characteristics of mergers in manufacturing during the decade of
the 1970's. A comparision was made between the 1974-1975 time period
and 1979. The average size ratio of the acquiring to acquired in the
1974-1975 period was 18.5, but by 1979, the figure had dropped to 9.9,
implying that larger companies are becoming targets of acquisitions. The
nature of mergers was found to not have changed between the two time
periods such that no particular type of acquisition was dominant in the
1970's.

While Gort (1962) contended that mergers were prompted by
technological changes in R & D intensive industries, the study by
Chadrabarti and Burton concluded this not to be the case during the
decade of the 1970's. It was found in this study that acquistion
occurred predominately in firms with low and medium R & D intensitiy and
this did not change throughout the 1970's. Further, there was actually

a decrease in the acquisition of firms high in R & D throughout the 1970's. Conclusions of this study stated that the pattern as well as the level of mergers did not differ significantly during the previous decade. This study also concluded that mergers were motivated by a desire for diversification and reduction of systematic risk, as about one-half of the mergers in previous decade occurred between firms in the same industry.

Synergy

Mergers are often prompted by illusion of the expected financial efficiency of the merged firm. While synergism may be a by-product of mergers, it appears to exist in a financial realm, i.e., debt capacity rather than operating efficiencies. The synergism effect may be defined by the cooperative action of two firms such that the total effect of the two firms together is greater that the sum of the two effects taken independently. Thus the synergism effect is simply that two merged firms can operate more efficiently than the combination of the two operating independently of each other.

Hauger and Langetieg (1975) directed a study to determine if a merger of two firms produced effects different from those which might otherwise result from the purchase of both company shares by an individual investor. A synergistic effect would result because the merger might make it possible for the firm to enter new product lines. This would change the level of stability of the old line as well as the cyclical nature of the firm's profitability. This study examined 59 major industrial mergers, comparing the merging companies with a control group for a 36 month period prior to the merger and 36 months following the merger, to determine if the returns are significantly different for the two periods. The conclusions were that synergism does not take place within the scope of this study and that any investor could have

achieved the same results as those achieved by the merger. This con-
clusion does, however, examine the possiblity of financial synergism re-
sulting from the merger of two firms.

A study by Choi and Philippatos (1983) also considered the synergism
effect in mergers. Using a regresssion model for the period 67 months
prior to 8 months prior, as compared to a period 5 months after to 64
months after the merger, abnormal as well as cummulative abnormal returns
were calculated. Statisical analysis was performed upon the merged group
and was compared with that of the control group. The con-clusion of this
study found evidence of overall synergism which may re-sult from finan-
cial synergism resulting from increased financial leverage.

Financial synergism is examined by Kim and McConnell (1977). Finan-
cial synergism is described as the increase in the value of the combined
firms created by financial transactions that are attributable to the
merger activity and cannot be replicated by any transaction of the inves-
tors in the capital market. The realization of financial synergism can be
seen as the stability in the income of the two merged firms improves due
to the merger, and the market value of debt of the two firms increases
due to the effect of co-insurance. The merged firms are able to attract
additional financing which, in turn, increases tax savings from the addi-
tional interest payments. The Kim and McConnell study failed to find
evidence to support such financial synergism, even though debt financing
generally increases following the merger.

Jarrell and Bradley (1980) observed that the average tender premium
prior to the Williams Act (1968) is about 33%. After 1968 it was about
53% for federally regulated tender offers. These results do not

necessarily mean the acquiring firm's position was worse, but rather

their new requirements could result in success of only synergetic

mergers in which the successful bidder could afford to pay a higher pre-

mium and still be able to produce profitable results.

Steiner (1975) contends that often there exist tax motives exist

for mergers. As corporate tax losses can be carried forward to offset

future income, firms with large losses and dim future prospects may be-

come targeted for takeover. While tax losses are not salable, they may

be sold via the merger route and create an incentive to merge that would

otherwise not exist. In the period 1963-1968, 85% of all mergers were

consummated tax free through Section 368 of the Inernal Revenue Code.

In such a situation the assets of the acquired firm go on the books of

the new firm for tax purposes at whatever value they previously had, and

stockholders in the new firm realize no capital gains until their stock

is sold.

The Federal Trade Commission's Economic Report on Corporate Mergers

(1969) states on page 152 concerning Textron:

> Operating losses on some of its textile operations were more
> important sources of tax losses in 1952-1954, but most of the
> subsequent tax losses came from its sale of acquired plants,
> equipment, and in six instances, entire enterprises which had
> been acquired. Textron began its diversification program in
> 1953 with 2 acquisitions; by 1962 it had completed 37 more
> mergers. In this period, Textron's annual sales increased
> from $71 million to $550 million. Textron's tax losses were a
> major factor in motivating its growth by merger, in building
> up a glamorous reputation for growth of sales and earnings,
> and in financing many of mergers.[6]

Carleton, et al., (1983) distinguished three types of firms: non-

acquired, acquired in a cash takeover, and acquired in an exchange of

securities. Their findings that cash takeovers have been increasing

throughout the 1970's was attributed to finding that the median of ex-
change used in a merger was directly related to whether the acquisition
was taxable or nontaxable by the IRS. In the 1960's, many mergers were
consummated using convertible bonds, because the interest payment for
the acquiring firm was tax deductable. It was proposed that actually the
acquiring firm did not realize the value of the convertible bonds, as no
requirement was noted to reflect the diluting effect upon conversion.
Whether this is true or not, now fully diluted earning per share must be
reported according to Accounting Principles Board Opinion Number 15.
Consequently, a substantial rise has occurred in the number of firms
acquired in a cash takeover.

Financial Gains

Financial amelioration or immediate financial and economic gain, is
often a reason for mergers. It is probably viewed by the public as the
main purpose for which mergers transpire. Often firms acquire other
firms to "get a bargain" in the merger or to be able to purchase the ac-
quired company in the market at a much lower price than individual as-
sets are actually worth. Conglomerate mergers of the 1960's did in fact
involve such motives, and many firms were bought and sold piece by piece
at a substantial profit for the acquiring firm. Such a motive seems to
exist and is often exercised by some firms which hope to reap a quick
profit. In fact, such a profitable possibility seems to be rare within
the market today.

Weston (1970) states that a rise in the price earning ratios from
the 1950's to the early 1960's resulted in faster a stock price growth
rate than the growth rate in earnings. The greater valuation placed on
growth caused the advent of various methods to increase the growth in
earnings per share. Thus, the emphasis on higher price-earning ratios

acted as a catalyst for mergers and acquisitions. The hope of immediate improvement of price-earning ratios through acquisition became the impetus for mergers.

Firth's (1979) results suggest a higher price-earning ratio of the acquired firm compared to the acquiring firm in the period leading up to the takeover is not sufficient to guarantee investment gains. A firm with a low PE ratio and low valuation ratio will, therefore, constitute a relatively good buy even though subsequent share-price movements may cancel out immediate capital gains. The efficient market hypothesis states that all mergers reflect the true value of the firm and perfect disemination of information occurs. The value of the firm is subseqently determined and reflected in the bidding price of the successful acquiror. If the returns to the stockholders of the acquired firm are abnormal beyond the announcement month, then the failure of share prices to incorporate the information on the share purchase would be inconsistent with the efficient market hypothesis. Informal acquisition announcements are made by management and then reflected in the financial press. Formal announcements are made through Schedule 13-D which must be filed with the Securities Exchange Commission by the acquiror of more than five percent of a class of common stock within ten days of the open market purchase. Potential corporate takeovers are often predicted as the purchases reported in the 13-D are often followed by merger proposals.

The concept of competition in the acquisition market entails rivalry among bidding firms, as each potential bidder evaluates the value of the firm and advances the offer as long as it is advantageous to do so. This process continues and the offer is raised until the merger has a

negative net present value for the sucessful bidders. This would mean even if only one price is offered that no gains are available to any other potential bidder at the bid price.

Gort and Hogarty (1970) examined a number of aspects of mergers. Their statistical analysis indicated that the stockholders of the acquired firms gained on the average, while the owners of the acquiring firm lost on the average. They also found that mergers have a neutral effect of the aggregate worth of the firms that engaged in mergers. Hogarty (1971) attempted to measure the profitability of mergers. A successful merger was defined as one which increases the present value of the owner's interest in the firm. Forty-three firms which were heavily involved in merger activity between 1953 and 1964 were analyzed. The findings of this investigation revealed that the investment performance of heavily-merging firms is generally worse than the average investment performance of firms in their respective industries. Secondly, this study concluded that since the stock price performance of acquiring firms was worse than their per share earnings, it would appear that a merger is at least perceived to be a risky form of investment. Those few highly successful mergers tempt other firms to engage in merger activity, which for the most part is not profitable according to this study.

An empirical investigation of the market for acquisitions was presented by Mandelker (1974). This study tested the perfectly competitive acquisition hypothesis and the efficient capital market hypothesis. Mankelker's findings were that the market does provide perfect dissemination of information. The price the acquiring firm paid for the acquired firm's stock would allow the stockholder to receive normal returns on the acquisition. The abnormal gains in acquisitions are, however, received

by the stockholders of the acquired firm. This study also concluded that anticipatory price movements prior to the consummation of the merger reflect all economic gains expected from the merger. While prices did not adjust following the merger, the beta of the firm changed, and rates of return adjusted accordingly with the change in risk.

Ellbert (1976) presented data which was inconsistent with Mandelker's findings. In this study, Ellbert found that the acquiring firm does in fact realize significant gains from mergers. Ellbert uses the performance of the common stock of the acquired to conclude that competition does exist in the acquisition market. However, other studies have not found this to be the case. Ellbert's study was one of only a few to conclude that significant gains are achieved by mergers.

Ruback (1983) concludes that the market for corporate acquisitions is competitive, and that on the average, the successful price offer exhausts all potential gains for successful bidders. Asquith (1983) concluded that on the announcement date, the abnormal returns for successful and unsuccessful bidders are similar. This suggests that the market does not distinguish betweeen successful and unsuccessful offers until the outcome of the offers is released. This is consistant with the results of Bradley, et al, (1983). Bradley's study reported that average abnormal returns for an unsuccessful bidder was about 1.3 percent over the five day period prior to the first public announcement, but a cummulative negative 4.7 percent return for the forty days following the public announcement. Consistent with Ruback's findings, no significant abnormal returns were associated with either the announcement of the offer or the failure of the offer found in this study.

Franks (1978) concluded that the gain to shareholders whose interests were acquired by the acquiring firm prior to the bid announcement were substantially less than the gain received by the shareholders after the bid announcement. This result suggested that gains to merger participants were partially realized before any formal public announcement concerning the merger of the firm was made.

A study by Madden (1981) examined eighty-six major acquired companies which were acquired beween November, 1977, and June, 1979. The examination over the 22 months surrounding the announcement month of the acquisition found significant positive abnormal returns both in the announcement month and the immediate preoceeding month. Thus, the lack of significant abnormal returns on the period following the announcement is in agreement with the efficient market hypothesis.

Research by Firth (1979) studied the premium actually paid for the acquired firm above the market value of shares, and the movement in share price in and just after the month in which the takeover announcement was made (from a study of 224 mergers during 1972-1974). It was found that the owners of the acquiring firm suffered negative returns which almost exactly matched the postitive returns to the acquired companies shareholders.

Discrimination of median of exchange and the abnormal returns of a merger were investigated by Yagil (1980). Yagil found that from 1948-1975, fifty percent of all mergers were stock exchanges, twenty-nine percent were cash, and twenty-one percent were a combination of various arrangements. The cummulative abnormal returns (CAR) for the eight months before the merger date was 5.3% for the acquiror and 18.7% for the acquiree when the acquisition was financed with securities. For cash

mergers, the CAR over the same period was 7.9% for buyers and 31.9% for sellers. It appears that if any abnormal returns are to be realized in an acquisition, the gains will be realized by the owners of the acquired firm rather than the owner of the acquiring firm. Most studies show the market to reflect a worse position for the acquiring firm after the merger than before the merger.

An explanation of merger activity over time is presented by Melicher et al. (1983), in a study of mergers from 1947-1977. It has been argued that anticipated economic prosperity would provide a basis for explaining aggregate merger activity over time. This study revealed only a weak relationship between merger activity and economic conditions for the period 1947-1977. Using a univariate time series model, Melicher concluded aggregate merger activity was actually related to capital market conditions. The results indicated that changes in merger activity relate to current and prior changes in stock prices and bond yields. Considering that merger negotiations started two quarters before consummation, efforts in negotiations appear to reflect anticipation of rising stock prices and falling interest rates which would result in a more receptive and less costly financing environment for mergers to take place.

While it has often been stated that the primary motive for mergers was immediate financial gain, this is not so. Most studies in the area have concluded that, in fact, a merger can often be detrimental to the acquiring firm, due to the support found for the efficient market hypothesis. It appears that presently all gains are received prior to the takeover, and the acquired firm's stockholders are the recipients of any abnormal gains.

Merger Evaluation Methods

There are basically three approaches to valuing a firm considered for takeover according to Brigham (1982). These are: (1) market approach, (2) valuation of the firm's assets, and (3) capitalization of expected cash flows. The market comparable approach is based on the actual market prices of comparable assets. The valuation of the firm's assets approach may be calculated by:

$$VA = E + D = NWC + FA + IA$$

where

VA = value of the firm's assets

E = shareholder's equity

D = long term debt

NWC = net working capital

FA = fixed assets

IA = value of intangible assets

IA is a residual that will occur if the value of the firm is greater than the value of the assets. It should be noted that economic obsolescence results in a discount on the value of the firm's assets.

