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BANK HOLDING COMPANIES: FORECASTING MARKET RISK
FROM ITS ASSOCIATION WITH ACCOUNTING MEASURES

by

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A DISSERTATION

IN

BUSINESS ADMINISTRATION

Submitted to the Graduate Faculty
of Texas Tech University in
Partial Fulfillment of
the Requirements for
the Degree of

DOCTOR OF BUSINESS ADMINISTRATION

Approved

Accepted

August, 1974

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1974
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ACKNOWLEDGMENTS

I am twice indebted to Professor William P. Dukes for his timely direction of this dissertation and for his sponsorship of the many research projects that made it possible for me to develop my research capability. I am also indebted to Dr. Carl H. Stem, Dr. R. Corwin Grube, and Dr. John T. Sennetti for steering this dissertation on the proper path. Finally, I am indebted to my wife, Peggy, for her assistance in coding and keypunching some ten thousand computer data cards and typing all drafts of this dissertation.

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CHAPTER I

INTRODUCTION

The purpose of this section is to examine the potential application of modern portfolio theory to the acquisition opportunities presently faced by bank holding companies. Current problem areas will be identified and a theoretical framework will be suggested for evaluating the potential changes in market risk associated with these opportunities.

The present body of portfolio theory has been developed from the pioneering work of Markowitz [45][46]. Markowitz observed that investments offering the greatest potential for high returns were often those whose variance of returns were also high.¹ Prior to Markowitz, the conventional wisdom was to select those securities whose present value of expected returns were greatest [68]. Reasoning that the maximization of expected returns would not lead to the diversified portfolios believed to be preferred by the rational, risk averse investor, he suggested the need for an

¹This direct relationship between risk and return as observed by Markowitz has been questioned. For example, see Friend, Irwin and Blume, Marshall, "Measure of Portfolio Performance Under Uncertainty," American Economic Review, (September, 1970), 561-75.

additional explanatory parameter. Markowitz chose variance of return as a measure of risk for consideration by the investor.²

Consideration of both risk and return provided an alternative solution to the assessment of investment alternatives, i.e., the Expected Return-Variance of Return Rule (E-V Rule). The E-V Rule is still the principle on which most modern portfolio theory is based. The rule requires that an investor choose a portfolio from an efficient set. An efficient set is one that meets the criteria that for a given E, V would be a minimum or for some V, E would be a maximum. Choosing a portfolio from an efficient set would further require that the investor specify his particular risk-return tradeoff preferences.

The Markowitz model requires the investor to estimate for a given group of securities:³ (1) their expected return; (2) their expected variance of return; and (3) the expected covariance of return among every possible pair. These estimates for all possible security portfolios of size

²Alternative approaches to the measurement of risk include: the semi-variance approach by Mao and Brewster [44]; the stochastic dominance models of Porter [56], Hardar and Russell [30], and Levy and Sarnat [37]; and the suggested use of higher moments of return distributions by Long and Dyl [41], and Alderfer and Bierman [1].

³The alternative approaches cited in [1][30][37][41][44][56] involve informational and/or computational requirements that exceed those of the E-V approach.

1, 2, . . . n, are utilized to compute the efficient set of investment alternatives.⁴

The methodology for finding efficient portfolios has been simplified by the introduction of Sharpe's diagonal model [61]. In order to simplify the estimation process, the diagonal model assumes that the returns on individual securities are related to the level of some index. Further, it assumes that relationships among securities derive from common relationships with this index. The types of indexes most often utilized in security portfolio analysis are those composed of a number of representative securities, the movement of which is taken as a proxy for the movement of the market for securities in general.

Using Ordinary Least Squares (OLS) regression techniques, if we regress the returns of an index (independent variable) with returns of an individual security (dependent variable), the resulting regression or characteristic line yields usable information for the investor. For example, given an estimated or expected return of the index for the next period, this security characteristic line would enable the investor to estimate the expected return of the security for that period. Further, the regression coefficient, b_i , of the characteristic line becomes a measure of the volatility

⁴For a 100 security universe, this would require $[(n^2 - n/2) + 2n]$ or 5150 estimates. Sharpe's diagonal model described below would require only $3n + 2$ or 302 estimates [61, p. 282].

or responsiveness of security i with respect to movements in the market.⁵ A b_i value of less than one would be indicative of a security whose returns were less responsive than market returns, while a b_i value which is greater than one would reflect the opposite.

As a practical matter, portfolio selection based on a tradeoff between beta and expected return, beta representing a proxy for risk, has effectively replaced the more cumbersome Markowitz model as a practical tool for the investor and investment analyst.⁶

If we view the bank holding company as an investor who holds a portfolio of assets (subsidiaries) in both banking and non-banking areas, the task of choosing an optimal portfolio of assets is closely akin to the problem of selecting an optimal portfolio of securities. Portfolio theory would dictate that the bank holding company choose an asset portfolio from an "efficient set." Choosing from an efficient set would further require that the bank holding company specify its risk-return tradeoff preferences. It is with the apparent similarity of security and asset selection that

⁵The regression coefficient is often referred to as b-value, beta value, or beta coefficient.

⁶For example, Value Line Investment Survey [65] publishes beta values based on 260 weekly price observations. Thus, beta values are available to all institutional traders and the general investing public. See also the comments of Block [7] and Zinbarg [70].

the dissertation will proceed.⁷

In the following chapters, a theoretical framework will be developed to deal directly with the application of portfolio theory to the asset acquisition opportunities of bank holding companies. In developing this framework, the specific problem areas to be addressed are: (1) the identification of a risk measure amenable to the specific needs of the bank holding company industry; (2) the inquiry into the relationship of this measure of risk with bank holding company structural characteristics as evidenced by accounting measures; and (3) the ability to use the above relationships to forecast changes in risk associated with acquisitions and/or mergers.

Bank Holding Companies--A Historical Perspective

Bank holding companies have existed since the turn of the century, developing originally in states that limited or prohibited branch banking. Bank holding companies have been typically classified by the number of banks controlled by the parent holding company, resulting in the dichotomous classification of one-bank and multi-bank holding company.⁸

⁷The application of security portfolio analysis to corporate capital budgeting decisions can be found in Van Horne [66] and Litner [40].

⁸For a precise definition of bank holding company types and other common terms associated with bank holding company jargon, see Appendix A.

Most of the major bank holding companies in operation prior to the recent one-bank holding company formations were multi-bank in nature and were organized between 1925 and 1930. Although there were numerous factors which contributed to the growth in the number of bank holding companies in that period, the two most significant elements at that time were (1) the desperate condition of thousands of banks in the United States, and (2) the great "bull market" in common stocks [3]. The weakness of these banks made many of them anxious to affiliate with a holding company and the booming stock market made it possible for a group system to obtain the necessary funds to purchase them.

In the early period of the '30's a few holding companies failed, the banking assets and number of multiple units declining slightly. From that period until 1949, the bank holding company did little more than hold its own in relation to the total deposits of the banking system, deposits growing somewhat less than the banking industry as a whole.

