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Dynamic and Risk Measurement Perspectives on Bowman's Risk-Return Paradox for Strategic Management: An Empirical Study

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ABSTRACT

Bowman's (1980, 1982) widely quoted papers have reported the existence of a risk/return paradox for strategic management. In this paper the authors examine the dynamic behavior of the risk/return relationship and analyze whether the risk/return paradox is stable across time. The analysis involves tracking Bowman's so-called negative association ratio across time. Using accounting measures of risk and return, it is demonstrated that while the paradox holds during the 1970's, the finding does not hold in the environment of the 1960's. Further, the paradox disappears if market-based risk measures are used. Some implications for strategic management are then discussed and attention is directed towards the meaning of risk in the context of strategic management. In addition, possible explanations for this paradox are evaluated and directions for further research are suggested.

Introduction

The concept of risk is attracting increasing attention in the field of strategic management. For example, Bettis (1983: 413) states that "the term 'risk' is taken in modern financial theory to be a precise technical term defining the probabilistic distribution of future market returns. In the strategic management literature, however, it is often taken (among other things) as a manager's subjective judgement of the personal or organizational consequences that may result from a specific decision or action." Baird and Thomas (1985) also stress the need for conceptual models of strategic risk-taking which can be used to understand the nature of strategic risk and to formulate strategic risk policies.

Bowman's (1980, 1982) empirical papers have received considerable attention from strategic management researchers.[1] Bowman noted the existence of a risk-return paradox for strategic management, namely, that business risk and return are negatively correlated across companies within most industries. Clearly this paradox runs counter to the hypothesis of a positive correlation between risk and return commonly advanced in finance and economic theory (Brealey and Myers (1981: 42); Van Horne (1980: 72)).

Bettis and Hall (1982) and Bettis and Mahajan (1985) extend and verify Bowman's results. In particular, they suggest that a negative relationship is more likely to exist for related diversified than unrelated diversified organizations (see Rumelt (1974) for an explanation of this taxonomy of corporate diversification strategies). Bettis and Mahajan (1985: 796) also note

the importance of industry characteristics in determining superior risk-return performance. They therefore conclude that such factors as diversification strategy and industry context may directly affect risk-return performance.

Bowman (1982) advances a number of different explanations for the risk/return paradox which can be classified into two broad categories: (1) explanations involving management and planning factors and (2) explanations involving firms' attitudes toward risk. Explanatory hypotheses under heading (1) include the influence of good firm-level strategic management which can, for example, simultaneously increase returns and lower their variance. A dominant hypothesis in category (2) is that lower profit (troubled firms) actively seek risks.

The purpose of this paper is to re-examine this paradox from a number of perspectives. First, this study analyzes whether the risk/return paradox is stable across time or whether it is dependent upon the particular time period studied. The need for such dynamic studies is also suggested by Bettis and Mahajan (1985: 6) when they argue that risk-return studies of a dynamic character are needed to explore changes in risk-return measures over time.

Second, the existence of the paradox is examined using both market and accounting-based measures of risk. Bowman (1980: 25) and finance theorists believe that the firm level paradox can be eliminated through asset pricing in efficient markets. Thus, the use of market based risk measures derived from the capital asset pricing model (CAPM) and the presence of efficient markets may compensate for anomalies in the behavior of firms.

Third, the relationship between risk-return performance and industry characteristics is explored. For example, differences in industry environments may explain differences in risk-return profiles.

The plan of the paper is as follows. The paper begins with a brief literature review which sets the context of the study, followed by a discussion and examination of the method and results. The conclusions and strategic management implications are then presented.

Review of Bowman's Research Findings

It is important to have a clear initial statement of Bowman's research results. Bowman's 1982 article summarizes the basic findings derived from risk-return analyses of two data bases, Value Line and COMPUSTAT,® in the following manner (Bowman, 1982: 35).

(i) Value Line Data Base

The main sample consisted of 85 industries and 1572 companies for the nine-year period (1968-76). Of this total set of 85 industries, 56 supported the hypothesis of a negative correlation between risk and return (statistically significant beyond 0.001), 21 refuted it and eight were tied.

A smaller sample of 11 industries from Value Line was also analyzed for the time period 1972-76. Ten out of the 11 industries studied showed negative association over the five-year time period.

(ii) Standard and Poor's Compustat® Data Base

The sample, analyzed by Treacy (1980), consisted of 54 (2 digit SIC-Code) industries and 1458 companies for the ten-year period 1966-75. Forty-three of the 54 industries had a correlation coefficient that was negative (statistically significant beyond 0.00001) supporting the paradox findings. Controlling for size of firm reduced the number of negative partial correlations only slightly--from 43 to 39 of 54.