The discounted cash flow method is probably the most feasible of the methods. This method projects the available cash flows of the firm for several years and then discounts it at an appropriate rate considering the value of money and involved risk of the firm. The expected cash flow is calculated

$$ECF = CFO - (NWC + CE - D)$$

where

ECF = expected value of cash flow

CFO = cash flow provided by current operations

NWC = net working capital

CE = capital expenses

D = incremental long term debt

The cash flow provided by current operations is the most important variable and is determined by sales-expenses. Sales may be determined by time series analysis and statistical demand analysis. Upon determination of sales, the contingency variable of expenses may be calculated through regression analysis of historical data being divided into fixed, variable, and semi-variable expenses. Working capital may be determined by historical working capital ratios and applied to projected figures. The determination of capital investment is more subjective, based upon the age of the plant, present physical condition of the plant and the economical and technological obsolescence of the plant.

A rate of return must be determined to evaluate the ECF and to calculate a determined value of the cash flow of the firm. This rate of return must take into consideration the risk-free rate of government securities, a premium for business risk based upon the volatility of the firm's market, and a premium for financial risk that relates to the firm's financial structure. The computation of the required rate of return is:

$$k = R_F + R_B + R_C$$

where

k = required rate of return

R_F = risk free return

R_B = business risk

R_C = capital or financial risk

Larson and Gonedes Model

Larson and Gonedes (1969) use an an exchange ratio method of evaluation of mergers. The exchange ratio is the number or shares the acquiring firm has given in exchange for one share of the acquired firm. Thus, by the exchange ratio method, the wealth position of the parties involved can be measured to see if it has increased or diminished.

The Larson-Gonedes (L-G) model first analyzes the price-earning ratio of the individual firms compared to that of the acquired firm. This is presented more as an approximate cause rather than an observed effect; thus, it is not an evaluation method, but a cause of the merger. The earning multiple ratio is computed as follows:

$$\frac{P_0}{(Y/S)_0} = \sum_{t=1}^{n} \frac{(1+g)^{tb}}{(1+k)^t} + \frac{P_n}{(Y/S)_n} \times \frac{(1+g)^n}{(1+k)^n}$$

where

Y/S = annual per share earnings

g = constant growth ratio

k = required rate of return by investors

b = dividend pay out ratio

P_0 = price in time 0

P_n = price in time n

With all factors being equal, the PE ratio of the merged firm should be greater than the average of the unmerged firms before an allowance for risk to qualify as a beneficial merger. In theory, the g of the firm will vary directly with re-investment, and the k will vary

directly with risk and opportunity cost. The L-G exchange ratio model determines which firms gain more incremental value from the merger. The current wealth position of the holders of common stock A is equated by:

$$W_A = (M_A) (Y_A/S_A)$$

where

W_A = current wealth position of the holder of a share of common stock in company A (equal to the price per share of stock A)

M_A = PE ratio of A

Y_A = total earnings of A

S_A = company's A total outstanding stock

In the same manner the current wealth position of company B is calculated :

$$W_B = (M_B) (Y_B/S_B)$$

Therefore, the expected post merged price of a share of stock of the merged company would be:

$$W_{AB} = (\P)(Y_A + Y_B) \times \frac{1}{[S_A + (ER)S_B]}$$

where

W_{AB} = expected price per share of the merged company

$\P$ = expected PE ratio of the merged company

Y_A+Y_B = first period earning of the merged company

$S_A+(ER)S_B$ = total outstanding common stock of merged company

S_A = A's shares outstanding before the merger

S_B = B's shares outstanding before the merger

Thus, the wealth position of the holders of the merged firm will be increased if:

$$W_{AB} > \frac{1}{(ER)} W_B$$

The position of the acquiring firm will be improved if:

$$W_{AB} > W_A$$

Thus the maximum exchange ratio which is acceptable by the acquiring firm's stockholders is:

$$ER_A = \frac{\P (Y_A + Y_B) - (M_A)(Y_A)}{(M_A)(Y_A)(1-S_A)(S_B)}$$

The minimum exchange acceptable to the acquired firm's stockholders is calculated by:

$$ER_B = \frac{(M_B)(Y_B/S_B)(S_A)}{(\P)(Y_A+Y_B)-(M_B)(Y_B)}$$

The incremental value of the merger is calculated:

$$ER = W_B/W_A = \frac{(M_B)(Y_B/S_B)}{(M_A)(Y_A/S_A)}$$

If ER is greater than W_B/W_A, the acquired firm will benefit in proportion to the incremental value of the merger. Conversely, when the oppostite is true, the acquiring firm benefits from the merger.

Conn and Nieisen Model

Conn and Nieisen (1977) conducted an empirical test of the Larson-Gonedes model of exchange ratio determination and concluded that 40% of the 131 mergers in their sample did not conform to the rationality assumption of the L-G model. Further analysis revealed that the incident of wealth loss was much greater for acquiring firms than for acquired

firms. Also, a large number of mergers resulted in losses for the acquiring and the acquired firm such that

$$P_{12} < P_1S_1 + P_2S_2$$

where

P = price per share for company 1 or 2

S = number of shares of common stock outstanding

The L-G model provides that the acquiring firm desires the maximum exchange rate (ER), while the acquired firm desires the minimum ER. The ER is the number of acquiring firm's shares exchanged for each share of the acquired firm's equity. The ER ratio of company 1 and 2 are calcuated as follows:

$$ER_1 = (S_1/S_2)[-1+(E_1+E_2)(PE_{12})/P_1S_1]$$

$$ER2 = \frac{P_2S_2}{(PE_{12})(E_1+E_2)-(P_2)(S_2)}$$

where

PE = price/earnings ratio

P = price of common stock

S = number of shares of common stock outstanding

E = earnings

A comparison of the exchange ratio for the two merged companies to the ex post PE ratio then reveals the benefits received by whom in the transaction so that:

(1) if ER_1 > Actual Earnings Ratio (AER) > ER_2, there is an increase to acquiror's wealth

(2) if AER > ER_1 and ER_2, both the acquiree and acquiror experience an increase in wealth

(3) if ER_2 > AER > ER_1, the acquiree experiences an increase in wealth

(4) if AER < ER$_1$ and ER$_2$, both acquiree and acquiror
will experience a loss in wealth

The ex ante PE ratio (¶) resulting from a merger premium

depends upon the AER relative to P$_2$/P$_1$. In a positive merger premium

the ex ante PE ratio can be determined by:

$$¶ = \frac{P_1 (AER (S_2) + S_1)}{E_1 + E_2}$$

or in the case of a negative premium such that AER < P$_2$/P$_1$ the AER=ER$_2$

so that

$$¶ = \frac{P2 (S_1 + S_2 (AER))}{AER (E_1 + E_2)}$$

The ex post PE ratio is calculated:

$$R = \frac{Average\ P_1}{(E1 + E2)/ (S1 + S2 (AER))}$$

This empirical study supports the L-G model but rejects the null

hypothesesis that there is no difference in the ex ante and ex post PE

ratios.

Scott's Model

Scott (1977) evaluates the effect of mergers upon the stockholders

financial position. Scott's model deals with the following aspects of

mergers:

(1) Effects of merger value of equity on the merged
firm vs. the unmerged firm's equity

(2) The effect of mergers on non-contractual corpor-
ate liabilities in which (A) the rights to their
payments are not marketable, (B) the amount of
payment is fixed and not changed by payments
(These non-contractual obligations include legal
judgments on such obligations as sales and ex-
cise taxes)

(3) The effect of the corporate income taxes on the
profitablity of the conglomerate merger if
bankruptcy is possible

(4) The effect on profitability on conglomerate mergers
when the debt capacity of the merged firm exceeds the
debt capacity of the unmerged firm.

Under the conditions of a perfect security market, Scott presents

the followings model to the value of equity of firm A for period 0:

$$S_a = \sum_{j=1}^{n} P_j \, (1-t) \, \max \, [Q_{aj} - C_{aj} - R_a, \, 0]$$

where

0 = period zero which is the present period

S_a = firm A's equity value

P_j = present value of one dollar, if any, only if
state j occurs in the future period (state j
pays one dollar if state j occurs and nothing
if another state occurs)

t = corporate tax rate

Q_{aj} = proceeds from sale of output

R_a = total principal and interest payment due A's
bondholders in period 1

C_{aj} = A's obligation to noncontractual creditors in
state j of period 1

Scott argues that a conglomerate merger of all equity firms could

never be profitable because the acquired firm is weaker than the unmerg-

ed firm. Generally, acquired firms will not be as likely to go bankrupt

as unacquired firms, and the cash flows from the solvent firms are ap-

plied to noncontractual creditors of the otherwise insolvent firm.

Scott further states that a merger is a transfer from noncontracutal

creditors, and under these conditions, a firm seeking to maximize the

stock-holder's wealth will engage in divestitures. Thus, an equity

merger is determined to be profitable if $S_{ab} > S_a + S_b$.

The merger will be profitable if the debt capacity of the merged

firm exceeds the sum of the debt capacity of the unmerged firm. If A

and B merge, the capital structure does not change, as $R_{ab} = R_a + R_b$.

However, studies by Lewellen (1971) point out that the value of AB's

debt will exceed the combined to total value of unmerged firm's A and B.

Schick's Model

Schick (1972) presents the following models to determine whether

ROI of shareholders is actually increased in a takeover. First, the

change in shareholder returns is calculated by the following formula:

$$\triangle R_N = \frac{P_N \sum_{t=0}^{N} D_t}{P_0} - \frac{P'_N \sum_{t=0}^{N} D'_t}{P_0}$$

where

P_N = price of share at time N

D_t = Dividend received at time t

R_N = the difference in return produced by the firm's decision to merge

P_0 = price of common share at time 0

D'_N = price of share at N if merger had not taken place

D'_t = dividend received at t if merger had not taken place

Studies conducted using this method generally conclude that there

is no increase to the returns of shareholders as a result of a merger

(Kelly, 1967 , Block, 1969, and Hogarty, 1970). It should be pointed

out, however, that these studies have used two methods: (1) returns from

a sample of firms which ignore the initial position of the merged firm

(Hogarty), (2) returns from a similar non-merging firm (Kelly).

Schick modifies this method by introducing calculated price per

shares which are not subject to random fluctuations. The following is

the modified model:

$$P_t = P_t \; E_t$$

P_t = actual share price

P_t = calculated price of share as function of dividends

E_t = random error term with expected value =1.0

Substituting this equation for the first equation, yields the following:

$$\triangle R_N = [P_N + \sum_{t=0}^{N} D_t - P_N' + \sum_{t=0}^{N} D_t']/P_O$$

At this point, the above equation is multiplied by P_O and a new quantity MB_N is obtained by:

$$MB_N = R_N P_O = P_N - P_N' + D_t - D_t'$$

Any MB_N which is greater than 0 will increase the return to shareholders and the merger will be beneficial to the acquiring firm.

P_t can be evaluated using Gordon's (1962) model for determining the price of a share at a given time period by using the following model:

$$P_t = D_t E_t/(k - br)$$

where

P_t = price in time t

D_t = dividends in time t

br = dividend growth rate

E_t = error term

k = investor's required rate of return

Simkowitz and Monroe Model

Simkowitz and Monroe (1971) constructed a model to determine a financial profile of firms merged during a period of nine months in 1968 by use of multiple discriminant analysis (MDA). The method divided the study into two groups: those that were acquired during the period and those that were not acquired during the period. The study was based upon the hypothesis that the financial profile of the firm, based on selected financial ratios, provides a basis for determining targeted takeovers. The MDA model is presented below:

$$Z_{gj} = V_1 V_{gj1} + V_2 V_{gj2} + \ldots\ldots V_n X_{gjn}$$

where

V_i = the ith discriminate coefficient for the ith variate

X_{gji} = the valueof the ith variate of the jth subject in group g

Z_{gj} = the discriminant score for the jth subject in the gth group

Simkowitz and Monroe used seven variables in the MDA model to measure (1) growth, (2) size, (3) profitability, (4) leverage, (5) dividend policy, and (6) liquidity. The variables were computed using the following computations:

(a) market turnover of equity shares

(b) price earning ratio

(c) sales volume

(d) three year average dividend payout

(e) three year average annual percent change in common equity

(f) dummy variables for negative returns

(g) three year average common dividends/ last years common equity

Using this method, Simkowitz and Monroe were able to correctly classify an acquired firm in 82.6% of the sample and correctly identify a non-acquired firm 72% of the time, for a total prediction rate of 77%. This study compared samples of acquired and non-acquired firms based on a group of financial ratios and used a discriminant model to classify firms based on financial characteristics. They concluded that the acquired firms were smaller, have lower PE ratios, lower dividend payouts, and lower growth in equity. This study further observed that other non-financial characteristics were important. Their use of stepwise discriminant analysis with highly correlated data, however, makes it questionable as to which financial characteristics were significant.

Gort (1969) attempts to measure the merger ratio, that is, the ratio of the number of acquisitions to the number of business firms that can be acquired. Gort bases his theory upon three conditions that promote mergers: (1) discrepancy in valuation, (2) reduction of competition, and (3) economies of scale.

The discrepancies of valuation occur when a higher price is placed on the assets of the firm by the non-owners (acquirors) than by the owners. Reduction of competition may allow the firm to provide barriers to entry into the market and allow larger gains in earnings. Thus, when barriers to entry are high, the value of the future earnings of the firm may greatly exceed the value of its physical assets. Economies of scale allow for the acquiring firm to acheive its desired size at a lower cost than construction of new facilities; thus, a merger is advantageous if economies of scale do exist.