The period from 1949 through 1964 saw a considerable growth in bank holding company assets and deposits. Much of the great expansion of bank holding companies was concentrated in a two-and-one-half year period between January, 1954 and June, 1956. The major elements underlying this expansion were the fear that an extremely restrictive federal law would result from the public hearings dealing with bank holding companies and the desire of one large multi-bank

holding company to rebuild their portfolio of bank stocks. These stocks had been divested while the bank holding company faced charges under a Clayton Act Section 7 suit (which it later won).

The present period of growth began in the mid '60's, spurred by the exclusion of the one-bank holding company from regulatory control in the Bank Holding Company Act of 1956. The one-bank holding company form provided the vehicle through which banks sought to expand bank related activities, i.e., formation of a one-bank holding company, as such expansion was not prohibited under the Bank Holding Company Act of 1956. As late as June 30, 1966, the total deposits of all one-bank holding companies were \$15.9 billion--representing only 4.7 per cent of the total deposits of all commercial banks in the United States. (See Table 1.) Between June 30, 1966, and April 1, 1970, the number of banks controlled by one-bank holding companies increased by 475, or approximately 74 per cent. Over the same period, the deposits under the control of the companies increased almost ninefold. This extraordinary increase in the number of banks and the amount of deposits controlled by one-bank holding companies was in large part responsible for public hearings culminating in the amending of the Bank Holding Company Act of 1956 to include control of the one-bank form on December 31, 1970.

With the elimination of the comparative advantage

TABLE 1
DEPOSITS OF ONE-BANK HOLDING COMPANIES

Date	Number of Banks	Total Deposits (billion dollars)	Ratio to Total Deposits of all Banks (per cent)
December 31, 1954	113	3.1	1.7
December 31, 1965 ^a	548	13.9	4.5
June 30, 1966	641	15.9	4.7
December 31, 1968	783	108.2	27.5
April 1, 1970 ^a	1,116	138.8	32.6

^aDeposits are for previous June.

Source: Business Conditions: Federal Reserve Bank
of Chicago, July, 1970, p. 6.

of the one-bank holding company form as pertained to unregulated expansion into bank related activities, a recent movement toward the multi-bank form has been observed. The sample bank holding companies examined in this dissertation included both bank holding company forms (see Appendix B). The differences in structural characteristics of the two forms were adjudged not to be as striking as their dichotomous classification might suggest. Both groups tended to be represented by companies exhibiting a comparable range of deposits and assets. The asset composition of the one-bank versus multi-bank holding company structure tended to show more diversification vis-a-vis bank related activities although such diversification has been undertaken by the multi-bank holding

company form since the 1970 Amendment. In the subsequent applications of portfolio theory, no explicit distinction of holding company form will be recognized, rather the two forms will be treated as one group, i.e., bank holding companies.

The Application Of Portfolio Theory To Bank
Holding Company Investment Alternatives

With the rapid growth of bank holding companies in numbers, deposits, and ratio of deposits to total deposits of all banks, (see Table 2) the bank holding company movement is constantly changing the structure of financial markets. Accompanying this rapid growth of bank holding companies are the related problems of asset expansion. / As a result of the December 31, 1970, amendment to the Bank Holding Company Act of 1956,⁹ bank holding companies are allowed to engage in a group of activities related to banking (see Table 3). / With a wider range of risk-return activities now available, it is imperative that existing portfolio theory be brought to bear on the asset acquisition opportunities of the bank holding company.

On the basis of a wider range of risk return activities available to the bank holding company, a move toward an

⁹For a specific review of the amendment see: Donald L. Kohn, and John F. Zoellner, "The Amended Bank Holding Company Act," Monthly Review, Federal Reserve Bank of Kansas, May, 1971.

TABLE 2

COMPARISON OF OFFICES AND DEPOSITS OF BANKS AFFILIATED
WITH REGISTERED BANK HOLDING COMPANIES

	1956	1960	1965	1968	1969	1970	1971 ^a
Number of companies	53	47	53	80	97	121	1,567
Banks	428	426	468	629	723	895	2,420
Branches	783	1,037	1,486	2,262	2,674	3,260	10,832
Total Offices	1,211	1,463	1,954	2,891	3,397	4,155	13,252
Offices as a percent- age of all bank offices	5.7	6.1	6.7	8.9	10.1	11.8	36.1
Deposits (in billions of dollars)	14.8	18.2	27.5	57.6	62.5	78.0	297.0
Deposits as a percent- age of all bank deposits	7.5	7.9	8.3	13.2	14.3	16.2	55.1

^aThe 1971 figure includes one-bank holding companies, brought under regulation by the Bank Holding Company Act for the first time on December 31, 1970. As of December 31, 1965, however, a total of 550 one-bank holding companies accounted for only 4.5 per cent of total United States bank deposits, and multi-bank companies for 8.3 per cent, or a total of 12.8 per cent.

Source: "Bank Affiliates and Their Regulation--Part III," Monthly Review, Federal Reserve Bank of Richmond, May, 1973, p. 7.

TABLE 3
NONBANKING ACTIVITIES UNDER
SECTION 4(c)(8)

Authorized

1. Issuing letters of credit and accepting drafts
2. Making mortgage loans
3. Consumer finance activities
4. Operating credit card company
5. Factoring
6. Operating an industrial bank
7. Servicing loans
8. Providing trust services
9. Acting as investment and financial adviser as specifically authorized
10. Furnishing general economic information and advice
11. Providing portfolio investment advice
12. Leasing of personal property on a full-payout basis
13. Making investments in community welfare projects
14. Providing bookkeeping or data processing services
15. Acting as insurance agent or broker where insurance is connected with an extension of credit
16. Underwriting of credit insurance and credit accident and health insurance that is directly related to extensions of credit by the bank holding company system

Denied

1. Insurance premium funding
2. Underwriting general life insurance
3. Real estate brokerage
4. Land development
5. Real estate syndication
6. Property management
7. Management consulting
8. Owning savings and loan association (this activity may be the subject of further consideration by the Board)

TABLE 3--Continued

Under Consideration

1. Leasing real property ✓
 2. Furnishing armored car and courier services ✓
 3. Providing mortgage guarantee insurance
-

Source: "Bank Affiliates and Their Regulation,"
Monthly Review, Federal Reserve Bank of
 Richmond, May, 1973, p. 8.

increased risk profile with associated higher expected returns should be examined. Whereas a commercial bank must preserve the safety of the institution and the banking system, therefore limiting risk exposure, such does not appear to be the case for the bank holding company. The safety of banks will not legally be impaired due to their affiliation with a bank holding company. Only in the event that the public views the potential insolvency of a bank holding company as a sign of weakness of affiliated banks, reacting unfavorably through mass withdrawals of funds from these banks, should there be adverse effects. Federal Deposit Insurance decreases substantially the likelihood of such an event taking place.¹⁰

The previous comments concerning the process of asset selection and an increased risk profile for a bank holding

¹⁰For a discussion of the one bank holding company from the public interest viewpoint, see: Paul S. Nadler, "One Bank Holding Companies: The Public Interest," Harvard Business Review (September, 1970), pp. 107-13.

company suggest a need for a measure that adequately reflects the risks inherent in asset selection. An investigation of the relationship of such a risk measure with certain accounting measures of a bank holding company may provide a link between management decisions and subsequent market evaluation of risk. Such a relationship may provide the theoretical framework for obtaining estimates of the perceived changes in bank holding company risk prior to a proposed acquisition and/or merger.