It should be noted that Bowman's measure of risk is accounting-based (i.e., variance of returns) and targetted at the firm level.

On the other hand, modern finance literature and the capital asset pricing model emphasizes the variance in returns to investors and advocates the use of market-based risk measures. However, Bowman notes that the strong correlation between market-based and accounting-based risk measures (Beaver, Kettler and Scholes (1970)) provides an empirical justification for using accounting-based risk measures. Further, since accounting measures can be more directly controlled by corporate management they are probably more valuable for firm-level strategic management.

In the following studies both market and accounting based measures are used since they provide different insights about the relationship between risk and return. While market measures focus around a capital market perspective, accounting measures can be particularly useful for managers of diversified firms. In such firms accounting measures provide managers with a direct assessment of business unit performance whereas the calculation of the impact of the business unit on the firm's stock price is less easily obtained.

HYPOTHESES, METHODS AND RESULTS

Examination of Negative Association Ratios Through Time

Bowman remarks in his 1980 paper (1980: 20) that "In sum, both five-year periods and nine-year periods support the negative correlation paradox beyond the statistical pale."[2] Treacy (1980: 11) uses a different ten-year time period (1966-75) in his study and notes that "any bias introduced by the selection of this time period could not be avoided." In this study we hypothesize that the negative association ratio may not remain stable over time.

It is clear from a number of sources (Hofer and Schendel (1978: 15), Gluck, Kaufman and Walleck (1980: 157) and Business Week ("The New Breed of Strategic Planner," 17 Sept. 1984: 63) among others) that the 1960's and 1970's had markedly different strategic characteristics. The 1960's were a boom decade in which growth seemed eternal, where market structures were relatively stable, where inflation rates were low and where the diet of alternative strategic options seemed rich and almost unbounded. On the other hand, the 1970's saw the rise of the conglomerate, the energy crunch and the advent of added complexity in strategic decision-making arising from increasing rates of environmental change and competitive pressure. Consequently, the 1970's business environment was less predictable, ill-structured and required much more effort to be focused upon the recognition of the limited number of opportunities which would provide the firm with a successful future. As a result, it is hypothesized here that the risk-return paradox (formulated in terms of accounting risk measures) would be more evident in the environment of the 1970's than the 1960's.[3] This is formulated as proposition 1.

Proposition 1

> The negative association ratio (risk-return paradox) is more likely to exist in the more uncertain environment of the 1970's than the more predictable and stable environment of the 1960's.

In order to test this proposition, the methodology developed in the Bowman (1980) paper is adapted for this study in the following sense. For each of the sixty-three two-digit SIC industries represented on the

COMPUSTAT® data base, separate Bowman-type risk-return analyses were performed for the non-overlapping five-year time periods 1960-64, 1965-69, 1970-74 and 1975-79 using the COMPUSTAT® data base. In these time periods the number of industries in the research sample was 37 for 1960-64, 50 for 1965-69, 55 for 1970-74 and 56 for 1975-79. This resulted from the researchers sample selection criteria which required that each company must have at least three years of data for the relevant time period and each industry must have at least six companies in the sample to ensure meaningful estimates of mean and variance.

The risk-return calculations closely followed Bowman's procedure. Therefore, for each time period, the average ROE and variance of ROE were calculated from annual data for ROE derived for each firm in each two-digit industry. Within each industry a rank order of all companies for each characteristic--ROE and ROE variance--was constructed and then divided at the median.[4] Each company was then deemed to be High or Low on each of the characteristics leading to one of four possibilities (or quadrants in a two by two contingency table): High ROE, High Variance (HH), High ROE, Low Variance (HL), Low ROE, High Variance (LH) and Low ROE, Low Variance (LL). Negative association ratios (i.e., (HL + LH) divided by (HH + LL)) were calculated for each two digit industry for each of the four non-overlapping five-year time periods.

The results of this exercise are shown for each industry and time period in Table 1. There is much stronger evidence of negative

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Insert Table 1 About Here

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association for the two later periods than for the two earlier time periods. Notice that 72% of the industries showed negative association for 1970-74 and nearly 70% showed negative association for 1975-79. Indeed, using a binomial test similar to Bowman's (1980) version,[5] the negative association ratio is shown to be statistically significant at the 10% level for both the 1970-74 and 1975-79 time periods. There is also evidence of significant positive association for the 1965-69 time period and inconclusive results for 1960-64 (though indicating positive association (see the negative association ratio of 37% in Table 1)). On balance, the research results provide strong support for Proposition 1. Indeed, these findings tend to suggest that the choice of time period (which itself may reflect wider environmental influences) may critically offset the finding of negative association between risk and return.