Gort presents the following models for a measure of the three conditions:

$$(1) \quad Y = f(T, C, G)$$

$$\frac{\partial Y}{\partial T} > 0, \quad \frac{\partial Y}{\partial C} > 0, \quad \frac{\partial Y}{\partial G} > 0$$

$$(2) \quad Y = g(C, G, \frac{\Delta C}{C})$$

$$\frac{\partial Y}{\partial C} > 0, \quad \frac{\partial Y}{\partial G} < 0, \quad \frac{\partial Y}{\partial \Delta \frac{C}{C}} > 0$$

$$(3) \quad Y = h(\Delta \frac{A}{A}, G, \Delta \frac{P}{P})$$

$$\frac{\partial Y}{\partial \Delta \frac{A}{A}} > 0, \quad \frac{\partial Y}{\partial G} < 0, \quad \frac{\partial Y}{\partial \Delta \frac{P}{P}} > 0$$

where

Y = merger rate

T = measure of technical change

C = concentration ratio

$\frac{C}{C}$ = change in concentration ratio

$\frac{A}{A}$ = change in average size of firm

$\frac{P}{P}$ = change in number of firms

Results of this hypothesis test support valuation discrepancies and reduction of competition while there is no support for the economies of scale hypothesis.

Shackett, Brown, and Mock Model

Shackett, Brown, and Mock (1971) presented a model which deals with a determination of return on equity (r) where:

$$r = \frac{earnings}{equity} = \frac{earnings/share}{equity/share} \text{ or } \frac{EPS}{BV}$$

Thus, if EPS increases by 4% and BV increases by 11%, r must decline by 6% (1-1.04/1.11). EPS, rather than return on equity, is reflected in the market price of common stock so that an appropriate equation is EPS = r x BV.

The optimal merger candidate should have a greater growth rate and a smaller price-earnings ratio than the acquiring firm so that

$$\frac{PE_A}{PE_B} \times \frac{(1 + g_B)^n}{(1 + g_A)^n} > 1$$

where

PE_A = PE ratio of company A stock

PE_B = PE ratio of company B stock

g_A = expected annual growth rate of income for company A

g_B = expected annual growth rate of income for company B

For the merger to be beneficial, the shareholder wealth must be increased (eventually) and reflected by an increase in the value of the shares of the firm in the market. The PE ratio now adjusts to the new expected growth rate, so that the postmerger common stock price is greater than the unmerged common stock as shown:

$$P_M > P_A$$

$$\frac{1 + (EAT_B/EAT_A)}{1 + (PE_B/PE_A)(EAT_B/EAT_A)} > \frac{k-b[zr_A + (1-z)r_B}{k-br_A}$$

where

EAT_A = current net income of company A

EAT_B = current net income of company B

PE_A = price earnings ratio of company A stock

PE_B = price earnings ratio of company B stock

k = cost of equity capital

$$z = \frac{EAT_A}{EAT_A + EAT_B}$$

b = percent of earning retained

r = return on equity

This assessment of corporate merger is limited to firms with the following characteristics:

(1) the PE ratio of the acquiring firm will remain unchanged by the merger

(2) each company has approximately the same tax rate

(3) both firms have low debt-equity ratios

(4) the merger will take place by exchange of common stock of the two companies

Based upon this, the merger will be profitable if the EPS of the acquired firm's stock, which was issued to acquire it, is greater than the premerger EPS of the acquiring firm.

Tobin's q Ratio

James Tobin's q ratio is defined as the ratio of market value to net replacement cost of plant, equipment, and inventory. Tobin's q was introduced by Tobin (1969) and was based upon the premise that if investors value assets at prices which are greater than replacement costs then there are strong inducements for investments in preproducable real capital. The basic germ of the idea for the q ratio was originated by John Keynes (1936). Keynes states on page 151 of his writing:

> "...the daily revaluations of the Stock Exchange, though they are primarily made to facilitate transfers of old investments between one individual and another, inevitabley exert a decisive influence on the rate of current investment. For there is no sense in building up a new enterprise at a cost greater than that at which a similar existing enterprise can be purchased; while there is an inducement to spend on a new project what may seem an extravagant sum, if it can be floated off the Stock Exchange at an immediate profit. Thus certain classes of investment are governed by the average expectation of those who deal on the Stock Exchange as revealed in the price of shares, rather than by the genuine expectations of the professional entrepreneur."

Keynes' statement that there is no sense in building a new enterprise when one can be purchased for less (not to mention the debugging cost, time factor of implementation, etc.) is the basis for application of this ratio as an evaluation method of mergers and acquisitions. Much research has been done concerning Tobin's q, but most of that research has been in the area of the ratio's influence on the capital markets. Intuitively, one would think that q could measure to a certain degree the financial advantage of an acquisition as opposed to entry into a new market or product line from a cold start. If a firm can be purchased in the market for less than it costs to organize from the ground up, certainly the prudent firm would prefer the former.

A firm that sought to maximize the stockholder's wealth would determine its investment decision based upon the induced change in the market value of the firm compared to the cost of acquiring new capital. If the cost was smaller than the change in market value of the firm, the shareholders would profit, but in the converse the shareholder's wealth would decline. Thus, stockholders would benefit from receipt of any funds that might be spent of any given project. Smith (1981) studied the correlation between q and investment levels and concluded that a relationship definitely existed between q and the level of investment. This study concluded that investment would increase when the firm's value on the market was higher than the physical assets replacement cost (i.e., the q is greater than 1.0). Conversely, investment will decline as investment in physical assets is valued in the market below their replacement cost which results in a q less than 1.0.

Tobin's q ratio has also been evaluated as an index for investment profitability for a firm. Ciccolo and Fromm (1979) evaluated approaches to determine the desired level of capital stock, and the effects of bankruptcy and taxes when equity and debt were sources of finance for investment. Their conclusion was that the use of debt financing by a firm permits leverage of earnings to stockholders, but increases the risk of bankruptcy, and therefore increases the required rate of return. When physical asset investment increases, the marginal product of capital falls, and as risk increases, the expected rate of return falls as the required rate of return rises. Thus, the q ratio may be seen as an indication of relative potential profitability for investments of the firm. If this is the case, then the potential for synergism from a merger would be increased.

Holland and Myers (1979) studied the q ratio as an effect of capital cost in the market trends. Their analysis concluded that during the first 20 years following World War II, the q ratio for the aggregate market was about 1.5. The following 12 years, however, the q ratio was below 1.0, reflecting that the aggregate market value of non-financial corporations was below the net replacement cost of the physical assets held by those firms. Holland and Myers determined 1965 to be the turning point for q, and until 1976, q was on an erratic downward course. Conclusions from this study indicated that q reflected the expected profitability of a firm's investment. Thus, any increase in q would be indicative of an increase in that firm's investment.

Yoshikawa (1980) reviewed the micro-economic foundations of the q ratio. Desired capital stock is determined first, and the investment is derived from the discrepancy between the desired level of capital stock and the actual level of capital stock. Allowing a divergence between the value of capital as set forth in the financial market and the price of capital goods explains investment as a result of short-run disequilibrium set forth by Yoshikawa.

Malkiel, Von Furstenberg, and Watson (1979) studied q as a determination of desired future stock of capital. This study shows no statistical significance concerning the effect of changes in a level of output relative to trends or changes in capacity utilization rates on investment in the industries studied. Tobin's q ratio was, however, statistically significant in the majority of cases. Industries do not act as if they forecast next year's q to be the average of all previous q's. These industries do assume that deviations in q will remain and require continuous adjustments in the stock of capital until q is constant and the growth rate of capital is restored.

III. RESEARCH METHODOLOGY

Overview

The purpose of this study is to determine if James Tobin's q ratio is an acceptable method of evaluating merger candidates. If the q ratio of a sample of merged firms is significantly different from that of a sample market q, then q could have some implications on merger activity. Therefore, the following hypotheses are set forth:

$$(1) \quad \mu \text{ q acquired} \ < \ \mu \text{ q market,}$$
$$(2) \quad \mu \text{ q acquiring} \ > \ \mu \text{ q market, and}$$
$$(3) \quad \mu \text{ q acquiring} \ > \ \mu \text{ q acquired}$$

The first hypothesis contends that those firms which are acquired will have a smaller q than those of the market sample, i.e., the ratio of market value to net replacement value is smaller for acquired firms. The logic behind this hypothesis follows the thought set forth by Keynes that firms which can be bought in the market for less than they can be started will be very attractive to other firms who wish to enter a new business. The second hypothesis states that the acquiring firms will have a higher q ratio than the market sample. This indicates that the market reflects a higher value for these firms relative to their assets than for the random sample. The third hypothesis states that the q ratio of the acquiring firm is expected to be statistically different from that of the firms being acquired. These hypotheses are neither mutually exclusive nor collectively exhaustive.

Both acquiring and acquired firms were selected from a listing of the 100 largest acquisitions (in dollars) as listed in Mergers and Acquisitions for 1983[7] and 1982[8]. Acquired firms that met the following criteria were used:

     (1)   The company's financial data was available on
           Standard and Poor's Compustat tapes

     (2)   The company's financial data was available on
           Financial Accounting Standard Board's tapes

A random sample of acquiring firms was selected from firms which also met the above criteria.

Using data from Standard and Poor's Compustat tapes and the Financial Accounting Standard Board's (FASB) tapes, Tobin's q ratio was calculated on the selected firms. Using the Statistical Analysis System (SAS) package, statistical evaluation of the results were performed. The remainder of this chapter is devoted to detailed procedures of this study.

The Firms

Those companies that met the criteria prescribed above were selected for this study. Thirty-three acquired companies were involved in this study. These companies are listed in Table 1. Data was collected for any combination of the years 1981, 1980, and 1979. The value of these transactions ranged between $4.4 billion and $100 million.

Forty-one companies were randomly selected from a list of firms that were active in acquisition between 1981 and 1983. The selected firms are listed in Table 2, along with the firm(s) which were acquired. Privately-held companies were not included in this listing, as financial data for such firms is not made available to the public. Acquisitions made by private investors also lacked any financial data and are not considered in this study.

TABLE 1

ACQUIRED FIRMS IN STUDY

Acquired Firm	Year in Study	Year in Merger	Value $ Millions
ACF	79-81	1983	114
Albany	80	1983	270
Allied Telephone	81	1983	118
American Can	81	1982	446
Bendix	79-80	1983	1,800
Campbell Taggart	80-81	1982	570
CCI	80	1983	100
Continental Group	80-81	1983	510
Cities Services	79-81	1982	4,202
Dan River	80-81	1983	153.9
Diamond International	80-81	1982	400
Dillingham	79-81	1983	350
El Paso	79-81	1983	1,276
Gearhart	80	1983	117
Gulf Oil	80-81	1983	909
Harris	79-80	1983	250
Heublein	79-80	1982	1,620
Interpace	81	1983	151.2
Itek	79-81	1983	240
Martin Marietta	79-81	1982	1,193.7
Maryland Cup Corp.	80	1983	530
Missouri Pacific	79-81	1983	1,028
Norton Simon	79-80	1983	990
Northwest Energy	81	1983	819
Pabst	79-81	1982	179
Pargas	79-81	1983	155
Pittson	80-81	1983	1,276
Purex	79-80	1982	358
Raymond	79-81	1983	165
Suburban Propane	79-80	1983	270
Thiokol	81	1982	562
Warner Communications	81	1982	103
Wheelabrator-Frye	80	1983	946

TABLE 2

ACQUIRING FIRMS IN STUDY
FOR 1981

Company	Firm Acquired
Allied store	Garfinckel Inc.
American Standard	Trane Co.
Anheuser-bush	Campbell-Taggart
Bally Manufacturing	Six Flags Corp.
Burlington Northern	El Paso
Capital Cities Communication	Cable Com General
Centel Corp.	Asarco Inc.
Coca-Cola Inc.	Columbia Pictures
CPC International	CF Mueller Co.
Dart and Kraft	Hobart Corp.
Dow Chemical	Richardson-Merrell
Du Pont De Nemours	Conoco
Ethyl Corp.	First Colonial Life
Fort Howard Paper	Maryland Cup
General Electric	Picker Corp.
Hercules Inc.	Simmonds Precision Products
IBM	Intel
Lone Star Industries	Marquette Co.
Martin Marietta	Bendix Corp.
Mid-Continent Telephone	Allied-Telephone
Monsanto	Fisher Controls International
Motorola	Phase-Four Systems
Northwest Energy	Cities Services Gas Co.
Occidental Petroleum	Cities Services
Ogden	Allied Maintenance
Penn Central	Northern Propane
Reading and Bates	Gould Inc.
Reynold Inc.	Heubleim Inc.
Schlumberger	Applicon Inc.
Sears, Robuck and Co.	Dean Witter Reynolds
Smith International	Gearhart Industries
Smithkline	Beckham Instruments
Southland Corp.	CITGO Petroleum
Standard Oil of Indiana	Harbert Corp.
Teledyne	Kidde Inc.
Tenneco	Houston Oil
U.S. Steel	Marathon Oil
Warner-Lambert	Imed Corp.
Williams Co.	Northwest Energy
Xerox	Crum and Forster

The sample size selected is justified by a procedure set forth by Lapin (1973) for evaluation of sample size validity. The method for sample size selection used by Lapin is as follows:

$$n = \frac{z^2 \; \sigma^2}{e^2}$$

where

n = sample size

z = risk of committing error

σ = standard deviation of the population

e = tolerable error acceptance level

Lapin contends that σ^2 is approximately equal to the standard deviation of the sample (S^2) and S^2 may be substituted for σ^2. For the sample involving acquired firms S^2 was determined to be .2874, and the e was set at 10%. The following computations were made upon this formula

$$n = \frac{z^2 \; S^2}{e^2}$$

$$33 = \frac{z^2 \; (.2874)^2}{(.1)^2}$$

$$z^2 = 3.995$$

$$\sqrt{z^2} = \sqrt{3.995} = 1.9987$$

This figure is located on a z-value table to conclude that with a 95% confidence level, this sample is truly representative of the population from which it was drawn. When the same procedure was applied to the 44 companies that were actively involved in acquiring other firms, a 98% confidence level was found in the sample.