An examination of the empirical studies related to market risk definition and the relationship of market risk with accounting measures is presented in Chapter II, together with an appraisal of their results. Chapter III considers market indexes and problems related to their construction and validity. Chapter IV describes the sample and the methodology employed, while Chapter V presents the findings. Finally, Chapter VI summarizes the empirical results, their implication for market risk forecasts, and suggestions for further areas of research.

CHAPTER II

MARKET BASED RISK VERSUS ACCOUNTING MEASURES

Recent published articles by Beaver, Kettler, and Scholes [5], Gonedes [27], and Breen and Lerner [10] were concerned with the association between market-based risk measures and (1) accounting-based risk measures [5], (2) income numbers [27],¹¹ and (3) corporate decision variables [10] respectively. The above measures are all similar in that they are generated from corporate accounting data. The accounting system generates measures thought to be utilized by investors to form price expectations. Evidence concerning their relationship with market risk as defined by portfolio theory is the subject of this chapter.

In terms of the development of a framework of predicting changes in market risk resulting from a bank holding company acquisition or merger, the significance of these studies lies in the evidence concerning the degree of association between the market-based risk measures and accounting measures. A strong association between these measures would support a hypothesis that accounting relationships somehow

¹¹Income numbers is the name given to the market and industry earnings measures as scaled by total assets.

reflect the underlying events that are responsible for the riskiness of securities, or alternately, that these events are reflected in the market price of securities. Assuming for the moment that these measures are associated, two potential applications are suggested.

First, the association might provide the identification of specific structural characteristics of bank holding companies (as evidenced by accounting measures) that give rise to a given level of market risk. Thus, bank holding company acquisition decisions could be made on the basis of the perceived impact on market risk due to the proposed changes in structure as evidenced by proforma accounting statements. Finally, the association may provide a basis for forming ex ante market risk estimates that ex post prove to be superior to those of existing naive forecast models which assume no change in the level of market risk from period to period.

The findings of Beaver, Kettler, and Scholes and by Gonedes to be examined below generally support a statistically significant relationship between market-based risk measures and certain accounting measures, although the degree of association differed markedly between studies. The Breen and Lerner study found a very weak relationship between corporate decision variables and market measures of risk. A review of these empirical studies is presented below subsequent to the development of the market model to be utilized in computing market-based estimates of risk.

Market Based Risk Measures

Sharpe [59][61], Litner [39][40], and Mossin [51] have modified and extended the earlier work of Markowitz [45] [46] to include a diagonal model and a capital asset pricing model. The primary impetus for the development of the diagonal model, hereafter referred to by the more general name of single index model, was to reduce the enormous amount of parameter estimates required to implement the Markowitz model. Capital asset pricing models, outgrowths of the earlier portfolio work, attempt to determine the equilibrium prices for all securities in the market.

The single index model asserts that a security's return is composed of two elements, a systematic component which reflects common movement of the security's return with the return of a hypothetical market, and a component unique to the security that moves independently of the market return. These relationships are specified in the linear regression model below:

$$R_i = a_i + b_i R_M + e_i \quad (1)$$

with the specifications that

$$\begin{aligned} E(e_i) &= 0, \\ \text{Cov}(R_M, e_i) &= 0, \\ \text{Cov}(e_i, e_j) &= 0, \\ R_i &= \text{return of security } i, \\ R_M &= \text{return of the market}, \\ e_i &= \text{residual error reflecting that} \\ &\quad \text{portion of security } i\text{'s return} \\ &\quad \text{not associated with } R_M, \end{aligned}$$

a_i = intercept of the regression,

b_i = slope of the linear relationship.

Since the early work of Markowitz, variance of return has commonly been used as a measure of total risk for both an individual security and security portfolios. A security's contribution to the risk of a portfolio has been measured by its average covariance with other securities in the portfolio. Covariance reflects the extent to which security returns move together. Two security returns are said to have positive (negative) covariance if, when one security's ex post return is larger (smaller) than its expected value, the other security's ex post return is also larger (smaller).

The regression coefficient b_i bears a direct relationship to the concept of covariance. This relationship can be expressed as:

$$b_i = \frac{\text{Cov}(R_i, R_M)}{\sigma^2(R_M)} \quad (2)$$

where

$\text{Cov}(R_i, R_M)$ = covariance of security i 's returns with the market,

$\sigma^2(R_M)$ = variance of the market return.

Thus, measuring a security's riskiness in terms of its beta coefficient is compatible with the historical use of covariance as a measure of risk.

Another convenient property of the single index model is the ease with which aggregate portfolio measures for return and market risk can be computed. The properties

of the single index model are such that the return on a portfolio is simply the weighted average of the returns of the individual securities. Notationally this is equivalent to:

$$R_p = \sum_{i=1}^n X_i R_i$$

where

R_p = return of portfolio,

R_i = return of security i ,

X_i = relative proportion of the portfolio invested in security i .

The variability of the systematic component of a security's return is defined as market risk and is equivalent to:

$$\sigma_i^S = b_i \sigma_M$$

where

σ_i^S = market risk,

b_i = slope of the linear regression as defined in equation (1),

σ_M = standard deviation of market return.

Since the standard deviation of market return over a specific time period is a constant, the systematic risk varies directly with b_i . Thus, b_i is used as a proxy risk measure for the individual security.

The market risk of a portfolio is a function of the market risk of individual securities and is similar to the specification of equation (4):

$$\sigma_p^S = b_p \sigma_M$$

where

$$\begin{aligned}\sigma_p^s &= \text{systematic risk of a portfolio,} \\ b_p &= \text{combined beta of the portfolio,} \\ \sigma_M &= \text{standard deviation of market return,}\end{aligned}$$

and b_p is specifically defined as:

$$b_p = \sum_{i=1}^n X_i b_i \quad (6)$$

where

$$\begin{aligned}b_i &= \text{beta for security } i, \\ X_i &= \text{relative proportion of the portfolio invested in security } i.\end{aligned}$$

Empirical evidence indicates that for portfolios composed of sixteen [36] to twenty [18] securities, the unsystematic risk is effectively diversified away, i.e., reduced to near zero.¹² For large portfolios with σ_M constant, b_p also becomes a measure or proxy for the total as well as market risk of a portfolio.