Further, in studying Table 1 it should also be noticed that the values of the negative association ratios change over time for virtually all of the industries studied. This is demonstrated clearly since the ratio never consistently maintains a value either above or below 1 for most of the industries studied here. Therefore, there is evidence of instability in the direction of the risk/return relationship which suggests that macro economic and other environmental factors may affect risk/return performance.

Industry Effects

One environmental factor which may influence the risk/return findings is the industry environment, i.e., since industries have wide

variations in average risk and performance levels, it could be hypothesized that a firm's risk/return performance may be strongly influenced by the industry environment in which it competes.

Bowman (1980: 27) notes that some industries (e.g., regulated industries) may be more prone to exhibit positive association than others. He suggests that a close study of such industry characteristics as the extent of industry concentration or the stage of the industry life cycle may explain the influence of industry environment on risk-return relationships.

Researchers in strategic management, economics and finance have sought to understand the relationships between market power (measured in terms of such variables as concentration ratios, market shares and firm size) and risk/return characteristics. In strategy the PIMS studies (e.g., Buzzell, Gale and Sultan (1975)) have noted the strong correlations between market share and profitability (return). Treacy (1980: 35) investigated the relationship between firm size and the risk-return profile and concluded that firm size does not by itself explain the negative association of level and variance of return on shareholders' equity within an industry. However, a number of finance and economics researchers (e.g., Melicher, Rush and Winn (1976), Winn (1977), Sullivan (1978), and Moyers and Chatfield (1983)) have produced evidence to support a negative relationship between risk and market power variables. In general, therefore, these researchers provide strong evidence for the proposition that market power may convey opportunities for firms to absorb adverse effects and obtain advantageous risk-return profiles (particularly in the direction of high return, low risk).

In this study the market power hypothesis has not been tested because of the difficulty of obtaining adequate data on concentration ratios and market share on an annual basis. Rather this study has concentrated upon an examination of the life cycle effect.

Life cycle concepts have been discussed at the level of firms (e.g., Chandler (1962)); of products (e.g., Kotler (1980)); and of industries (e.g., Shepherd (1979)). It is clear that industries go through phases such as birth/growth, maturity and decline in which different cost and demand characteristics apply. Typically, the industrial organization literature suggests that high growth industries (with relatively fewer competitors) exhibit higher average profitability than more mature industries (with newer entrants present) and declining industries (with substitute products emerging through time). In addition, growth industries tend to exhibit positive risk-return profiles whereas declining industries would tend to exhibit negative risk-return profiles.

In this study the following propositions about industries and risk-return relationships are advanced:

Proposition 2a

That there will be stronger evidence of positive association for growth (high ROE) industries and stronger evidence of negative association for declining (low ROE) industries.

Proposition 2b

If the risk-return relationship is time-dependent (Proposition 1) then it is suggested that growth industries (high ROE industries) may exhibit strong positive correlation in the periods of economic

stability (the 1960's) whereas declining industries (low ROE industries) may exhibit strong negative correlation in periods of greater environmental turbulence (the 1970's).

In order to test these propositions, the research sample of industries (see Table 1) has been re-worked in order to identify industries in each period as being in one of three categories: High relative ROE (Birth/Growth), Medium ROE (Mature) and Low ROE (Decline). The classifications of High, Medium and Low in each time period were obtained by dividing the overall industry ROE distribution into tertiles corresponding to the upper one-third, middle one-third, and lower one-third of the distribution. Table 2 shows the results of this exercise.

Insert Table 2 About Here

First, Proposition 2a appears to be strongly supported. High ROE industries show much stronger evidence of significant positive association whereas low ROE industries exhibit a tendency towards negative association.

Second, Proposition 2b is also strongly supported. Low ROE industries show significant negative association for the periods of environmental uncertainty (1970-74 and 1975-79) whereas high ROE industries show significant positive association for the periods of environmental stability (1960-64 and 1965-69).

The support for these results suggests that industry level factors may begin to throw light upon the risk-return paradox. However, even richer explanations for these phenomena must be obtained by examining

firm-level behavior for several of the industries shown in Table 1 in greater detail. For example, some consistently low performing industries such as furniture, paper, holding companies and hotels show strong consistent evidence of negative association whereas others in the low performing category such as textiles, agricultural production and construction show oscillatory risk-return profiles over time. Similarly, some highly profitable industries such as leather, chemicals, printing and motor freight also show oscillatory risk-return profiles over time.