The Model

The model used to calculate q is set forth in a study by Ross and
Lindenberg (1981), which was predicated upon a study by Tobin and
Brainard (1977). The basic Ross and Lindenberg model is developed
below:

$$q = \frac{\text{Market Value of Firm}}{\begin{array}{l}\text{Net replacement value}\\\text{of property, plant, and}\\\text{inventory of firm}\end{array}}$$

where

Market Value of Firm = MV (Debt) + MV (Common Stock)
+ MV (Preferred Stock)

The market value of debt is determined by a procedure followed by
Tobin and Brainard. An economy-wide annual index of the value of corp-
orate bonds is determined, based upon Standard and Poor's average compo-
site high grade bond price for a given year.[9] If the average price for
all bonds in 1969 was $68.63 for $100 per bond, this price was converted
into an index for that year, i.e., .6863, which was then multiplied by
the long term debt outstanding in 1969, to arrive at the market value of
a firm's debt. A more complex procedure is used by Ross and Lindenberg,
which deals with bond issue and return at a rate of 5% per year, with
value of the bonds based upon yield to maturity for each year. This, in
effect, yields the same value as Tobin's method. The index used is based
upon the assumption that all bonds have a 20-year maturity and are issu-
ed at par with price indexes based on average yield indexes. Thus, this
index shows the market's valuation of all bonds (considering twenty year
issues) for any given year. If a firm had one million dollars worth of
bonds in 1969, which had been issued and retired at a rate of 5% per
year, the market would, as a whole, (by means of the market prices)

value these bonds at $686,300. Short-term debt of less than one year was valued at book value and added to the value of long-term debt, to determine the total value of debt.

The market value of common stock is derived by the total shares outstanding multiplied by the year-end closing price. Both of these items were available upon the Compustat tapes. The market value of the firm's preferred stock was calculated by a procedure used by both Ross and Lindenberg, and Tobin and Brainard. Preferred stock dividends from the Compustat tapes were divided by a Standard and Poor's preferred stock yield index[10] to determine the market value of the preferred stock. Again, the market value is determined by the actual market. When the market value of debt (long-term plus short-term debt) is added to the market value of common and preferred stock, the market value of the firm is determined.

The replacement value of property, plant, and inventory has been calculated through complex procedures in many other studies. This particular study, however, relied upon the replacement value reported by the firms in compliance with the Securities and Exchange Commission's 10-K schedule, which is reported on the FASB tapes.

The FASB tape contains information disclosed by 1,200 companies, in compliance with the Financial Accounting Standard Board, Statement 33. The data was obtained directly from the companies via forwarded 10-K reports. In meeting the requirements set forth by the SEC and FASB, these companies reported the replacement value of the firm's assets. This figure was then applied to the replacement value formula.

Replacement value of the firm was defined by Ross and Lindenberg as:

$$RC_t = TA_t + RNP_t - HNP_t + RINV_t - HINV_t$$

where

RC_t = total replacement cost in year t
TA_t = total assets at historical value in year t
RNP_t = net plant at replacement cost in year t
HNP_t = net plant at historical value in year t
$RINV_t$ = inventories at replacement cost in year t
$HINV_t$ = inventories at historical value in year t

Historical values were accessed by means of Compustat tapes, while replacement costs were derived from the FASB tape. A conversion was necessary, as the FASB data is listed in millions of dollars, whereas the Compustat data is listed in tens of thousands of dollars. Further, the number of shares outstanding were listed in thousands. Conversion to tens of thousands of dollars was necessary to accomplish calculation of the q ratio. All variables used are given in the appendix.

The Selection of the Market Sample

A listing of companies was first determined by those companies that met the same criteria as mentioned before. Eight hundred thirty-four companies met these qualifications. Using a procedure set forth by Stockton and Clark (1971), a random selection of these companies was made. These companies were assigned numbers between 500 and 1334. The 75 companies were selected by use of a random number table for each of the three years in the study. While 75 companies were selected, not all companies' financial data was available for that year. For 1981, 44 companies were available and for 1980, 43 companies were available for analysis. Since the initial selection involved 75 companies, the same as the other two years, no further selection was made, and 30 companies' q was calculated for 1979. All companies are listed in Table 3.

TABLE 3

RANDOMLY SELECTED FIRMS

1981	1980	1979
American Electric Power	Abbot Labs	Allis-Chalmers
Amfac	Arvin	Amerace
Arkansas Best	Bassett Furniture	American Cynamid
Avon Products	Brockway	Baker International
Bally Manufacturing	Cameron Iron Works	Beker
Bell and Howell	Carter Hawley Hale	Borden
Castle and Cook	Chesebrough-Ponds	Borg-Warner
Connecticut Natural Gas	Cluett, Peabody & Co.	Capital Cities Comm.
Copperweld Corp.	Colt Industies	Celanese
Detroit Edison	Control Data Corp.	Crystal Oil
Dorsey	C F National	Deere & Co.
Forest City Enterprises	Cyclops	Di Giorgio
General Motors	Disney Productions	Dravo
B. F. Goodrich	Eagle-Picher	El Paso
Ingersoll-Rand	Eastman Kodak	Fisher Food
Kerr Glass	Evans Products	General Refactories
Kimberly-Clark	Ferro Corp.	Harsco
Long Island Lighting	FMC	HRT
Mattel	Fotomat	Lamson and Sessions
McGraw-Hill	Gannett	Midland-Ross
Michigan Energy	General Tire	National Semi-
Resources	Grumman	conductor
Middle South Utilities	Harsco	Norton Simon
Nevada Power Co.	Hesston	Phibro Salomon
Oklahoma Gas & Electric	International	Quaker Oats
Orange and Rockland	Harvester	Reichhold Chemical
Pacific Lumber	Kay Corp.	Shackler
J. C. Penney	Loews Corp.	Stanley Works
Pfizer	Magic Chef	Toys R US
Piedmont Aviation	Monogram Industries	Uniroyal
Poloroid	Munford	Wal-Mart
Public Service of	Newmount Mining	
Indiana	Olin	
Purolator	Paccar	
Raymark	Parker Drilling	
RCA	Rubbermaid	
Rohn and Hags	Scovill	
Sharon Steel	Telex	
Stauffer Chemical	Transway	
Supermarket General	Uniroyal	
Texas Instruments	Wean United	
TRW	Whirlpool	
VF Corp	Witco Chemical	
Weis Markets	F. W. Woolworth	
Western Co of North		
America		
Zayre		

Defense of Procedure

The procedure used to calculate the q ratio is comprised of two elements: the market value of the firm and the replacement value of the firm. Both of these elements will be examined in light of the procedure used in this study. The basic procedure of q = market value/replacement value is the same as that followed by Tobin and many others who have since used his methodology. It is therefore assumed that the basic procedure is acceptable in the fact it is widely published and read in financial literary circles.

Following procedures used by both Ross and Lindenberg, and Tobin and Brainard, the market value of long-term debt was determined by the use of an aggregate index for all firms. While this procedure may lack the acuteness of accuracy that might be desired, it is acceptable as it conveys the value of all debt for all firms. This paper did not follow the detailed method used by Ross and Lindenburg, as such manipulations were beyond the scope of this study. The index used, i.e., the Standard and Poor's price of aggregate twenty-year bonds valued at yield to maturity based upon average yield, is considered to be acceptable, though admittedly not the most refined method. Valuation of preferred stock by the method used in this paper is also acceptable in financial literature, e.g. Chappel and Cheng (1982).

This paper deviates substantially from any previous method in calculation of q by using FASB data to calculate the replacement value of the firm's property, plant and equipment. This procedure is defended by the fact that detailed procedures have been used to calculate the replacement value of assets in accordance with the FASB. Thus retrieval of such data from the FASB tapes makes available estimates of replacement values by means of acceptable accounting practices. Though different from any previous method, this q ratio may be defended as a viable method.

IV. ANALYSIS OF RESULTS

Introduction

In this chapter, results from procedures outlined in the previous chapter will be presented and statistical applications will be discussed. The first section presents the calculation of q ratios for the acquired firms. The second section presents the calculated q for the acquiring firm, and the next section relates to the random market sample. Statistical measures are given within each group and then among the groups. The results from this statistical analysis are then related to prescribed hypotheses, and conclusions are made concerning the q ratio as it affects merger activity.

Acquired Firm's q

Following the procedure described in the previous chapter, Tobin's q was determined for acquired firms. The data was first grouped by firm and presented in Table 4. As a group over the three year period, the average q was .6943 with a standard deviation of .4776. The minimum value was .2464 and the maximum value was 3.9856. Approximately 92% of the observations were below 1.0. When Gearhart Industries' q of 3.9856 was removed from the sample, the mean q was .6436 and the standard deviation became .4106.

An observation concerning Table 4 should be made. In firms in which three years of data exists it appears that q was declining from 1979 to 1981 in a negative correlation with higher interest rates. One would expect that as interest rates increase the market value of the firm will decline, reflecting (1) decline in market value of debt, (2) decline in common stock price as investors require a higher rate of return, and (3) decline in preferred stock value as preferred stock declines

proportionately with interest rates. In the denominator, replacement value would rise in relation to inflation during the period 1979-1981. While no statistical basis exists for this observation, nor any sufficient data to make such an observation, this follows with what one could intuitively expect for this period of time.

When the data is broken down by individual years, the following occurs:

Year	N	Mean q	Stan. Dev.	Minimum Value	Maximum Value	Variance
1981	22	.5928	.2601	.2464	1.4167	.0676
1980	27	.7941	.6762	.2595	3.9856	.4522
1979	16	.6652	.2279	.2615	1.1407	.0519

When Gearhart Industries' q of 3.9856 is deleted from 1980, the following changes are made:

Year	N	Mean q	Stan. Dev.	Minimum Value	Maximum Value	Variance
1980	26	.6347	.2433	.2595	1.4367	.0621

Concerning the mean, gradual decline is noted when the extremities are removed. Thus, from the standpoint of the means, a statistical decline is evident from 1979-1981 in the q ratio of acquired firms.

TABLE 4

ACQUIRED FIRM'S q RATIO
(GROUPED BY FIRM)

Company	1981 q	1980 q	1979 q
ACF	.3754	.4926	.4467
Albany	-----	.8006	-----
Allied Telephone	.4241	-----	-----
American Can	.4657	-----	-----
Bendix	-----	.7521	.6736
Campbell Taggart	.5823	.5472	-----
CCI	-----	.7115	-----
Continental Group	.4525	.4865	-----
Cities Services	.5181	.5627	.4331
Dan River	.3526	.3889	-----
Diamond International	.7191	.6655	-----
Dillingham	.5201	.5509	.6911
El Paso	.6918	.7842	.9224
Gulf Oil	.4161	.5097	-----
Gearhart	3.9856	-----	-----
Harris	-----	1.4367	1.1407
Heubleim	-----	.7759	.7825
Interpace	.4578	-----	-----
Itek	.8271	.8774	.8922
Martin Marietta	.4771	.7067	.7070
Missouri Pacific	.2464	.2596	.2616
Maryland Corp.	.5416	-----	-----
Norton Simon	-----	.7162	.6678
Northwest Energy	.4343	-----	-----
Pabst	.6671	.4564	.3876
Pargas	.5598	.6514	.6671
Pittson	.7562	.7564	-----
Purex	-----	.7449	.7529
Raymond	.7519	.9110	.7405
Suburban Propane	-----	.5270	.5843
Thiokol	1.0693	-----	-----
Warner	1.4161	-----	-----
Wheelbrator-Frye	-----	.9128	-----

Acquiring Firm's q

The q for firms which actively acquired other firms in 1982 or 1983 is given in Table 5. The average of all q's for the acquiring firms sampled is .9906 with a standard deviation of .5818. The q for acquiring firms ranged from .2104 to 3.0168. When the two extreme values of Schlumberger (2.9051) and Smithkline (3.0169) are removed, the mean drops to .9237 with a standard deviation of .3428.

Another extremity that should be noted is Burlington Northern's q ratio of .2104, which is relatively low for this sample. Investigation of this firm reveals a great deal of depreciated assets, e.g., rail lines, forest, etc. Further investigation reveals excessive cash reserves as a result of the depreciation taken on these assets. It should be noted, however, that some questions exist as to whether Burlington might become a take-over candidate itself.

The only year that was observed for the acquiring firm's q was 1981. The reason for this observation is that the q ratio of the aggregate market varies from year to year reflecting interest rates, market expections, etc. Since the q ratio was measured across the market for random firms as well as the acquired, these ratios would be reflected only after the merger was consummated, and prior to the last year of the study the ratios of the acquired firm would not be reflected in the new q ratio of the acquiring firm. Some mergers, however, may not be reflected in the 1981 q ratio anyway.