Empirical assessments of the values of a_i and b_i can be formulated from a time series, least-squares regression of the following form:

$$R_{it} = a_i + b_i R_{Mt} + e_{it} \quad t = 1, T \quad (7)$$

where

$$\begin{aligned}R_{it} &= \text{ex post return for security } i, \\ R_{Mt} &= \text{ex post return for the market,} \\ e_{it} &= \text{disturbance or error in the equation.}\end{aligned}$$

Estimates of β_i (b_i) from a time series regression assumes stationarity of β_i during the estimating period.

¹²For example, Sharpe [60, p.150] indicates that portfolios with twenty securities have approximately 3 per cent more unsystematic risk remaining than the minimum possible.

Evidence by Blume [8], Sharpe and Cooper [62], Jensen [31], and Levy [38] suggests that b_i estimates behave as if they are stable, especially in a portfolio context. Evidence by Breen and Lerner [10] indicates that although the stationarity assumption may not be seriously violated in a portfolio model, the same assumption may hinder efforts to detect relationships between market-based risk measures and accounting measures. If β_i remained stationary over long periods of time, no functional relationship between β_i and accounting measures could be found [10]. The ideal requirements are that β_i (thus b_i) change slowly through time and yet the lag between the change in accounting measures and β_i be short. This severe requirement may explain part of the reason why the standard econometric procedures to date have failed to capture the precise relationship between b_i and accounting measures.¹³

Empirical evidence of Fama et al., [20] indicates that equation (7) conforms well to other assumptions of the linear regression model, i.e., linearity, serial independence of the error terms, and homoscedasticity with the exception that the distribution of the estimated error residuals have longer tails than Gaussian distributions. The evidence that the error residuals have longer tails than would be expected under normality is consistent with Fama's [19] findings that

¹³Other reasons can be found in [11][29] and will be discussed in a subsequent section of this chapter.

security returns are members of the Stable Paretian family of distributions with finite means but infinite variances. Wise [69] has shown that under these conditions, least-squares estimates of β_i are unbiased and consistent, but not efficient.

In summary, the measure of market risk for security i selected for this dissertation is the beta coefficient, b_i . This selection is predicated on the informational and/or computational advantages previously discussed in Chapter I, the additional favorable properties of the single index model discussed in this chapter, and the present voluminous use of beta by other empirical studies related to the dissertation (some of which appear below).

Breen And Lerner Study [10]

The Breen and Lerner study examined the relationship of b_i with seven corporate variables using a multiple regression model. The corporate variables were: (1) the ratio of debt to equity and (2) the ratio squared, (3) the growth of earnings, (4) the stability of the growth in earnings as measured by R^2 for variable three, (5) the size of the company as measured by the market value of common stock, (6) the dividend payout ratio, and (7) the number of shares traded.

The dependent variable b_i was estimated from a time series regression similar to equation (7). The sample monthly returns were defined as $\Delta P_i / P_i$ for 1400 companies found on

the Quarterly Industrial COMPUSTAT Tape for the period 1965 to 1970. The market return was computed as the percentage change (monthly) of the New York Stock Exchange (NYSE) Index.

Monthly cross section regressions were computed using first a twenty-four and then a thirty-six month b_i as the dependent variable and the seven variables above as independent variables. The regression results revealed two important points: (1) many of the multiple regression coefficients were not significantly different than zero and (2) the overall R^2 for the estimating equations were low. The signs of the coefficients, however, usually behaved the way that the traditional corporate finance literature suggests that they should.

Beaver, Kettler, And Scholes Study [5]

The Beaver, Kettler, and Scholes study, hereafter referred to as BKS, was concerned with the relationship between market determined and accounting determined measures of risk. The BKS study attempted to identify the types of exogenous variables of a non-price nature impounded in the assessment of security prices and price changes, and to use this information to make better predictions of market risk parameters for a future decision period. Fama [21] and others [2][6] have suggested that the securities market is efficient in the following way: (1) Security prices behave as if they are unbiased estimates of intrinsic value at any

point in time and (2) the market reacts quickly, and on average, in an unbiased manner to new information as it becomes available. Thus, BKS assumed such public information, as reflected in accounting statements, to be impounded in security prices and price changes.

The BKS study was based on an analysis of 307 firms for the period 1947 through 1965, which represented the overlapping period for which required data from the Compustat Industrial Tape and the Center for Research in Security Prices (CRSP) Tape were available.

BKS determined the market risk measure for the time periods studied by a least squares regression of the following form:

$$R_{it} = a_i + b_i R_{Mt} + e_{it} \quad t = ML, NL \quad (8)$$

where

$$R_{it} = \ln \left[\frac{P_{it} + D_{it}}{P_{it-1}} \right]$$

$$R_{Mt} = \ln \left[\frac{(L)_t}{(L)_{t-1}} \right]$$

ML = January, 1947 (period one) or January, 1957 (period two),

NL = December, 1956 (period one) or December, 1965 (period two),

D_{it} = cash dividend payable on common stock i in month t ,

P_{it} = closing price for common stock i at end of month t ,

P_{it-1} = closing price for common stock i at end of month $t-1$, adjusted for all capital changes,

L_t = Fisher's Link Relative Index [22].

Studies by King [33] and Fisher [22] indicate that the estimated b_i value is essentially the same whether the continuous compounding log form of equation (8) or the discrete compounding form of equation (7) is used. Further, studies by Fisher [24] and Fama, et al., [20] indicate that Fisher's Link Relative Index is highly correlated with other popular indexes so that their findings were essentially the same regardless of the market index used.¹⁴

The list of accounting risk measures utilized by BKS include: (1) dividend payout, (2) asset growth, (3) leverage, (4) liquidity, (5) asset size, (6) variability of earnings, and (7) covariability of earnings (see Appendix C for precise definitions). The a priori relationships posited between the accounting risk measures above and the market-based risk measure b_i were positive for asset growth, leverage, variability of earnings, and covariability of earnings and negative for the others. The results of the cross-sectional correlations at the individual security level using both rank and product-moment correlation confirmed that the signs of the coefficients were in the predicted direction with but one minor exception, and in that case the correlation was near zero. (See Table 4.)

Instrumental variables approach

The primary thrust of the BKS study was concerned

¹⁴A study by Dukes and Brewer [16] found a lower degree of correlation among weekly index returns during the period January, 1963 through June, 1973.