Handling Market Based Risk Measures

The evidence in Tables 1 and 2 suggests that time effects (and such associated environmental correlates as industry and economic factors) may influence the relationship between risk and return. However, it is possible that risk/return performance may also depend upon the measure of risk chosen in the research.

Bowman states (1980: 28) that "given that a negative correlation between risk and return (to the firm) within industries is established here, in what way, if any, does this idea carry over into the capital markets?" He speculates that it is unlikely that a market imperfection would be discovered. He explains that the negative association anomaly or paradox at the firm level can be eliminated in stock markets through the pricing mechanism. Firms with lower risks and higher returns can have their stocks priced relatively higher by the market, which lowers the return to the stock purchaser and thus eliminates the paradox at the level of the stockholder.

If the preceding argument is true, then the following proposition about the risk-return paradox (couched in terms of market based measures of risk) should hold:

Proposition 3

Using a market based risk measure (such as the beta from the capital asset pricing model) will mask the firm-level risk-return paradox. The "perfect" market will both compensate for and mask the effects of the risk-return paradox.

Insert Table 3 About Here

Table 3 shows the negative association ratios calculated using a market-based risk measure, the beta (or systematic risk) measure, derived from application of the capital asset pricing model[6] (see Brealey and Myers (1981)). The results indicate that from the perspective of a market-based risk measure the risk-return paradox does not exist. Therefore, proposition 3 holds for this research sample.

Insert Table 4 About Here

In parallel with the previous study of industry effects, Table 4 examines whether in fact there is more evidence of significant negative association for low ROE rather than high ROE industries using the beta measure. The results show clearly that there is no evidence at all of the negative risk-return paradox for industries with different performance levels when a market based risk measure is used. Therefore, Proposition 3 appears to hold and it is, therefore, clear that the

negative association paradox is not a problem when viewed from a capital markets perspective.

Summary of Research Results

In summary the research results presented in Tables 1 to 4 suggest that the following propositions hold. First, the risk-return paradox appears to be dependent upon the time period adopted in the study. It appears more likely to hold in more uncertain, less predictable environments such as the decade of the 1970's.

Second, better performing industries tend to exhibit positive risk-return associations whereas low performing industries appear to be more prone to exhibit negative association. Further, this negative association tendency is more closely associated with the uncertain environments of the 1970's.

Third, the use of market-based risk measures (betas) in calculating risk-return correlations tends to eliminate the risk-return paradox. Thus, the paradox exists at the firm-level (where accounting based risk measures are most often used) and is not a problem at the level of capital markets.

Implications and Conclusions

Bowman's (1980, 1982) and Treacy's (1980) findings of a negative risk-return relationship provided the springboard for the current research. By tracking the dynamic behavior of Bowman's negative association ratio it was demonstrated that the risk/return paradox varies across time. In particular, with variance of returns as a risk measure significant positive association was found for the 1965-69

time period, whereas the 1970-74 and 1975-79 periods showed much stronger evidence of significant negative association. This suggests that the markedly different and less stable environmental and economic conditions of the 1970's may provide some justification for the risk-return paradox. Further, it was also evident that the negative association finding was dependent upon the choice of a market or accounting-based risk measure. The risk-return paradox is not present when a market-based risk measure is used. Yet while the market-based measure is important from a "financial markets" perspective, the accounting-based measure (or "total risk") is valuable from a strategic risk management perspective. As Bowman (1984: 70) points out: "It is the total risk which is their (managers') risk, and a better understanding of total risk at the level of the firm, and managers' attitudes to it under various circumstances--aversion, neutrality, or seeking--is warranted."

These, and other studies including Bettis and Mahajan (1985), indicate a number of important directions for future research.

First, risk/return relationships must be studied more closely at the level of the individual industry. Bettis and Mahajan (1985: 796) stress the influence of industry characteristics on risk-return profiles. They point out, following Rumelt's example, that an unfavorable industry environment may constrain a firm's performance expectations (they quote Rumelt's observation, "You can't make a silk purse out of a sow's ear"). Risks clearly vary as a function of the competitive characteristics of each industry environment and of the organizations which comprise the industry. Porter (1980) and others have highlighted the range of

factors which must be considered in formulating competitive strategy. Baird and Thomas (1985: 28) provide an inventory of risk characteristics (ranging from the number of competitors, mobility barriers and the industry life cycle to the size and age of the organization) at the industry and organizational levels which provide a rich set of propositions for further research. Among them there is a need for a close re-examination of the relationship between market power and risk. While Treacy (1980) found that firm size did not explain the negative risk-return relationship, a range of finance and economics researchers (quoted earlier in the paper) found consistent negative association between market power and risk. An inventory of these alternative research efforts, focusing on methodological and conceptual differences would be of great value. It might lead to both empirical re-examination and further conceptualization of research propositions.