TABLE 5

q RATIO OF ACQUIRING FIRMS FOR 1981

Allied Stores	.7658
American Standard	.9179
Anheuser-Busch	.9027
Bally Manufacturing	1.3852
Burlington Northern	.2104
Capital Cities Communication	1.6970
Centel	.5863
Coca-Cola	1.4297
CPC International	1.1046
Dart and Kraft	1.0011
Dow Chemical	.7050
Du Pont De Nemours	.6725
Ethyl Corp.	.6700
Fort Howard Paper	1.9334
General Electric	1.0919
Hercules	.7679
IBM	1.6356
Lone Star Industries	.5270
Martin Marietta	.4771
Mid-Continental Telephone	.4216
Monsanta	.7555
Motorola	1.0601
Northwest Energy	.5758
Occidental	.6753
Ogden Corp.	.6597
Penn Central	.6639
Reading and Bates	.9749
R.J. Reynolds	.8327
Schlumberger	2.9051
Sears, Roebuck and Co.	.4531
Signal	.8827
Smith International	1.3652
Smithkline	3.0168
Southland	.7912
Standard Oil of Indiana	.8811
Teledyne	1.1580
Tenneco	.6734
U.S. Steel	.4228
Warner-Lambert	.9848
Williams Co.	.5466
Xerox	1.2425

Random Firm's q

The q ratio was calculated on the firms within a random sample for 1979-1981. The calculated q's are given in Tables 6-8. For 1981, the average q calculated from the randomly-selected firms was .8563 with a standard deviation of .4147 and a range from .3413 to 2.0137.

An oddity existed in this sample in the fact that 16% of the firms in this sample were classified with an SIC industry code of 4911 - firms involved in electrical services. The Compustat tape firms (from which this sample was selected) involved in electrical services account for only 2.8% of all firms. A new adjusted mean was calculated when the following firms were removed: (1) American Electric Power, (2) Detroit Edison, (3) Long Island Lighting, (4) Middle South Utilities, (5) Nevada Power Company, (6) Oklahoma Gas and Electric, and (7) Public Service of Indiana. The adjusted mean q was .9460 with a standard deviation of .3931.

The adjusted mean q was the more preferred account of random sampling, as the q ratio of the electrical facilities in 1981 were among the lowest of those randomly selected. Further analysis was done using both the random q and the adjusted q.

The firms for 1980 that were randomly selected and their q ratios are listed in Table 7. The mean q ratio for this group was .9675 with a standard deviation of .6004. The randomly chosen group ranged from 3.9490 to .1601. When Walt Disney (3.9490) and Ferro (.1601) were dropped from consideration, the mean was lowered to .9587 with a standard deviation of .3924. The group appeared to lack any obvious abnormalities as existed in the 1981 data.

TABLE 6

RANDOMLY SELECTED FIRMS' q FOR 1981

Company	q ratio
American Electric	.3622
Amfac	.7098
Arkansas Best	.6784
Avon	1.4594
Bally	1.3905
Bell and Howell	.8288
Castle and Cooke	.6313
Conneticut Natural Gas	.4385
Copperweld Corp.	.8999
Detroit Edison	.3413
Dorsey Corp.	.7185
Forest City Enterprises	.8937
B.F. Goodrich	.5366
Ingersoll-Rand	.8378
Kerr Glass	.5208
Kimberly-Clark	.8965
Long Island Lighting	.4121
Mattel	.9155
McGraw-Hill	2.0137
Michigan Energy Resources	.4220
Middle South Utilities	.3780
Nevada Power	.4352
Oklahoma Gas and Electric	.3676
Orange and Rockland	.3818
Pacific Lumber	1.8520
J.C. Penney	.8427
Pfizer	1.4546
Piedmont Aviation	.7557
Polaroid Corp.	.9498
Public Service of Indiana	.4519
Purolator	.3176
Raymark	.7371
RCA	1.0401
Rohm and Haas	.9186
Sharon Steel	.6899
Stauffer Chemical	.6442
Supermarket General	.7002
Texas Instruments	1.2075
TRW	.9786
V.F. Corp.	1.2875
Weis Markets	1.6345
Western Company of North America	1.1761
Zayre	.7104

TABLE 7

<u>RANDOMLY SELECTED FIRMS' q FOR 1980</u>

Company	q Ratio
Abbott Labs	1.9818
Arvin	.6200
Bassett	1.0401
Brockway	.5274
Cameron Iron Works	1.4450
Carter Hawley Hale	.6860
Cheesebrough-Pond	1.5688
Cluett, Peabody & Co.	.8240
Control Data Corp.	1.1256
CF National Corp.	.5617
Cyclops	.4406
Walt Disney	3.9490
Eagle-Picher	.7054
Eastman Kodak	1.2870
Evans	.7079
Ferro Corp.	.1601
FMC	1.7455
Fotomat	.8898
Gannett	1.7225
General Tire	.6026
Grumman Corp.	.7925
Harsco Corp.	.9434
Hesston Corp.	.8762
International Harvester	.6173
Kay Corp.	.7789
Loews Corp.	.4937
Magic Chef	.7147
Monogram Industries	.7186
Munford	.6066
Newmont Mining	.8549
Olin Corp.	.7373
Paccar	1.1016
Parker Drilling	1.0993
Rubbermaid	1.4364
Scovill	.6787
Telex	1.0299
Transway International	.9448
Uniroyal	.5395
Wean United	.6366
Whirlpool	1.0722
Witco Chemical	.7972
F.W. Woolworth	.6219

TABLE 8

RANDOMLY SELECTED FIRMS' q FOR 1979

Companies	q Ratio
Allis-Chalmers	.7013
Amerace	.5000
American Cynamid	.7390
Baker International	2.1550
Beker	.7809
Bordon	.6601
Capital Cities Communication	2.0224
Celanese	.7389
Crystal Oil	2.6090
Deere and Company	.9248
Di Giorgio's	.6641
Dravo	.8195
El Paso	.7993
Fisher Foods	.4845
General Refactories	.5583
Harsco	.9970
HRT	.6718
Lamson	.3187
Midland-Ross	1.0352
National Semi-Conductor	1.4942
Norton Simon	.7993
Philbro Salomon	.6678
Quaker Oats	.9081
Reichhold Chemical	.5371
Shaklee	1.3611
Stanley Works	1.0703
Toys R Us	.5573
Wal-Mart	3.3743
Warner	.9232

The companies selected for 1979 and their calculated q's are given in Table 8. While data was only available for 30 of the 75 randomly selected firms in this study, a 90% confidence level was established, using a method by Lapin which was described earlier. This group had a mean q of 1.0899 with a standard deviation of .7237 and a range from 3.3742 to .3186. The following extremities were dropped:

(1)	Baker International	2.1546
(2)	Capital Cities Communication	2.0224
(3)	Crystal Oil	2.6091
(4)	Toys R Us	2.4612
(5)	Wal-Mart	3.3742

An adjusted q was calculated to be .9864 with a standard deviation of .3984. This adjusted q, however, was not considered later as it required deletion of 16% of the observations.

A summary of the q ratios for the randomly selected firms is given below:

Year	N	q	Minimum Value	Maximum Value	Standard Deviation
1981	43	.8563	.3413	2.0137	.4147
1980	43	.9675	.1601	3.9490	.6004
1979	30	1.0899	.3186	3.3742	.7237

When the extremities were dropped in 1979 and 1980 and the electric power firms in 1981 were dropped, the following tabulation resulted:

Year	N	q	Minimum Value	Maximum Value	Standard Deviation
1981	36	.9460	.3818	2.0137	.3931
1980	41	.9587	.4406	1.9818	.3924
1979	25	.9864	.3187	1.4942	.3984

With the adjusted q's, a consistant standard deviation of the firms

results, but for further analysis, only the adjusted q for 1981 will be

used. The adjusted q for 1979 and 1980 will not be used because

extremities both up and down will exist, and the sample size test

previously determined the sample to be representative of the population.

The 1981 sample, however, does not reflect the population and therefore

the adjusted q will be used in for 1981.

Analysis of Variance of q Ratios

Statistical analysis was performed upon the q ratios to test the

hypotheses set forth earlier. Those hypotheses were:

(1) μ q acquired < μ q random
(2) μ q acquiring > μ q random
(3) μ q acquiring > μ q acquired

Based upon a simple comparison of the means, the following relationship

exist:

Year	q random	q acquired	q acquiring
1981	.9460	.5928	.9906
1980	.9675	.7941	-----
1979	1.1137	.6652	-----

The random q used in 1981 was an adjusted q but all others are actual

q's. Based upon this simple comparison of means, hypothesis 1 is true

for all three years of the study. Hypotheses 2 and 3 are true for 1981,

the only year in which the acquiring firm's q's were calculated. This

procedure, however, is not statistically acceptable, and no conclusions

may be made based upon this comparison.

A more sophisticated method was used to test the three hypotheses. An SAS application for determining the analysis of variance among the means of the group was applied to the q ratio of the three groups for all years involved. The data used was the calculated q for all groups with the exception of 1981, which used an adjusted q.

The first groups of data tested were the q's of the acquired firms for 1981 and the random q's for 1981. The results from the analysis provided an F-value of 6.95 with 61 degrees of freedom. This resulted in a p-value of .0106. Therefore, with an alpha of .05 (allowing for a 95% confidence level), it is statistically asserted that for the year 1981 hypothesis 1 is true, and the q ratio for acquired firms is less than the q ratio for a sample of market firms.

Testing 1980 q's of acquired and random firms provided and F-value of 1.59 and a p-value of .2119. With a continued alpha of .05, hypothesis 1 for 1980 must be rejected as false, and no significant difference exists for the group in 1980. The alpha would have to be increased to a value greater than the p-value in order for this hypothesis to be true. With such a value for alpha, the risk of committing a Type I error would be extreme.

The q ratios of 1979 for acquiring firms and random firms were tested. The results of testing the difference between the means were an F-value of 5.32 and a p-value of .0258. With this group, hypothesis 1 was indicated to be true at the 95% confidence level.

When the random q's for 1981 were compared to the q's of acquiring firms for 1981, an F-value of 1.29 resulted. The p-value for this group was .2601. Based upon the same alpha level, hypothesis 2 is rejected in

that no statistical significance existed. A later analysis compares the adjusted q ratio for the firms with the acquiring firms' q's.

Hypothesis 3 was the test comparing the analysis of variance among the means for the data of 1981 acquired firms and 1981 acquiring firms. This test resulted in an F-value of 8.84 and a p-value of .0042, indicating the greatest significance of any of the tests. As a result of this test, hypothesis 3 is accepted as true and statistical evidence suggests that the q ratio of the acquiring firms was greater than that of the acquired firms in the aggregate. This data cannot be applied to a one-on-one basis, i.e., that the acquiring firm has a larger q than the firm it acquires.

When the adjusted q for 1981 is used for analysis, hypothesis 1 remains true and the p-value declines to .0006. The analysis of variance between the 1981 adjusted random q's and the 1981 acquiring firm's q's, however, provides a stronger rejection of hypothesis 2 with a p-value of .7717. Thus, the substitution of the adjusted q ratio has no effect upon the acceptance or rejection of the hypotheses.

Summary of q Ratios

All three hypotheses are supported by comparision of means only, but this is not an acceptable test of statistical significance. As a result of the statistical analysis of variance procedure performed upon the distribution of mean q ratios for each group, hypotheses 1 and 3 are accepted as true. Hypothesis 2, however, is rejected as false. Each hypothesis either has very strong support or is strongly rejected. The type I error is held to a minimum by the use of an alpha equal to .05. Even if this alpha is raised to .10 or lowered to .025, no bearing is made upon the acceptance or rejection of the hypotheses.

V. CONCLUSIONS AND RECOMMENDATIONS

This paper investigated the use of James Tobin's q ratio as a

method of evaluating mergers and acquisitions. The q's of several firms

which were acquired were calculated for each of the three years prior to

their takeover. These q's were compared to the q's of the acquiring

firms immediately prior to the takeover. Further comparision was made

with a random selection of firms. The results provided support for the

hypothesis that the acquired firms had a lower q than the aggreagate

market. Support was also given to the hypothesis that acquiring firms

had a higher q ratio than acquired firms. No support was found for the

hypothesis that acquiring firms had a higher q ratio than the aggregate

market q.

Conclusions made from this study include:

> (1) While not true in all individual cases, on
>   average the q ratio of firms acquired are less
>   than the aggregate q of the market.
>
> (2) The q ratio of the acquired firms, as a whole,
>   tends to be considerably less than the q ratio
>   of all acquiring firms.
>
> (3) No conclusions can be drawn from this study on
>   an individual basis, i.e., that in any given
>   merger the q of the acquiring firm is greater
>   than the acquired firm.
>
> (4) The q ratio of all acquired firms does not fit
>   into an easily distinguished category, but
>   rather covers a wide range.

This study fails to provide any major pro-merger criteria for potential

candidates, but it does provide a guideline for establishing possible

candidates. Based upon this study, one could measure the market

response of potential takeover targets as measured by q. While q as a

a method of evaluating candidates for takeover is by no means a panacea,

it can provide some insight into the evaluation process.