TABLE 4

CONTEMPORANEOUS ASSOCIATION BETWEEN MARKET
DETERMINED MEASURE OF RISK AND SEVEN
ACCOUNTING RISK MEASURES^a

Variable	Period One (1947-56)		Period Two (1957-65)	
	Individual Level	Portfolio ^b Level	Individual Level	Portfolio ^b Level
Payout	-.49 (-.50)	-.79 (-.77)	-.29 (-.24)	-.50 (-.45)
Growth	.27 (.23)	.56 (.51)	.01 (.03)	.02 (.07)
Leverage	.23 (.23)	.41 (.45)	.22 (.25)	.48 (.56)
Liquidity	-.13 (-.13)	-.35 (-.44)	.05 (-.01)	.04 (-.01)
Size	-.06 (-.07)	-.09 (-.13)	-.16 (-.16)	-.30 (-.30)
Earnings Variability	.66 (.58)	.90 (.77)	.45 (.36)	.82 (.62)
Accounting Beta (β_i)	.44 (.39)	.68 (.67)	.23 (.23)	.46 (.46)

^aRank correlation coefficients appear in top row, and product-moment correlations appear in parentheses in bottom row.

^bThe portfolio correlations are based on sixty-one portfolios of five securities each.

with the ability of so called accounting risk measures to forecast market-based risk measures in some future period. The comparison standard against which forecast accuracy was evaluated was a naive forecasting model that assumed market risk stationarity over time, i.e., an unchanging b_i . As

mentioned previously, empirical studies have demonstrated moderate degrees of correlation of b_i from period to period even for the individual security, so that the naive model was thought to represent a fair standard to beat.

The BKS instrumental variables approach is one solution offered in removing measurement errors in observed data for the purpose of generating better estimates. This approach has been used by Miller and Modigliani [48] in removing measurement errors in observed earnings data in order to generate better earnings estimates for use in empirical tests of valuation theories of the firm. The use of instrumental variables is documented in Johnston [32] as one approach to the errors-in-the-variables problem.

Values of b_i for different time periods t_1 and t_2 (b_1 and b_2 for example) obtained from equation (7) are estimates of the true parameters β_1 and β_2 . Assume that the relationships between the true values of β_1 and β_2 are specified as:

$$\begin{aligned} b_1 &= \beta_1 + \mu \\ b_2 &= \beta_2 + \nu \end{aligned}$$

where

μ and ν are error terms.

Even though β_1 is not directly observable, it is linearly related to n observable variables z_1 through z_n , called instrumental variables by the relationship:

$$\beta_1 = \phi_0 + \phi_1 z_1 + \dots + \phi_n z_n \quad (9)$$

β_1 can then be estimated from the following cross section linear regression equation:

$$b_1 = c_0 + c_1 z_1 + \dots + c_n z_n + w, \quad (10)$$

where for the BKS study,

$$\begin{aligned} z_n &= \text{accounting risk measure } n, \\ w &= \text{error term, reflecting error in } b_1, \\ b_1 &= \text{estimate of } \beta_1 \text{ obtained from equation (7)} \\ \phi_n &= \text{true multiple regression coefficients,} \\ c_n &= \text{estimated multiple regression coefficients.} \end{aligned}$$

Subtracting the error term w from b_1 , we obtain a new estimate $\hat{b}$ from which theoretically the measurement error has been purged:

$$\hat{b}_1 = b_1 - w \quad (11)$$

The validity of this approach is a function of how well the instrumental variables are chosen. For each different set of instrumental variables chosen, a new estimate of $\hat{b}_1$ is generated. Due to problems of multi-collinearity among variables, only three instrumental variables--payout, growth, and earnings variability were included by BKS in equation (9).

The forecasting errors observed when b_1 and $\hat{b}_1$ were used to forecast b_2 favored the $\hat{b}_1$ specification. An analysis of the proportion of times that the instrumental variables specification had a lower error than the naive specification favored $\hat{b}_1$ by a margin of 54-46. More striking perhaps is the comparison of the instrumental variables

forecasts and naive forecasts in the tail areas, where the split favored $\hat{b}_1$ by a large margin of 78-22.

BKS conclude that their study provides evidence that accounting measures of risk are impounded in the market-based risk measure, b_1 . Whether investors actually do use accounting risk measures in their decisions, or whether the market risk measure and accounting data are jointly reflecting the same underlying events and investors are reacting to those events rather than the accounting data, is open to further study and interpretation. Finally, BKS offer their results as support for the hypothesis that accounting data can be used to provide superior forecasts of beta for the time periods studied.

Gonedes Study [28]

The Gonedes study was concerned with empirical evidence on the information content of earnings measures and restricted its investigation to the information content of income numbers. Gonedes conceived that a firm's income number series could be treated in a manner analogous to the market model of equation (1), i.e., the events affecting a firm's operations may be thought of as belonging to (1) industry or economy-wide events or (2) events specific to a particular firm. He thus perceived of the variability of a firm's income number series as composed of both systematic and non-systematic or individualistic components. Evidence

on this perspective of a firm's income number series is also provided by Brealey [9], Brown and Ball [12], and Gonedes [28].

Although several estimation models were used in the study of accounting income numbers, only two models, first differences in income numbers and scaled first differences in income numbers, will be discussed here because these specifications provided the best results.

Using Gonedes notation, the first differences in income numbers model appeared as,

$$\Delta Y_{it} = \gamma_{2i} + \delta_{2i} \tilde{\Delta Y}_t^E + \omega_{2i} \tilde{\Delta Y}_t^I + \tilde{\epsilon}_{2it} \quad (12)$$

and the scaled first differences as,¹⁵

$$\frac{\tilde{\Delta Y}_{it}}{\tilde{A}_{it}} = \gamma_{4i} + \delta_{4i} + \frac{\tilde{\Delta Y}_t^E}{\tilde{A}_t^E} + \omega_{4i} \frac{\tilde{\Delta Y}_t^I}{\tilde{A}_t^I} + \tilde{\epsilon}_{4it} \quad (13)$$

where (letting the tilde ~ denote a random variable):

- $\tilde{Y}_{it}$ = the income number of firm i for period t ,
- $\tilde{Y}_t^E$ = the economy-wide income number for period t ,
- $\tilde{Y}_t^I$ = the industry income number, for the industry to which firm i belongs, for period t ,
- $\tilde{A}_{it}$ = the total-asset number of firm i at the beginning of period t , and
- $\tilde{A}_t^I$ = the total-asset number for the industry-grouping of firm i at the beginning of period t ,

¹⁵The economy-wide and industry income numbers were derived from an index of all firms in the sample and/or industry, omitting the income numbers of firm i .

$\gamma_{ni}, \delta_{ni}, \omega_{ni}$ = multiple regression coefficients,
 $\tilde{\epsilon}_{nit}$ = multiple regression error term.

Estimates of the systematic variability (i.e., the multiple correlation coefficients) were obtained for all companies in Gonedes sample and for each of the above income-number models. This sample contained ninety-nine firms for which monthly price-relative data were available on the CRSP Tape and income and asset numbers were available from the Annual Industrial Compustat Tapes for the period 1946-1967. The results of Gonedes study were based on Net Income and Total Assets as defined on the Annual Industrial Compustat Tapes.