Second, further examination of the hypothesis that troubled companies take larger risks (Bowman (1982:40)) seems to be justified. While this industry-level study only offers some indirect support for this hypothesis, it nevertheless indicates appropriate future research avenues. Clearly, the various managerial explanations--such as agency theory--of this risk-seeking tendency should be tested empirically using a within-industry sample. In addition, from a strategic management viewpoint, an evaluation of the role of alternative diversification strategies in handling and managing risk should be undertaken over a wide range of industries and companies. Bettis and Hall (1982) and Bettis and Mahajan (1985) both conclude that diversification strategy may directly affect risk-return performance. Bowman

(1982:41) also speculates that large diversified firms may be better able to support the risk-seeking and innovatory behavior of troubled divisions than headquarters managements of other firms which set specific divisional targets.

Third, more research is needed into the definition of appropriate measures of risk for strategy research. One level of concern is that while risk is an ex ante concept, it is typically measured ex post (Bowman, 1982: 34). Bettis (1983) argues that managers should be concerned primarily with unsystematic risk and that strategies should be couched in terms of total risk. In other words "strategic adaptation by skillful, rigorous, and continuous management of unsystematic risk, lies at the very heart of strategic management" (Bettis, 1983: 408).

Armour and Teece (1978), Bettis and Hall (1982), Bowman (1980) and others have used income variability as a proxy for risk. This proxy, however, may not adequately reflect the perceptions of corporate managers (Litzenberger and Rao (1971)). Barefield and Comiskey (1975) note that the predictable portion of earnings variability should have no effect on market returns. They suggest that forecast error might therefore be used to represent corporate risk.

Another level of concern centers around whose risk is important for strategic decision-making. For example, risk-return tradeoffs may be examined from a managerial viewpoint. Smith (1976), Bowman (1980) and others observe that manager controlled firms tend to generate smoother earnings and exhibit lower systematic risk than owner-controlled firms. Clearly the important research issue is to identify which stakeholder(s) viewpoint (owner, manager, shareholder, etc.) is important in strategic

decision-making since it is those stakeholder risk perceptions which affect strategic decisions.

A fourth level of concern is the potential biases in the calculation and interpretation of risk measures. For example, the mean-variance approach suffers from the fact that it ignores the path or time series pattern of the risk-return measures. The same mean and variance can be obtained from quite different risk-return paths.

Finally, both this research and the earlier studies can be criticized for aggregating the risk-return analysis across time periods (i.e., five year periods in this study vs. nine to ten-year periods in the Bowman/Treacy studies). It seems sensible to research the dynamic characteristics of risk return measures on an annual basis. This suggests that time series analysis methods (Bettis and Mahajan, 1985: 4) need to be more widely used in order to understand and analyze risk-return relationships in the strategy field.

These research directions, and this paper's results, should lead us to focus upon the question of "What is risk anyway for the strategic manager?" Bowman's (1984) paper argues for risk measures which reflect the behavioral importance of total risk (rather than market-based risk) to strategic managers. The total risk perspective is highlighted by Bettis (1983) and Hertz and Thomas (1983).

FOOTNOTES

[1]Finance-based researchers (for example, Marsh and Swanson (1984)) have also questioned the existence of the paradox on both theoretical and empirical grounds. See Bowman (1984) and Marsh and Swanson for an interesting debate on these issues.

[2]Bowman uses a binomial test to confirm the statistical validity of his results (see Bowman (1980), pages 20 and 29).

[3]This hypothesis is also suggested by Bowman's (1980, 1982) results quoted in the paper. Whereas 66% (56 out of 85) of industries exhibited negative correlation in the 1966-75 study (Bowman, 1980), fully 90% (10 out of 11) of industries exhibited negative correlation for the shorter time period 1972-76 (Bowman, 1982).

[4]Note that the detail of the calculations for ROE and ROE variance follows exactly from Bowman's (1980) article. Although mean/variance approaches are used here to facilitate comparison with Bowman's results it is clear that the mean/variance approach may produce biased performance measures because of small samples and because it ignores the potential presence of autocorrelation in the data samples.