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APPENDIX

OBS	COMPANY	HNP	HINV	TA	COMM	CSPRICE	PD	STDEBT	LTDEBT
1	ALLIED STORES	898.4	445.15	2179.3	20230	26.1	0.105	735.63	2179.3
2	AMERICAN STANDARD INC	551.8	342.31	1574.3	27159	29.6	0.100	499.26	1574.3
3	ANHEUSER-BUSCH COS INC	2257.6	228.40	2875.2	45488	41.1	0.000	493.40	2875.2
4	BALLY MFG CORP	375.9	100.69	705.3	25832	29.1	0.000	111.15	705.3
5	BURLINGTON NORTHERN INC	4146.1	324.76	5673.5	37161	53.5	8.583	1014.56	5673.5
6	CAPITAL CITIES COMMUNICATION	185.6	13.74	697.6	13025	73.6	0.000	113.43	697.6
7	CENTEL CORP	1729.5	71.25	2036.3	26727	33.1	1.267	197.42	2036.3
8	COCA-COLA CO	1409.5	750.72	3564.8	123623	34.6	0.000	1006.32	3564.8
9	CPC INTERNATIONAL INC	1182.1	560.20	2462.0	47770	35.4	0.000	706.40	2462.0
10	DART & KRAFT INC	1565.3	1851.30	5053.8	54567	50.6	0.000	1570.00	5053.8
11	DOW CHEMICAL	6174.0	2113.00	12496.0	189393	26.2	0.000	2688.00	12496.0
12	DU PONT (E.I.) DE NEMOURS	12722.0	4500.00	23829.0	234434	37.2	10.000	4894.00	23829.0
13	ETHYL CORP	658.3	147.03	1262.0	19129	23.4	2.956	230.69	1262.0
14	FORT HOWARD PAPER	351.1	76.47	580.7	26925	40.4	0.000	91.51	580.7
15	GENERAL ELECTRIC CO	6844.0	3461.00	20942.0	227761	57.3	0.000	8734.00	20942.0
16	HERCULES INC	907.7	406.91	1997.1	42514	22.5	0.000	335.32	1997.1
17	INTL BUSINESS MACHINES CORP	17278.0	2805.00	29586.0	592294	56.7	0.000	7320.00	29586.0
18	LONE STAR INDUSTRIES	701.5	137.30	1178.2	11181	27.5	6.144	144.88	1178.2
19	MARTIN MARIETTA CORP	1439.4	460.58	2545.9	36252	36.0	0.000	464.69	2545.9
20	MID-CONTINENT TELEPHONE	824.9	15.48	958.4	11915	17.6	4.848	81.86	958.4
21	MONSANTO CO	3183.9	873.20	6069.2	39468	70.1	0.300	1063.90	6069.2
22	MOTOROLA INC	978.1	611.14	2399.4	31566	57.6	0.000	619.95	2399.4
23	NORTHWEST ENERGY	937.1	122.11	1538.0	16242	20.7	6.374	516.73	1538.0
24	OCCIDENTAL PETROLEUM CORP	4494.1	803.55	8074.5	95177	24.0	49.135	2395.00	8074.5
25	OGDEN CORP	855.3	236.69	1646.2	13449	26.1	0.799	385.89	1646.2
26	PENN CENTRAL CORP	1395.5	623.50	3394.9	21324	41.2	35.000	603.30	3394.9
27	READING & BATES CORP	740.8	30.45	930.9	27790	25.3	6.046	112.65	930.9
28	REYNOLDS (R.J.) INDS	3643.8	2694.10	8096.0	104355	47.1	29.600	1971.20	8096.0
29	SCHLUMBERGER LTD	2390.9	612.38	6525.3	289269	55.7	0.000	1902.97	6525.3
30	SEARS, ROEBUCK & CO	3311.6	3935.20	34509.4	347900	16.1	0.000	0.00	34509.4
31	SIGNAL COS	770.4	1429.30	3678.6	72240	25.3	0.000	936.90	3678.6
32	SMITH INTERNATIONAL INC	413.5	365.56	1034.8	22622	45.7	0.000	239.33	1034.8
33	SMITHKLINE BECKMAN CORP	580.9	306.55	1883.5	66723	67.5	0.000	467.64	1883.5
34	SOUTHLAND CORP	964.9	236.51	1677.8	23683	31.6	0.000	507.57	1677.8
35	STANDARD OIL CO (INDIANA)	15263.5	1422.42	22916.6	295272	52.0	0.000	6451.39	22916.6
36	TELEDYNE INC	364.9	164.40	2868.2	20658	138.4	0.000	387.20	2868.2
37	TENNECO INC	10079.0	1897.00	16808.0	129115	33.4	63.000	4146.00	16808.0
38	U S STEEL CORP	6676.3	1197.70	13316.1	90579	29.7	0.000	2823.30	13316.1
39	WARNER-LAMBERT CO	869.8	583.97	2963.1	79676	22.2	0.000	851.74	2963.1
40	WILLIAMS COS	1497.8	298.32	2445.9	29772	27.3	0.000	426.21	2445.9
41	XEROX CORP	3343.8	1131.90	7674.4	84508	40.4	0.000	2080.80	7674.4

APPENDIX TABLE 1

VARIABLE VALUES FOR ACQUIRING FIRMS FOR THE YEAR 1981

OBS	REPINV	REPLANT	RINV	RNP
1	51008	126437	510.08	1264.4
2	53331	78485	533.31	784.8
3	30300	300000	303.00	3000.0
4	11176	45428	111.76	454.3
5	23379	2193314	233.79	21933.1
6	1022	26196	10.22	262.0
7	7125	271070	71.25	2710.7
8	86025	227223	860.25	2272.2
9	60660	159600	606.60	1596.0
10	188770	250480	1887.70	2504.8
11	283400	978900	2834.00	9789.0
12	595300	1964200	5953.00	19642.0
13	25431	93715	254.31	937.1
14	8601	47211	86.01	472.1
15	601800	976800	6018.00	9768.0
16	58386	129362	583.86	1293.6
17	275600	1885200	2756.00	18852.0
18	14300	113130	143.00	1131.3
19	61800	270000	618.00	2700.0
20	1548	132590	15.48	1325.9
21	142370	434550	1423.70	4345.5
22	65200	159900	652.00	1599.0
23	12211	178250	122.11	1782.5
24	89858	729474	898.58	7294.7
25	24994	115492	249.94	1154.9
26	95730	162870	957.30	1628.7
27	3045	96932	30.45	969.3
28	409020	564480	4090.20	5644.8
29	63700	280000	637.00	2800.0
30	370000	710000	3700.00	7100.0
31	167800	138100	1678.00	1381.0
32	41105	52155	411.05	521.5
33	34100	52155	341.00	521.5
34	28920	153730	289.20	1537.3
35	534800	2194500	5348.00	21945.0
36	56000	74000	560.00	740.0
37	221500	1394200	2215.00	13942.0
38	349770	1472690	3497.70	14726.9
39	63500	153200	635.00	1532.0
40	36100	276600	361.00	2766.0
41	1.14270	216530	1142.70	2165.3

APPENDIX TABLE 1 CONTINUED

OBS	COMPANY	YEAR	RINV	RNP	HNP	HINV	TA	COMMON	CSPRICE	PREFDIV
1	ACF	1979	22839	91841	60375	23712	101680	885.9	34.25	0.0
2	ACF	1981	27766	114274	77000	27225	124060	915.6	40.88	0.0
3	AFC	1980	23380	106889	69840	23687	110950	900.9	46.00	0.0
4	ALBANY	1980	8214	12184	10530	8214	31880	670.4	27.75	0.0
5	ALLIEDTE	1981	1422	25417	17652	1422	24226	368.8	18.12	14.1
6	AMCAN	1981	88500	173000	116710	58160	283580	1936.5	34.37	370.0
7	BENDIX	1979	92680	112840	63830	77700	231100	2232.8	40.75	90.0
8	BENDIX	1980	95640	120530	70590	88960	292350	2293.9	59.00	890.0
9	CAMPBLTA	1981	6312	62771	29220	6230	51480	1597.5	20.88	0.0
10	CCI	1980	7535	4025	3070	7345	19070	623.8	11.25	0.0
11	CMPBELLT	1980	5304	56325	27800	5440	44360	1109.5	23.25	0.0
12	CONTI	1980	89200	270000	192950	43830	399430	3281.4	32.00	2510.0
13	CONTINTL	1981	82700	270000	197100	40080	417050	3279.0	32.00	2490.0
14	CSERV	1979	108000	671000	303188	37732	477310	2773.6	83.00	0.0
15	CSERV	1980	124000	740000	366980	50000	535800	8328.0	47.75	0.0
16	CSERV	1981	151000	812000	402640	57320	604850	7765.2	46.00	0.0
17	DANRIVER	1980	13061	24972	16750	10135	38330	565.5	14.75	30.0
18	DANRIVER	1981	14144	28011	18340	11299	40690	569.0	13.37	27.8
19	DIAMOND	1980	26800	65200	52050	17967	94330	1519.5	32.75	269.0
20	DIAMOND	1981	24300	67900	52470	16626	93200	1372.4	40.30	259.1
21	DILLHAM	1980	11890	61690	30430	11045	79400	1305.7	18.00	85.4
22	DILLING	1979	8430	51950	28348	7987	41020	817.1	11.75	85.4
23	DILLING	1981	13380	56990	29910	13133	83530	1536.5	13.20	36.2
24	GO	1980	530700	1638200	1088600	171300	1863800	19522.0	43.00	0.0
25	GO	1981	555100	2026800	1301300	213700	2042900	18527.0	35.00	0.0
26	GRHART	1980	5274	11792	10980	5710	23570	1514.5	56.37	0.0

OBS	STDEBT	LONGDT	PSINDEX	DEBTINDX	DEBTVAL	PREFVAL	COMMVAL	MRKTVAL	REPLACE	Q
1	19138	311	0.0911	0.5558	172.8	0.0	30342	49653	132273	0.37538
2	22079	37926	0.1236	0.3374	12796.2	0.0	37430	72305	161875	0.44667
3	16137	36671	0.1060	0.4138	15174.5	0.0	41441	72753	147692	0.49260
4	6640	3879	0.1060	0.4138	1605.1	0.0	18604	26849	33534	0.80064
5	2461	12771	0.1236	0.3374	4308.9	114.1	6683	13567	31991	0.42408
6	83880	56260	0.1236	0.3374	18982.1	2993.5	66558	172413	370210	0.46572
7	85100	39030	0.0911	0.5558	21692.9	987.9	90987	198767	295090	0.67358
8	96000	54940	0.1060	0.4138	22734.2	8396.2	135340	262470	348970	0.75213
9	11976	12546	0.1236	0.3374	4233.0	0.0	33356	49565	85113	0.58234
10	4431	7092	0.1060	0.4138	2934.7	0.0	7018	14383	20215	0.71152
11	11086	7074	0.1060	0.4138	2927.2	0.0	25796	39809	72749	0.54721
12	85380	96210	0.1060	0.4138	39811.7	23679.2	105005	253876	521850	0.48649
13	83500	96060	0.1236	0.3374	32410.6	20145.6	104928	240984	532570	0.45249
14	109214	102664	0.0911	0.5558	57060.7	0.0	230209	396483	915390	0.43313
15	106750	117550	0.1060	0.4138	48642.2	0.0	397662	553054	982820	0.56272
16	159410	170180	0.1236	0.3374	57418.7	0.0	357199	574028	1107890	0.51813
17	6731	9401	0.1060	0.4138	3890.1	283.0	8341	19245	49478	0.38897
18	7512	10130	0.1236	0.3374	3417.9	224.9	7608	18762	53206	0.35264
19	21453	8832	0.1060	0.4138	3654.7	2537.7	49764	77409	116313	0.66552
20	20738	16270	0.1236	0.3374	5489.5	2096.3	55308	83631	116304	0.71908
21	29692	17970	0.1060	0.4138	7436.0	805.7	23503	61436	111505	0.55097
22	24977	16998	0.0911	0.5558	9447.5	937.4	9601	44963	65065	0.69105
23	33821	9649	0.1236	0.3374	3255.6	292.9	20282	57651	110857	0.52005
24	515400	141400	0.1060	0.4138	58511.3	0.0	839446	1413357	2772800	0.50972
25	577900	186400	0.1236	0.3374	62891.4	0.0	648445	1289236	3109800	0.41457
26	6457	8723	0.1060	0.4138	3609.6	0.0	85372	95439	23946	3.98559