Gonedes utilized two tests to measure the association between market and accounting based estimates of variability of returns. The first involved the correlation between the estimates of systematic variability provided by equations (12) and (13) and the estimate of systematic variability provided by the market model of equation (8).¹⁶ A low correlation between the measures would suggest that the risk-information conveyed by accounting numbers is but a small portion of all the risk-information conveyed in stock prices. The opposite conclusion would be suggested by a high degree of correlation. An additional test involved

¹⁶The estimated coefficients of determination, R^2 's from the models provide estimates of a firm's systematic risk since they represent the proportion of variance explained by the regression.

the correlation between the estimated regression coefficients $\hat{\delta}_{4i}$ and $\hat{\omega}_{4i}$, and the estimated b_i coefficients from the market model.¹⁷

The correlation results (see Table 5) of the Gonedes study do not reflect as strong a degree of association between market risk and income numbers as the income measure of the BKS study. Gonedes explained that the higher association of the BKS study may have resulted from differences in scaling methods. Since BKS scaled their income measures with market prices, and these prices also appear in the return estimates of the market model, the significant association reported may have been the result of "spurious correlation," a phenomenon that occasionally characterizes results from regression analyses involving ratios.¹⁸

Other Related Studies

Some of the studies in this section are only indirectly related to the study of the relationship of market risk and accounting measures, e.g., the studies are concerned with the association of accounting measures with common stock values. Since market value is directly related to price which appears in the market model of equation (7), accounting measures that are associated with common stock

¹⁷In the Gonedes study, $\hat{\delta}_{4i}$ and $\hat{\omega}_{4i}$ are multiple regression coefficient estimates associated with economy wide and industry wide income numbers respectively.

¹⁸See, e.g., Mandasky [43], Kuh and Meyer [35], and Pearson [54].

TABLE 5

CORRELATION COEFFICIENTS, $\bar{R}$, BETWEEN ESTIMATES FROM MARKET
MODEL (M) AND TWO ACCOUNTING NUMBER MODELS (A)^a

	Models Compared				
	$M_2 - A_1$	$M_3 - A_1$	$M_4 - A_1$	$M_2 - A_2$	$M_3 - A_3$ $M_4 - A_4$
First Differences in Income Numbers	.28 ^c	.34 ^c	.13	.17	.28 ^c
$\bar{R}_2$ from A versus $\bar{R}$ from M	(.29) ^e	(.38) ^e	(.18)	(.15)	(.32) ^e
Scaled First Differences	.32 ^c	.42 ^c	.22 ^b	.18	.27 ^c
$\bar{R}_2$ from A versus $\bar{R}_2$ from M	(.29) ^e	(.42) ^e	(.24) ^d	(.16)	(.30) ^e
ω_{4i} versus b_i	.0	.0	.0	.0	.0
$\hat{\delta}_{4i}$ versus b_i	(.03)	(-.07)	(.0)	(.0)	(.21) ^d
	.22 ^b	.34 ^c	.0	.05	.04
	(.33) ^e	(.41) ^e	(.08)	(.29) ^c	(.0)
					(.07)

^aNinety-nine cross-sectional observations

^bSignificant at $\alpha = .05$ ($|\bar{R}| \geq .20$ with $p = .05$)

^cSignificant at $\alpha = .01$ ($|\bar{R}| \geq .25$ with $p = .01$)

^dSignificant at $\alpha = .05$ ($|r| \geq .20$ with $p = .05$)

^eSignificant at $\alpha = .01$ ($|r| \geq .25$ with $p = .01$)

values could be expected to exhibit some relationship with market risk.

One of the early studies of valuation models for the banking industry was by Durand [17]. Durand regressed year-end bank stock prices per share on operating earnings, dividends, and book value per share between 1946 and 1953. Despite extensive testing, he was unable to find variables other than those above which appeared to be significantly related to stock prices. Drzycimski [15] repeated Durand's equations for 1960 to 1964 and concluded that the influence of book value and dividends had declined and that the influence of operating earnings had increased.

Philips and Mayne [55] using a specification of value similar to Staubus [64] investigated the relationship of income measures and bank stock values. The study found a strong association between discounted bank stock values and operating earnings per share. Evidence relating stock values to nonoperating earnings components was relatively weak.

In a recent paper, Schick and Verbrugge [58] examined the price-earnings (P/E) ratios of large commercial banks and isolated a number of characteristics capable of correctly classifying approximately 68 per cent of a holdout sample of banks over a six year sample period. These characteristics were State income growth, relative size, loan to deposit ratio, and return on securities.

Finally, Fredman and Wert [25] in an examination of the effect of dividends, earnings, and book value on bank stock prices concluded that old methods of evaluating bank stock may need to be altered to include growth potential since growth potential now appears to be of increasing importance.

An Appraisal Of Market Risk Versus Accounting Measures

Considering the weak correlation found in the Breen and Lerner and Gonedes studies above and the hypothesized "spurious correlation" of the BKS study, this section attempts to appraise the potential for finding a strong relationship between bank holding company accounting measures and market risk estimates since it was expected that a strong relationship would be necessary for adequate prediction purposes.

Breen and Lerner [10] and others [29] have shown that estimates of beta depend on (1) the index used to compute market return; (2) the estimation period; (3) the type of observation, i.e., weekly, monthly, etc.; (4) the type of estimating equation; and (5) the number of observations. The process of determining the relationship between beta and accounting measures can be thought of as a two-stage procedure. The first step of the procedure is to find best estimates of β_i for the period under study. Since the true β_i is not observable, these best estimates have usually

been associated with the regression coefficients of Ordinary Least Squares (OLS) specifications similar to those found in equation (7) or equation (8). These estimates are subject to the sampling error arising from improper specification of any one of the estimating characteristics above.

The second stage of the procedure is that of identifying the proper accounting measures that are associated with the estimated beta coefficients. Finding these measures may depend on the (1) relative homogeneity of the sample, i.e., the variance of the accounting measures within the sample; (2) the proper specification of alternative accounting measures, i.e., net income, operating income, earnings available to common, etc.; and (3) current theoretical constructs concerning the hypothesized behavior of accounting measures relative to market risk on which to base the search, e.g., the business risk of a firm is hypothesized to be related to the variability of operating earnings.

Certainly the above studies have not exhausted all possible specifications and/or alternatives that could lead to the identification of a strong relationship between market risk and accounting measures. This possibility was recognized by Breen and Lerner [10] who called for additional study with the inclusion of alternate accounting measure specifications.

Evidence to be presented in Chapter V indicated that

when beta coefficients were estimated from weekly holding period returns, the annual accounting measures were regressed against these beta coefficient estimates for the five annual subperiods 1969-1973, the resulting annual estimating equations explained as much as 80 per cent of the variance of the bank holding company beta coefficients in some subperiods. These $\bar{R}^2$ or adjusted coefficients of determination (adjusted for degrees of freedom) were considerably higher than those found in [5], [10], and [27] above. This evidence furnished the necessary impetus for continuing the study. Chapter III which follows explores in depth the considerations involved in choosing a market index for computing bank holding company beta coefficients.