[5]The null hypothesis in Bowman's (1980) article is that if there is no relation between risk and return, half of the correlations should be negative and half should be positive (i.e., for significant negative association (itself a function of sample size) the proportion of negative associations would be significantly greater than 50%).

[6]The negative association ratios for the market-based risk measure (beta (β) or systematic risk) were calculated in the following manner. The beta values were calculated by ordinary least squares using the capital asset pricing model for the relevant five-year periods (60 monthly observations) from the CRSP (Center for Research in Security Prices, Chicago) tapes. A value weighted market return, including ordinary dividends, was used as a proxy for the market return. The derived beta measures for each firm (and the industry) were then used to define 'high' and 'low' on the market-based risk characteristic. Thus, the HH, HL, LH and LL cells of the risk-return matrix were defined. Finally, it should be noted that the CRSP and Compustat tapes did not match perfectly because of missing observations. This led to smaller but satisfactory size samples using the CRSP rather than the Compustat tapes.

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TABLE 1: NEGATIVE ASSOCIATION RATIOS FOR 57 INDUSTRIES FOR VARIOUS TIME PERIODS

	Industry name	SIC Code	1960-64	1965-1969	1970-1974	1975-19
1.	Agricultural production	1		.5 (6)	.33 (8)	1.33 (
2.	Metal mining	10	.80 (27)[a]	.43 (33)	.43 (33)	.73 (
3.	Bituminous coal	12		2.0 (9)	.66 (10)	1.0 (
4.	Oil and gas extraction	13	1.27 (25)	1.75 (44)	1.58 (62)	1.05 (
5.	Building construction	15	0.0 (7)	.44 (13)	1.40 (24)	2.0 (
6.	Construction other than building	16	2.66 (11)	.40 (14)	2.0 (18)	.80 (
7.	Food and kindred products	20	1.02 (43)	.60 (90)	1.15 (97)	1.82 (
8.	Tobacco manufactures	21	.80 (9)	2.0 (9)	2.0 (9)	1.50 (
9.	Textile mill products	22	.85 (26)	1.05 (35)	.81 (49)	1.68 (
10.	Apparel and other finished products	23	.28 (27)	.56 (39)	1.12 (53)	1.61 (
11.	Lumber and wood products	24	1.20 (11)	.46 (19)	2.22 (29)	5.20 (
12.	Furniture and fixtures	25		1.50 (10)	2.66 (11)	2.66 (
13.	Paper and allied products	26	1.25 (36)	.56 (39)	1.62 (42)	1.33 (
14.	Printing	27	1.40 (24)	.69 (39)	1.47 (47)	.60 (
15.	Chemicals and allied products	28	.95 (86)	.59 (97)	1.26 (104)	1.05 (
16.	Petroleum refining	29	.85 (39)	.64 (41)	1.23 (47)	.62 (
17.	Rubber and miscellaneous	30	1.14 (30)	.18 (38)	.81 (40)	1.33 (
18.	Leather	31	1.0 (12)	1.0 (16)	1.25 (18)	1.71 (
19.	Stone, clay and glass	32	.47 (25)	.47 (31)	1.17 (37)	.66 (
20.	Primary metal industries	33	.89 (55)	.75 (65)	.68 (69)	1.55 (
21.	Fabricated metal products	34	.77 (55)	.68 (74)	1.57 (85)	1.14 (
22.	Machinery	35	.92 (100)	1.06 (136)	1.52 (159)	1.26 (
23.	Electrical and electronic	36	1.30 (92)	.76 (120)	1.32 (137)	1.48 (
24.	Transportation equipment	37	1.31 (67)	.58 (76)	1.29 (85)	1.12 (
25.	Measuring instruments	38	.45 (32)	.64 (51)	1.11 (57)	1.80 (
26.	Miscellaneous manufacturing industries	39	1.66 (16)	1.55 (23)	1.12 (34)	1.05 (
27.	Railroad transportation	40		2.66 (11)	.88 (17)	.80 (
28.	Motor freight transportation	42	.54 (17)	.46 (19)	1.20 (22)	1.75 (
29.	Water transportation	44				2.0 (
30.	Transportation by air	45	1.20 (22)	1.0 (24)	1.16 (26)	2.85 (
31.	Transportation services	47		.50 (6)	2.0 (6)	6.0 (
32.	Communication	48	.57 (22)	.31 (25)	.55 (28)	.55 (
33.	Electric, gas and sanitary service	49	.80 (152)	.83 (158)	.89 (165)	1.0 (
34.	Wholesale trade - durable goods	50	1.60 (26)	.81 (40)	1.78 (53)	1.20 (
35.	Wholesale trade - nondurable goods	51	.72 (19)	.44 (26)	1.81 (31)	1.20 (
36.	Building materials	52			1.33 (7)	1.33 (
37.	General merchandise stores	53	.50 (30)	.58 (38)	.81 (49)	1.13 (
38.	Food stores	54	.80 (27)	.41 (34)	3.0 (40)	2.33 (
39.	Apparel and accessory stores	56		.20 (12)		1.42 (
40.	Furniture stores	57			3.0 (16)	
41.	Eating and drinking places	58		.85 (13)	1.50 (20)	1.0 (