OBS	COMPANY	YEAR	RINV	RNP	HNP	HINV	TA	COMMON	CSPRICE	PREFDIV	STDEBT
27	HARRIS	1979	32327	42278	22400	20859	82270	2619.2	32.88	0.0	38433
28	HARRIS	1980	38049	54095	33150	30322	113980	3043.0	52.12	0.0	37396
29	HEUBLEIM	1980	36194	55057	37200	30067	104700	2134.6	28.37	0.0	29955
30	HEUBN	1979	37772	58127	34511	27485	97190	2124.1	29.75	0.0	26335
31	INTERPAC	1981	8710	10040	7320	7897	23370	407.6	17.00	52.7	3514
32	ITEK	1979	6520	5660	4486	7776	21470	393.8	28.25	0.0	5475
33	ITEK	1980	7690	5900	4660	9122	25180	398.6	31.25	0.0	7237
34	ITEK	1981	5370	5530	4310	7958	21420	403.6	18.60	0.0	7188
35	MARTNMAR	1981	61800	270000	143940	46058	254590	3625.2	36.00	0.0	46469
36	MISPAC	1979	11948	599656	167363	7964	241110	1549.0	51.37	0.0	44491
37	MISPAC	1980	10800	720000	18961	6932	273020	1553.4	102.50	0.0	51222
38	MISPAC	1981	13000	780000	214060	7724	303780	1556.1	82.00	0.0	52371
39	MRTNMARI	1979	34500	147000	84146	23998	177360	2485.4	46.50	0.0	54106
40	MRTNMARY	1980	47500	215000	107780	33788	206940	2494.8	72.00	0.0	45329
41	MRYLNDCP	1980	11554	31398	16940	8426	35980	670.7	28.88	2.5	6145
42	NOSIM	1979	61367	100143	41146	82861	238920	4838.6	16.00	191.6	69552
43	NOWEST	1981	12211	178250	93713	12210	153795	1624.2	20.00	637.4	51673
44	NSIMON	1980	51844	79731	45740	86911	262020	4802.9	15.60	128.8	83708
45	PABST	1979	7987	40077	28348	7987	41020	817.1	11.75	0.0	7837
46	PABST	1980	7842	40600	27670	7842	43030	817.1	14.87	0.0	8932
47	PABST	1981	7972	37272	24890	7972	40400	816.6	15.37	0.0	11088
48	PARGAS	1979	2895	12653	8462	2784	15470	359.7	19.37	17.6	3690
49	PARGAS	1980	3277	13924	8724	3101	16470	359.7	22.50	14.9	4454
50	PARGAS	1981	3605	14240	8990	3632	17430	359.7	18.00	11.9	5012
51	PASO	1979	16762	177292	251803	15669	356888	4681.3	22.75	0.0	66775
52	PASO	1980	20759	217137	177289	18219	299074	4763.7	25.25	0.0	98333

OBS	LONGDT	PSINDEX	DEBTINDX	DEBTVAL	PREFVAL	COMMVAL	MRKTVAL	REPLACE	Q
27	9094	0.0911	0.5558	5054.4	0.00	86119	129607	113616	1.14074
28	21585	0.1060	0.4138	8931.9	0.00	158601	204929	142652	1.43657
29	22544	0.1060	0.4138	9328.7	0.00	60559	99842	128684	0.77587
30	23492	0.0911	0.5558	13056.9	0.00	63192	102584	131093	0.78253
31	4286	0.1236	0.3374	1446.1	426.38	6929	12316	26903	0.45778
32	4466	0.0911	0.5558	2482.2	0.00	11125	19082	21388	0.89219
33	5391	0.1060	0.4138	2230.8	0.00	12456	21924	24988	0.87738
34	5620	0.1236	0.3374	1896.2	0.00	7507	16591	20052	0.82741
35	35979	0.1236	0.3374	12139.3	0.00	130507	189116	396392	0.47709
36	95575	0.0911	0.5558	53120.6	0.00	79572	177184	677387	0.26157
37	104606	0.1060	0.4138	43286.0	0.00	159223	253731	977927	0.25946
38	105561	0.1236	0.3374	35616.3	0.00	127600	215587	874996	0.24639
39	13606	0.0911	0.5558	7562.2	0.00	115571	177239	250716	0.70693
40	16297	0.1060	0.4138	6743.7	0.00	179626	231698	327872	0.70667
41	8386	0.1060	0.4138	3470.1	23.58	19370	29009	53566	0.54155
42	63909	0.0911	0.5558	35520.6	2103.18	77418	184593	276423	0.66779
43	42053	0.1236	0.3374	14188.7	5156.96	32484	103503	238333	0.43428
44	65391	0.1060	0.4138	27058.8	1215.09	74925	186907	260944	0.71627
45	2028	0.0911	0.5558	1127.2	0.00	9601	18565	52749	0.35195
46	1468	0.1060	0.4138	607.5	0.00	12150	21690	55960	0.38759
47	1328	0.1236	0.3374	448.1	0.00	12551	24087	52782	0.45635
48	4209	0.0911	0.5558	2339.4	193.19	6967	13190	19772	0.66710
49	3732	0.1060	0.4138	1544.3	140.57	8093	14232	21846	0.65147
50	3257	0.1236	0.3374	1098.9	96.28	6475	12682	22653	0.55983
51	158659	0.0911	0.5558	88182.7	0.00	106500	261457	283470	0.92235
52	118833	0.1060	0.4138	49173.1	0.00	120283	267790	341462	0.78424

APPENDIX TABLE 2 CONTINUED

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OBS	COMPANY	YEAR	RINV	RNP	HNP	HINV	TA	COMMON	CSPRICE	PREFDIV	STDEBT
53	PASO	1981	26107	279825	210592	25549	371121	4846.0	24.87	0.0	140525
54	PITTSON	1980	26236	105193	59917	24547	134580	3783.0	25.50	0.0	35533
55	PTSON	1981	26155	103006	59787	25777	134360	3787.9	25.12	0.0	34955
56	PUREX	1979	12449	14180	8341	12326	35760	1126.3	15.50	13.4	11033
57	PUREX	1980	10792	12852	7800	11840	37390	1128.1	15.00	11.1	11911
58	RAMOND	1979	1041	12178	10550	651	29710	480.6	16.88	0.0	12425
59	RAYMOND	1980	1489	14179	10900	946	32800	585.6	29.25	0.0	14761
60	RAYMOND	1981	2041	18267	14540	1492	41290	600.9	22.00	0.0	19064
61	SUBPROP	1979	6056	31073	17029	4484	30570	459.3	36.00	0.0	5926
62	SUBPROP	1980	6145	34339	19257	6056	35150	471.2	34.00	0.0	6712
63	THIOKOL	1981	9240	22820	27810	12603	69650	1355.1	34.12	0.0	15968
64	WARNER	1981	79956	53568	37160	50735	267360	6204.2	54.88	0.0	96591
65	WHLABRTO	1980	23056	49833	36820	21893	193060	1692.1	52.60	295.0	86528

OBS	LONGDT	PSINDEX	DEBTINDX	DEBTVAL	PREFVAL	COMMVAL	MRKTVAL	REPLACE	Q
53	130305	0.1236	0.3374	43964.9	0.00	120520	305010	440912	0.69177
54	12858	0.1060	0.4138	5320.6	0.00	96467	137320	181545	0.75640
55	13242	0.1236	0.3374	4467.9	0.00	95152	134575	177957	0.75622
56	4990	0.0911	0.5558	2773.4	147.09	17458	31411	41722	0.75287
57	4584	0.1060	0.4138	1896.9	104.72	16921	30834	41394	0.74489
58	5319	0.0911	0.5558	2956.3	0.00	8113	23494	31728	0.74048
59	3561	0.1060	0.4138	1473.5	0.00	17129	33363	36622	0.91102
60	5857	0.1236	0.3374	1976.2	0.00	13220	34260	45566	0.75188
61	8140	0.0911	0.5558	4524.2	0.00	16535	26985	46186	0.58427
62	9154	0.1060	0.4138	3787.9	0.00	16021	26521	50321	0.52703
63	9893	0.1236	0.3374	3337.9	0.00	46236	65542	61297	1.06925
64	18746	0.1236	0.3374	6324.9	0.00	340486	443402	312989	1.41667
65	26193	0.1060	0.4138	10838.7	2783.02	89004	189154	207236	0.91275

APPENDIX TABLE 2 CONTINUED

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OBS	COMPANY	HNP	HINV	TA	COMM	CSPRICE	PD	STDEBT	LTDEBT
1	AMERICAN ELECTRIC POWER	9770.3	0.00	11567.0	161160	16.2	88.176	1486.58	11567.0
2	AMFAC INC	537.0	390.31	1371.6	14083	26.4	0.862	411.98	1371.6
3	ARKANSAS BEST CORP	107.0	23.19	176.2	3701	8.3	0.000	50.66	176.2
4	AVON PRODUCTS	518.3	391.80	1567.8	60156	30.0	0.000	527.40	1567.8
5	BALLY MFG CORP	375.9	100.69	705.3	25832	29.1	0.000	111.15	705.3
6	BELL & HOWELL CO	68.0	135.30	408.9	5621	19.0	0.022	151.63	408.9
7	CASTLE & COOKE INC	394.3	376.14	1243.0	25534	10.2	0.000	326.65	1243.0
8	CONNECTICUT NATURAL GAS CORP	128.9	0.00	171.0	1733	18.1	0.643	64.37	171.0
9	COPPERWELD CORP	216.4	101.24	416.4	5727	36.6	0.000	125.70	416.4
10	DETROIT EDISON CO	5843.0	0.00	6607.8	95089	11.3	57.566	925.86	6607.8
11	DORSEY CORP	124.0	45.56	255.1	4129	18.0	0.329	71.33	255.1
12	FOREST CITY ENTERPRISES INC	59.6	59.12	203.4	4049	13.6	0.000	95.95	203.4
13	GENERAL MOTORS CORP	20040.7	7222.70	38991.2	303627	38.4	12.900		38991.2
14	GOODRICH (B.F.) CO	1333.2	464.00	2702.9	17665	22.2	9.000	622.40	2702.9
15	INGERSOLL-RAND CO	657.6	1035.16	2678.1	19714	56.4	6.255	773.83	2678.1
16	KERR GLASS MFG	149.7	64.46	276.9	4008	13.0	3.564	44.86	276.9
17	KIMBERLY-CLARK CORP	1383.2	390.00	2413.8	22030	65.6	0.000	585.40	2413.8
18	LONG ISLAND LIGHTING	4041.8	0.00	4508.1	81371	14.1	48.830	361.19	4508.1
19	MATTEL INC	123.8	196.22	647.4	16531	11.0	6.042	243.32	647.4
20	MCGRAW-HILL INC	143.3	138.54	879.4	24863	51.6	0.045	318.28	879.4
21	MICHIGAN ENERGY RESOURCES CO	96.2	0.00	127.3	2237	11.2	0.000	39.04	127.3
22	MIDDLE SOUTH UTILITIES	7672.8	0.00	8318.6	123787	12.5	60.591	1092.53	8318.6
23	NEVADA POWER CO	525.0	0.00	610.1	8460	21.6	4.746	66.44	610.1
24	OKLAHOMA GAS & ELECTRIC	1588.6	0.00	1819.9	34606	14.1	11.916	169.84	1819.9
25	ORANGE & ROCKLAND UTILITIES	504.9	0.00	633.6	11262	13.3	4.753	90.97	633.6
26	PACIFIC LUMBER CO	126.2	51.22	288.4	24259	24.6	0.000	42.95	288.4
27	PENNEY (J.C.) CO	1932.0	1578.00	6216.0	71868	28.5	0.000	1702.00	6216.0
28	PFIZER INC	998.2	848.20	3647.1	74952	53.2	0.000	1123.80	3647.1
29	PIEDMONT AVIATION INC	367.6	34.55	502.7	7974	27.0	0.596	130.89	502.7
30	POLAROID CORP	332.9	412.70	1434.7	32855	20.4	0.000	352.30	1434.7
31	PUBLIC SERVICE CO OF IND	3020.9	0.00	3285.5	42244	20.2	22.600	245.52	3285.5
32	PUROLATOR INC	126.9	43.88	297.5	6530	36.0	0.000	101.73	297.5
33	RAYMARK CORP	60.0	97.71	242.8	2697	17.4	0.000	82.00	242.8
34	RCA CORP	2429.1	1520.80	7856.7	75447	18.2	68.500	3062.70	7856.7
35	ROHM & HAAS CO	537.5	376.81	1348.6	12903	61.0	0.000	290.73	1348.6
36	SHARON STEEL	373.7	214.15	1199.1	82053	5.3	0.000	337.52	1199.1
37	STAUFFER CHEMICAL CO	1170.3	308.62	2033.9	44018	22.2	0.000	293.16	2033.9
38	SUPERMARKETS GENERAL CORP	339.7	207.38	636.8	8242	19.2	0.000	258.94	636.8
39	TEXAS INSTRUMENTS INC	1105.5	372.00	2310.5	23580	80.4	0.000	764.80	2310.5
40	TRW INC	1002.3	700.97	3126.6	33257	54.6	8.530	888.66	3126.6
41	VF CORP	105.5	109.05	399.5	8085	40.6	0.000	108.80	399.5
42	WEIS MARKETS INC	88.2	47.00	254.6	9141	37.4	0.000	42.47	254.6
43	WESTERN CO OF NORTH AMERICA	871.5	42.99	1122.9	44698	23.6	0.000	141.09	1122.9
44	ZAYRE CORP	231.5	356.56	643.4	5412	28.6	0.145	191.99	643.4

APPENDIX TABLE 3

VARIABLE VALUES FOR RANDOMLY SELECTED FIRMS FOR 1981

OBS	REPINV	REPLANT	RINV	RNP
1	25537	2005400	255.37	20054.0
2	45856	85342	458.56	853.4
3	2543	13619	25.43	136.2
4	45010	85260	450.10	852.6
5	11176	45128	111.76	451.3
6	13940	13330	139.40	133.3
7	42100	69900	421.00	699.0
8	1134	29656	11.34	296.6
9	13829	29171	138.29	291.7
10	39943	1124400	399.43	11244.0
11	7233	16475	72.33	164.7
12	14940	1170	149.40	11.7
13	929980	2871080	9299.80	28710.8
14	73150	195460	731.50	1954.6
15	117640	116820	1176.40	1168.2
16	6342	23998	63.42	240.0
17	50080	203220	500.80	2032.2
18	9460	680000	94.60	6800.0
19	19770	17840	197.70	178.4
20	14690	19810	146.90	198.1
21	1017	21239	10.17	212.4
22	21258	1356365	212.58	13563.6
23	2771	93367	27.71	933.7
24	7346	315705	73.46	3157.0
25	2570	103714	25.70	1037.1
26	8200	20500	82.00	205.0
27	186700	236600	1867.00	2366.0
28	93070	162850	930.70	1628.5
29	3921	54276	39.21	542.8
30	41800	47900	418.00	479.0
31	2921	459420	29.21	4594.2
32	4396	16107	43.96	161.1
33	10700	9400	107.00	94.0
34	77000	214200	770.00	2142.0
35	49670	73760	496.70	737.6
36	30680	78799	306.80	788.0
37	51500	196700	515.00	1967.0
38	24975	56315	249.75	563.1
39	41600	160000	416.00	1600.0
40	93080	148810	930.80	1488.1
41	11023	14888	110.23	148.9
42	5925	10884	59.25	108.8
43	4389	108670	43.89	1086.7
44	37344	36490	373.44	364.9