CHAPTER III

MARKET INDEXES

The problems associated with choosing an index of the type that would represent the appropriate market for this study deserves special consideration. The more common indexes used in empirical research include Standard and Poor's, Dow-Jones, New York Stock Exchange, and Fisher's Link Relative Indexes. The question arises as to whether the broad-based indexes above should be used for the determination of market-based estimates of risk for bank holding companies.

The answer to the question of the appropriate market is not clearly indicated in the finance literature probably because most empirical studies utilizing a single index model have dealt almost exclusively with industrial equity securities. Market risk has become somewhat synonymous with the regression coefficient b_i of equation (7) where the market return is the return of one of the indexes above.

The proper index depends somewhat on the subsequent use of the beta coefficients derived from the index. One application for the derived beta coefficients is the concurrent prediction of expected security returns. Consider

again the linear regression model of equation (1) as presented in Chapter II.¹⁹

$$R_i = a_i + b_i R_M + e_i \quad (1)$$

where

R_i = return of security i ,

R_M = return of the market,

e_i = error term for security i ,

a_i = intercept of the regression,

b_i = slope of the linear relationship.

The regression model of equation (1) can be used to estimate the return of security i (R_i) given estimates of a_i , b_i , R_M , and e_i . Assuming that the expected value of e_i is zero, and abstracting from the problem of estimating a_i , predictions of the return of security i are dependent on the closeness of ex ante estimates of beta and market return with ex post realized values. If all market indexes, thus market return, could be forecast with the same degree of accuracy, then beta coefficients could conceivably be calculated from a wide range of indexes for this type of application.

A second application for beta coefficients calculated from a market model has been its subsequent use as a proxy for market risk. Based on numerous empirical studies, this application appeared to require that a broad-based market

¹⁹The model is reproduced below for the reader as a reference to the discussion.

index be used in the determination of the beta coefficient, although not explicitly stated in any study. The market risk measure calculated from a broad-based market index can thus be conceived of as a broad or universal measure of market risk.

In Chapter II it was noted that an additional decision criteria for evaluating asset acquisitions by bank holding companies involved the perceived impact on market risk due to changes in structure attributed to a merger. Forecasts of market risk appeared to be the vehicle through which such a decision criteria could be implemented. Since forecasting market risk was a primary objective, the type of index chosen was a broad-based market index. Such an index allowed for the comparison of bank holding company market risk with market risk estimates of other industry classifications. This appeared to be a very important consideration since bank holding company acquisitions included investments in other industries outside the area of banking.

In the remainder of this chapter, the different types of broad-based indexes are discussed and the alternative sampling, weighting, and averaging schemes of each type are examined.

Considerations In Constructing An Index

Lorie and Hamilton discussed three important issues which arise in constructing market indexes [42]. These

issues are the following: (1) selecting stocks for inclusion; (2) determining the relative importance or weight of each stock included; and (3) combining or averaging included stocks. In briefer terms, these are the considerations of sampling, weighting, and averaging.

An index can be based on a sample of stocks or on all of them. For example, movements in the New York Stock Exchange could be represented by the relatively few stocks contained in the Dow-Jones Averages or by the New York Stock Exchange Composite Index which contains all listed stocks on the exchange. The usefulness of indexes based on samples depends on the extent to which one can infer movements in stocks which are not included on the basis of the movements in stocks included in the index. The extent to which small samples adequately represent movements in the general market for equity securities is indicated by a recent study of the variability in prices of stocks listed on the New York Stock Exchange [23]. Fisher and Lorie noted that for forty individual years ending in 1965, the frequency distributions of wealth ratios of all stocks in each year and the frequency distributions of wealth ratios for portfolios of eight stocks selected at random were virtually identical except for the extreme tails. Certainly, if one chooses stocks which are not representative, such a degree of conformity would not be expected. As a general rule, however, small samples can be used to represent movements in the value of the desired

market with a high degree of confidence.

Each time an index is computed it is necessary to determine the relative importance of each stock included. Prices form the basis for value in the general price index. The most common ways of weighting prices are in accordance with market value or by assuming that equal dollar amounts are invested in each stock. Which method is used depends on the purpose of the index. The former method is commonly used for indicating changes in the aggregate market value of stocks represented by the index while the latter is utilized to indicate movements in the prices of typical or average stocks [42]. Since the thrust of this research is concerned with the relationships between stock prices and accounting measures, the market value weighting scheme seems most appropriate. The unanswered question of weighted versus unweighted indexes will be deferred for the moment.

Given a group of prices of common stocks and the relative weighting scheme to be employed, the final consideration is the type of average to employ to combine them into a single descriptive number. The two averages that have been used in constructing major market indexes are the arithmetic mean and the geometric mean. Most widely used indexes employ the arithmetic mean. The only index in popular vogue based on a geometric mean is the Value Line Index.

If there is any variation through time in the prices making up an index, there will be a difference between the

value of an arithmetic and geometric mean of prices, the degree of divergence dependent on the degree of variability in prices. Some people claim an upward bias for the arithmetic mean and a downward bias for the geometric mean. Since the purpose of an index is to adequately represent the performance of an average stock over time, it would appear that both methods introduce some departure from this average performance. One solution to the problem is that used by Fisher [22]. For the period 1926 to 1960 he computed both an arithmetic and geometric index of equally weighted relative price changes. When compared with the Fisher-Lorie rates of return in a previous study, the hypothesized biases were found to exist [24]. Fisher therefore computed a combined index with weights of 0.56 and 0.44 for the arithmetic and geometric indexes respectively, to adjust the index to reflect the performance of an average stock in the study period. Although this type of "Investment Performance Index" is intuitively appealing, it is rejected for this dissertation for three reasons. First, it is based on an unorthodox equally weighted relative price change scheme rather than market value weights. Also, the weights applied to the component indexes depend on a major study of the rates of return of the stocks under consideration. Finally, numerous studies indicate a high degree of correlation among all of the most common indexes including those of Fisher.

Cootner presents arguments which support the super-

iority of the weighted arithmetic index as a representation of stock market performance [14]. A paraphrase of his argument for the arithmetic index follows. To a close approximation, stocks are equally likely to rise to N times their initial value as they are to fall to $1/N$ of that initial value. This property results in an asymmetrical distribution of price changes over some observed period. There will be a scattering of stocks with large declines, but at the same time, there will be many increases relatively larger than these declines. There will be roughly the same number of price changes below the most frequent outcome as above that outcome, but the larger increases will be more important in making up the average because they are not limited to 100 per cent. Proponents of the geometric index point out that it tends to measure median performance, i.e., an index in which only half the components do worse than average. Cootner illustrates that portfolios of stocks tend to behave more like the average of all stocks than their median. As the number of stocks in a portfolio increases, the range of likely outcomes approaches the arithmetic average of all stocks, not the median, so that substantially more than half of all random portfolios will out-perform a geometric index. Thus, when discussing portfolio performance, Cootner argues that the geometric index appears to lose all of its rationale.