TABLE 1 (continued)

Industry name	SIC Code	1960-64	1965-1969	1970-1974	1975-1979
42. Miscellaneous retail	59	.76 (23)	.36 (30)	.80 (45)	1.40 (48)
43. Banking	60	.45 (45)	.72 (114)	1.09 (134)	2.85 (135)
44. Credit agencies other than banks	61	.16 (14)	.76 (23)	2.0 (27)	.75 (28)
45. Security and commodity brokers	62			2.0 (9)	.28 (9)
46. Insurance	63			1.29 (39)	1.20 (44)
47. Real estate	65		1.33 (14)	1.27 (25)	.70 (29)
48. Holding and other investment offices	67		2.0 (6)	2.20 (32)	2.0 (33)
49. Hotels	70	2.0 (6)	1.0 (12)	2.50 (14)	2.5 (14)
50. Personal services	72		.40 (81)	1.0 (8)	1.0 (8)
51. Business services	73	.80 (18)	.51 (41)	1.54 (56)	1.28 (57)
52. Automotive repair	75			2.0 (6)	.50 (6)
53. Motion pictures	78		2.0 (6)	.50 (6)	2.0 (6)
54. Amusement and recreation services	79			.40 (7)	1.0 (8)
55. Health services	80		.50 (6)	1.11 (19)	.72 (19)
56. Miscellaneous services	89		2.0 (6)	1.20 (11)	2.0 (12)
57. Nonclassifiable establishment	99	2.0 (7)	.28 (18)	1.0 (20)	1.5 (20)
Overall number of companies		1283	1930	2302	2394
Number of industries with negative association		14	12	40	39
Number of industries with tied (indeterminate) association		2	3	2	5
Number of industries with positive association		21	35	13	12
Total number of industries		37	50	55	56
Overall Negative Association Ratio[b]		37%	24%*	72%*	69.6%*

Notes to Table

a. The figures in parentheses denote the total number of firms in each two digit industry for each time period.

b. Denotes percentage of industries with negative association ratio.

c. Denotes significant value ($p \neq 0.5$) at $\alpha < 0.1$ (10% level) [where p is the proportion of negative associations].

TABLE 2: NEGATIVE ASSOCIATION RATIOS (ROE VS. VAR(ROE)) FOR DIFFERENT TIME PERIODS AND FOR LOW, MEDIUM, AND HIGH ROE INDUSTRIES

Industry ROE \ Period	1960-64	1965-69	1970-74	1975-79
Low Relative ROE (Lower Tertile)	58% (7)[a]	47% (8)	77.7%* (14)	78.8%* (15)
Medium (Middle Tertile)	50% (6)	17.6%* (3)	77.7%* (14)	66.6% (12)
High (Upper Tertile)	8.3%* (1)	5.8%* (1)	66.6% (12)	66.6% (12)
Total sample	37% (14)	24%* (12)	72%* (40)	69.6%* (39)

Notes to Table:

(i) [a] denotes number of industries with negative association in each tertile.

(ii) * denotes significant value ($p \neq 0.5$) at $\alpha \leq 0.1$ (10% level) [where p is the proportion of negative associations].