OBS	COMPANY	HNP	HINV	TA	COMM	CSPRICE	PD	STDEBT	LTDEBT
1	ABBOTT LABORATORIES	729.40	418.02	2355.61	122500	27.0	0.000	863.47	2355.61
2	ARVIN INDUSTRIES INC	113.20	64.05	293.40	6853	14.7	1.340	39.97	293.40
3	BASSETT FURNITURE INDS	41.68	42.43	200.92	6803	23.2	0.000	28.41	200.92
4	BROCKWAY INC	277.74	72.07	426.85	7463	14.4	0.000	86.96	426.85
5	CAMERON IRON WORKS	465.78	383.08	1094.35	30430	46.6	0.000	273.11	1094.35
6	CARTER HAWLEY HALE STORES	828.34	554.70	1741.72	28920	15.0	1.962	402.80	1741.72
7	CHESEBROUGH-POND'S INC	238.29	348.98	1059.43	32745	33.6	0.000	283.31	1059.43
8	CLUETT, PEABODY & CO	74.00	211.90	442.14	7981	15.0	1.397	120.63	442.14
9	COLT INDUSTRIES INC	470.82	483.15	1490.32	13596	56.0	0.444	367.28	1490.32
10	CONTROL DATA CORP	656.00	709.00	2825.90	37062	35.2	1.600	748.80	2825.90
11	CP NATIONAL CORP	206.56	0.00	268.61	2724	23.4	1.074	47.98	268.61
12	CYCLOPS CORP	160.51	124.79	434.38	3428	25.4	0.553	122.35	434.38
13	DISNEY (WALT) PRODUCTIONS	1069.37	118.85	1610.01	32433	52.2	0.000	191.57	1610.01
14	EAGLE-PICHER INDS	173.65	105.35	401.26	9632	14.0	0.080	80.26	401.26
15	EASTMAN KODAK CO	4157.00	1970.00	9446.00	162500	71.1	0.000	2119.00	9446.00
16	EVANS PRODUCTS CO	257.01	229.85	943.44	12363	17.4	4.910	211.51	943.44
17	FERRO CORP	135.59	100.63	392.27	7726	28.0	0.000	108.10	392.27
18	FMC CORP	1199.96	484.11	2738.86	32586	25.5	3.900	877.22	2738.86
19	FOTOMAT CORP	60.99	19.54	100.77	8911	6.4	0.000	28.59	100.77
20	GANNETT CO	541.58	34.06	1448.11	53045	36.1	0.000	·295.80	1448.11
21	GENERAL TIRE & RUBBER CO	595.47	307.65	1844.43	23093	21.4	0.288	421.15	1844.43
22	GRUMMAN CORP	156.43	538.19	1073.32	10378	27.6	5.610	206.45	1073.32
23	HARSCO CORP	274.45	165.56	701.80	19748	19.4	0.000	142.87	701.80
24	HESSTON CORP	39.24	86.89	166.40	3388	6.4	1.159	78.79	166.40
25	INTL HARVESTER CO	1360.79	1634.42	5346.12	32317	7.1	21.646	1808.15	5346.12
26	KAY CORP	31.02	130.55	294.40	3617	14.4	0.000	182.07	294.40
27	LOEWS CORP	372.01	399.97	9914.07	12558	89.0	0.000	909.77	9914.07
28	MAGIC CHEF INC	81.39	142.15	368.91	7788	9.0	2.860	108.22	368.91
29	MONOGRAM INDUSTRIES INC	97.84	55.45	242.78	1648	49.4	0.297	41.30	242.78
30	MUNFORD INC	46.39	41.98	113.42	2172	10.5	0.420	39.28	113.42
31	NEWMONT MINING CORP	840.74	248.34	1932.82	27028	43.1	0.930	227.55	1932.82
32	OLIN CORP	844.93	309.72	1618.03	23631	24.0	0.000	376.34	1618.03
33	PACCAR INC	·202.63	189.62	848.01	8245	81.0	0.000	205.40	848.01
34	PARKER DRILLING CO	507.33	58.61	743.84	28861	21.1	0.116	152.15	743.84
35	RUBBERMAID INC	125.83	33.51	237.85	7724	36.7	0.000	51.73	237.85
36	SCOVILL INC	146.95	123.81	557.72	9399	18.5	0.182	177.09	557.72
37	TELEX CORP	52.66	65.92	157.64	12634	6.4	0.000	30.29	157.64
38	TRANSWAY INTERNATIONAL CORP	121.98	32.20	326.56	6545	23.3	0.000	86.98	326.56
39	UNIROYAL INC	518.01	429.27	1458.23	26619	6.7	4.889	352.67	1458.23
40	WEAN UNITED INC	42.68	28.93	177.33	3090	4.5	0.600	69.92	177.33
41	WHIRLPOOL CORP	278.12	256.55	1133.97	36265	25.3	0.000	247.67	1133.97
42	WITCO CHEMICAL CORP	281.94	117.21	725.36	9315	24.2	0.140	220.67	725.36
43	WOOLWORTH (F.W.) CO	1217.00	1456.00	3142.00	30330	18.0	2.200	926.00	3142.00

APPENDIX TABLE 4

VARIABLE VALUES FOR RANDOMLY SELECTED FIRMS FOR 1980

OBS	REPINV	REPLANT	RINV	RNP
1	40330	89420	403.30	894.20
2	8095	18970	80.95	189.70
3	4686	8035	46.86	80.35
4	12005	44460	120.05	444.60
5	49976	68055	499.76	680.55
6	51250	120520	512.50	1205.20
7	30980	32780	309.80	327.80
8	19865	11795	198.65	117.95
9	59838	63913	598.38	639.13
10	57090	63950	570.90	639.50
11	482	29351	4.82	293.51
12	27200	38700	272.00	387.00
13	6100	13200	61.00	132.00
14	12258	25203	122.58	252.03
15	272119	706002	2721.19	7060.02
16	24019	35612	240.19	356.12
17	84429	185233	844.29	1852.33
18	13455	32142	134.55	321.42
19	1720	9700	17.20	97.00
20	2640	66683	26.40	666.83
21	51414	109629	514.14	1096.29
22	42760	27320	427.60	273.20
23	21284	33392	212.84	333.92
24	11088	2770	110.88	27.70
25	201480	186020	2014.80	1860.20
26	18330	11201	183.30	112.01
27	62422	111614	624.22	1116.14
28	16654	11201	166.54	112.01
29	5778	13751	57.78	137.51
30	3558	10488	35.58	104.88
31	23866	130940	238.66	1309.40
32	46870	108810	468.70	1088.10
33	35800	23870	358.00	238.70
34	6127	68154	61.27	681.54
35	4785	16286	47.85	162.86
36	20927	29813	209.27	298.13
37	6620	5430	66.20	54.30
38	3942	15826	39.42	158.26
39	43710	94900	437.10	949.00
40	4000	8000	40.00	80.00
41	44524	39907	445.24	399.07
42	19526	34510	195.26	345.10
43	166900	193400	1669.00	1934.00

APPENDIX TABLE 4 CONTINUED

OBS	COMPANY	HNP	HINV	TA	COMM	CSPRICE	PD	STDEBT	LTDEBT
1	ALLIS-CHALMERS CORP	369.23	349.39	1594.25	12565.0	15.7	8.478	577.47	1594.25
2	AMERACE CORP	71.33	77.18	214.35	2509.0	17.0	1.439	41.53	214.35
3	AMERICAN CYANAMID CO	1325.06	535.13	3065.02	47954.0	29.0	0.000	833.28	3065.02
4	BAKER INTERNATIONAL CORP	764.30	499.01	1808.54	67412.9	38.0	0.000	467.55	1808.54
5	BEKER INDUSTRIES	195.09	43.84	342.93	11819.0	8.3	0.000	87.46	342.93
6	BORDEN INC	1093.34	400.92	2508.82	29298.0	28.0	0.050	588.56	2508.82
7	BORG-WARNER CORP	673.20	354.00	2191.20	41697.0	26.4	0.400	560.40	2191.20
8	CAPITAL CITIES COMMUNICATION	185.63	13.74	697.62	13025.0	73.6	0.000	113.43	697.62
9	CELANESE CORP	1518.00	443.00	2991.00	15608.0	55.7	4.000	586.00	2991.00
10	CRYSTAL OIL CO	294.20	15.78	409.26	20937.0	19.4	0.000	72.75	409.26
11	DEERE & CO	1408.34	872.04	5683.88	67507.9	35.4	0.000	2304.51	5683.88
12	DI GIORGIO CORP	65.72	123.69	310.64	5902.0	9.0	0.957	92.35	310.64
13	DRAVO CORP	296.06	103.36	719.98	12930.0	16.6	0.396	271.38	719.98
14	EL PASO CO	2518.03	156.69	3568.88	46813.0	22.7	0.000	667.75	1586.59
15	FISHER FOODS INC	72.84	44.43	222.30	5442.0	13.0	0.111	75.31	222.30
16	GENERAL REFRACTORIES CO	113.88	81.91	303.43	3798.0	4.5	0.063	137.63	303.43
17	HARSCO CORP	274.45	165.56	701.80	19748.0	19.4	0.000	142.87	701.80
18	HRT INDUSTRIES INC	89.31	69.30	211.15	3470.0	9.0	0.000	56.13	211.15
19	LAMSON & SESSIONS CO	63.40	45.47	164.87	5261.0	4.6	0.000	35.13	164.87
20	MIDLAND-ROSS CORP	202.11	210.07	668.89	12208.0	17.4	0.116	222.90	668.89
21	NATIONAL SEMICONDUCTOR CORP	332.08	177.52	785.04	23247.0	19.1	0.000	286.90	785.04
22	NORTON SIMON INC	499.57	620.77	2382.48	39642.0	19.2	0.948	734.74	2382.48
23	PHIBRO SALOMON CORP	488.40	1048.90	5788.00	68096.9	26.0	0.000	3563.10	5788.00
24	QUAKER OATS CO	633.30	321.60	1454.10	19153.0	35.6	4.600	492.80	1454.10
25	REICHHOLD CHEMICALS INC	173.40	82.82	408.58	6915.0	11.3	2.944	89.84	408.58
26	SHAKLEE CORP	88.48	51.33	191.67	6232.0	23.6	0.000	51.34	191.67
27	STANLEY WORKS	231.53	178.80	666.47	26508.0	17.4	0.000	169.52	666.47
28	TOYS R US INC	151.20	140.66	442.50	20647.0	29.5	0.000	145.39	442.50
29	UNIROYAL INC	518.01	429.27	1458.23	26619.0	6.7	4.889	352.67	1458.23
30	WAL-MART STORES	333.03	490.57	937.51	32420.0	42.4	0.347	339.96	937.51

APPENDIX TABLE 5
VARIABLE VALUES FOR RANDOMLY SELECTED FIRMS FOR 1979

OBS	REPINV	REPLANT	RINV	RNP
1	45200	54500	452.00	545.00
2	10220	14520	102.20	145.20
3	67700	252700	677.00	2527.00
4	42478	71915	424.78	719.15
5	2877	25304	28.77	253.04
6	55376	184857	553.76	1848.57
7	59730	83890	597.30	838.90
8	778	14045	7.78	140.45
9	53800	176800	538.00	1768.00
10	779	12943	7.79	129.43
11	187800	186800	1878.00	1868.00
12	12951	12627	129.51	126.27
13	12300	44600	123.00	446.00
14	16762	177292	167.62	1772.92
15	9993	25130	99.93	251.30
16	11420	23868	114.20	238.68
17	21011	29316	210.11	293.16
18	4709	13646	47.09	136.46
19	10467	20007	104.67	200.07
20	15194	22990	151.94	229.90
21	15900	23200	159.00	232.00
22	61367	100143	613.67	1001.43
23	250000	44900	2500.00	449.00
24	38383	95110	383.83	951.10
25	12540	29210	125.40	292.10
26	4413	9730	44.13	97.30
27	26732	27600	267.32	276.00
28	9691	11967	96.91	119.67
29	19810	106360	198.10	1063.60
30	27421	21376	274.21	213.76

APPENDIX TABLE 5 CONTINUED

VITA

Anthony W. Lemaster

Candidate for the Degree of

Master of Business Administration

Thesis: JAMES TOBIN'S q RATIO AS AN EVALUATION METHOD OF
MERGERS AND ACQUISITIONS

Major Field: Finance

Biographical:

Personal Data: Born in Altus, Oklahoma, May 9, 1959.

Educational: Graduated from Navajo High School, Altus, Oklahoma in
May, 1977; received Bachelor of Business Administration from
Central State University in Edmond, Oklahoma in July, 1983;
completed requirements for the Master of Business Administration
at Oklahoma State University in December, 1984.