TABLE 3: NEGATIVE ASSOCIATION RATIOS FOR 38 INDUSTRIES FOR DIFFERENT TIME PERIODS (USING ROE TO MEASURE RETURN AND BETA (β) TO MEASURE RISK)

Industry name	SIC Code	1960-64	1965-1969	1970-1974	1975-1979
1. Metal mining	10	.59 (8)	.71 (12)	1.49 (15)	1.0 (16)
2. Bituminous coal	12		.66 (5)	.66 (5)	.5 (6)
3. Oil and gas extraction	13		.4 (7)	.5 (12)	2.0 (15)
4. Construction	16		4.0 (5)	.59 (8)	2.0 (9)
5. Food and kindred products	20	.63 (31)	1.78 (42)	1.77 (47)	1.76 (57)
6. Tobacco manufactures	21		.4 (7)	1.78 (6)	1.33 (7)
7. Textile	22	2.0 (9)	.33 (12)	1.0 (16)	1.10 (19)
8. Apparel	23	.4 (7)	.85 (13)	.28 (17)	1.56 (23)
9. Lumber	24			.66 (5)	1.20 (11)
10. Paper and allied products	26		1.33 (14)	1.10 (21)	.92 (25)
11. Printing and publishing	27		2.0 (9)	1.28 (16)	1.33 (21)
12. Chemicals	28	.75 (28)	1.31 (51)	1.28 (64)	1.12 (68)
13. Petroleum	29	1.33 (14)	.92 (25)	.8 (27)	1.28 (32)
14. Rubber	30	1.33 (7)	.75 (14)	1.42 (17)	.4 (21)
15. Leather	31			.5 (6)	1.33 (7)
16. Stone and clay	32	5.0 (6)	1.0 (16)	.69 (17)	.83 (22)
17. Primary metal	33	.80 (18)	1.33 (28)	1.53 (33)	.85 (39)
18. Fabricated metal	34	.4 (7)	2.22 (16)	1.16 (26)	.73 (33)
19. Machinery	35	1.35 (33)	1.49 (55)	1.21 (71)	1.58 (88)
20. Electronic machinery	36	1.0 (20)	1.31 (37)	1.47 (47)	1.47 (57)
21. Transportation equipment	37	.64 (33)	1.10 (38)	.68 (42)	.87 (47)
22. Measuring instruments	38	1.33 (7)	2.0 (21)	2.63 (29)	2.0 (30)
23. Miscellaneous	39			4.54 (5)	10.0 (11)
24. Railroad	40		4.0 (10)	.4 (14)	1.66 (16)
25. Transportation by air	45	1.0 (8)	1.49 (10)	.75 (14)	2.0 (15)
26. Communication	48		.5 (12)	.54 (17)	.42 (20)
27. Electric services	49	.62 (86)	.77 (96)	.68 (111)	.82 (128)
28. Wholesale trade	50			.66 (5)	1.0 (8)
29. Wholesale trade	51		2.0 (6)	.44 (13)	1.13 (15)
30. General merchandise stores	53	.44 (13)	1.0 (18)	1.56 (23)	1.0 (28)
31. Food stores	54	1.49 (5)	2.0 (9)	.5 (15)	2.38 (17)
32. Eating and drinking places	58				.66 (10)
33. Miscellaneous retail	59			.5 (12)	1.33 (21)
34. Banking	60			.57 (11)	.70 (29)
35. Credit agencies	61		9.09 (10)	1.13 (15)	1.25 (18)
36. Security and commodity brokers	62				2.0 (6)

TABLE 3 (continued)

Industry name	SIC Code	1960-64	1965-1969	1970-1974	1975-1979
37. Insurance	63			.28 (9)	.36 (15)
38. Holding offices	67				5.88 (14)
Overall number of companies		340	598	811	1024
Number of industries with negative association		7	16	15	23
Number of industries with tied association		2	2	1	3
Total number of industries		18	28	35	38
% of industries with negative association		38%	57%	42%	60%

Notes to Table:

(i) The figures in parentheses denote the total number of firms in each 2 digit industry for each time period.

(ii) Using a binomial statistical test no one of the negative association ratios is significantly different from 0.5 at the chosen 10% significance level. Therefore, there is no evidence of negative association in this table.

TABLE 4: NEGATIVE ASSOCIATION RATIOS (ROE VS. β) FOR DIFFERENT TIME PERIODS AND FOR LOW, MEDIUM, AND HIGH ROE INDUSTRIES

Industry ROE \ Period	60-64	65-69	70-74	75-79
Low	33.3% (2)[a]	44.4% (4)	50.0% (6)	46.1% (6)
Medium	50% (3)	66.6% (6)	58.3% (7)	61.5% (8)
High	33.3% (2)	66.6% (6)	33.3% (4)	69.2% (9)
Total sample	38.8% (7)	57.1% (16)	42.8% (15)	60.5% (23)

Notes: (i) [a] is number of industries with negative association.

(ii) Using binomial statistical test no one of the negative association estimates is significantly different from .5 (i.e., there is no evidence of significant negative association for low v. high ROE industries or for the overall sample).