A second argument for weighted versus unweighted

indexes is in support of the weighted index. Assume that all portfolios hold either equal dollar amounts or equal shares of every stock in the portfolio. All outstanding shares must be held by someone, so if each portfolio contains only 100 shares of American Telephone and Telegraph (AT&T), there must be more portfolios with AT&T than say Lukens Steel.²⁰ In evaluating a random portfolio, we would want to know how 100 shares of every stock performed, and also the likelihood that the portfolio contains the specific stock in question. That probability, under Cootner's assumptions, is measured by the number of outstanding shares, i.e., even though each portfolio holds an equal number of shares of each component company, the number of portfolios holding stock of any company must be proportional to the number of shares of that company outstanding.

Drawing on the previous discussion, a case was made for the use of a broad-based market index that used (1) an arithmetic averaging scheme and (2) a market value weighting scheme. Two indexes were available which met these criteria, the Standard and Poor's Composite Index and the New York Stock Exchange Composite Index. In the subsequent chapters, both indexes were used for deriving estimates of the beta coefficients used as proxies for market risk.

²⁰Cootner evidently assumes that the reader is aware that there are more shares of AT&T than Lukens Steel.

CHAPTER IV

METHODOLOGY

The purpose of this chapter is to specify both the scope of the dissertation and the methodology utilized. It is composed of five distinct topic areas which include: (1) selection of sample bank holding companies and the time period for study; (2) investigation of possible representative accounting measures; (3) accounting measure definitions; (4) model building; and (5) market risk forecasting and validation.

Sample Bank Holding Companies

Forty-three bank holding companies were chosen for study and are presented in Appendix B. These bank holding companies were chosen according to the following criteria: (1) weekly price data were available for both listed [4] and unlisted [67] bank holding companies; (2) ex-dividend dates were available [50][63]; (3) complete accounting data were available on both the Quarterly and Annual Compustat Tapes for determination of representative accounting measures;^{21,22}

²¹Compustat tapes were leased by the College of Business Administration, Texas Tech University, from Investors Management Sciences, Inc., Denver, Colorado.

²²Sample companies chosen by this criteria were

and (4) the sample bank holding companies chosen had formally commenced operations prior to December, 1969.²³

The time period chosen for study covered the period from January, 1969 through December, 1973. Weekly prices and dividends were used to compute weekly holding period returns for each of the forty-three bank holding companies in the sample from a natural logarithm form of the market model similar to equation (8). These holding period returns, together with the market holding period returns computed from both the Standard and Poor's Composite and New York Stock Exchange Composite Indexes, were used to compute estimates of market risk (beta coefficients) for five annual subperiods 1969-1973.²⁴ These market risk estimates are presented for both indexes in Appendixes D and E.

Selection Of Accounting Measures

Many of the twenty-four accounting measures chosen

generally of an older and larger type. Since these companies were in operation prior to the passage of the 1970 Amendment to the Bank Holding Company Act of 1956, they represent a relatively stable group that had made the decision to operate as a bank holding company prior to the aforementioned legislation. Further, these companies did not constitute a random sample, thus no statistical inferences from his sample to all bank holding companies could be drawn. However, logical inferences based on the results would be available.

²³The beginning data for operation of the holding company form was taken as the date the bank holding company stock was exchanged for the outstanding bank stock.

²⁴For some bank holding companies that became operational in 1969, less than fifty-two holding period returns were used to compute estimates of the beta coefficients for that period.

for this dissertation were included primarily on the basis of the empirical results of [5], [10], and [27] as presented in Chapter II, although some additional measures were identified and included (see Appendix F for a complete list). Brief comments on these additional accounting measures appear below.

The first additional measure considered was the standard deviation of weekly price returns. In an empirical study by Martin and Brewer [47], it was demonstrated that the beta coefficient exhibited strong correlation with the standard deviation of holding period returns calculated for the same period even for a two-security portfolio.²⁵ As the portfolio size increased, the correlations of market risk as measured by the beta coefficient and total risk as measured by the standard deviation of holding period returns increased to a maximum of .94 for random portfolios containing forty-five securities. Thus with the standard deviation of bank holding company holding period returns theoretically capturing the total riskiness of bank holding company securities, and the apparent correlation between market risk and total risk, the standard deviation of bank holding company period returns appeared to be a likely candidate for capturing part

²⁵For a random selection of 100 portfolios in two different time periods the correlations were .79 and .80 respectively.

of the relationship between market risk and accounting measures.²⁶

Several other accounting measures were included because of their uniqueness to the bank holding company industry. The ratio of capital to risk assets was included as a proxy for capital adequacy. The rate of return earned on the bank holding company security portfolio provided a proxy measure of the return on investment of securities. The loan to deposit ratio provided a proxy measure for the relative risk composition of the total investment portfolio, high ratios indicating a willingness to invest a high proportion of assets in loans vis-a-vis less risky government securities. Finally, the number of banks in the holding company, the number of other subsidiaries controlled by the holding company, and the total number of banks and subsidiaries were included as proxies for relative diversification.

Mean values for each of the twenty-four accounting measures in the five annual subperiods 1969-1973 are presented in Appendix F. These accounting measures have been grouped according to their common factors or characteristics.

²⁶Beaver, Kettler, and Scholes [5] recognized that accounting measures could be associated with both systematic and unsystematic components of risk. Since the systematic and unsystematic risk components have been shown to be associated, this association would make it possible for accounting measures to be highly associated with market risk. This association might exist even though it could not be shown that accounting measures could be dichotomized into those specifically associated with systematic risk and those specifically associated with unsystematic risk.

The simple subperiod correlations between each accounting measure and the market risk of the same subperiod appear in Appendix G.

Accounting Measure Definitions

Thirteen of the accounting measures could easily be defined from appropriate combinations of data items found on the Annual and Quarterly Compustat Tapes. Appendix H presents an all-inclusive list of data items found on the Annual and Quarterly Compustat Tapes that were used in calculating these measures. Appendix I defines each of the thirteen accounting measures in terms of their data definitions found in Appendix H.

Data for eleven of the accounting measures was either not available on the Annual and/or Quarterly Compustat Tapes or the measures could not easily be defined symbolically as those of Appendix I. Data gathered from other sources included information on (1) the number of owners; (2) the number of banks; (3) the number of subsidiaries at year end; (4) the total number of banks and subsidiaries; and (5) the variability of weekly returns. The year end data were collected from annual editions of Moody's Bank and Finance Manual [49], and the variability of weekly returns was computed from the same regression analysis that calculated the respective market risk for the five annual subperiods. For ease of understanding, a descriptive rather than symbolic

definition is presented below for the remaining six accounting measures.

The first of these measures was the accounting measure associated with listing or non-listing on the New York Stock Exchange. This measure was defined in terms of a 0-1 variable such that the measure took on a value of one in every subperiod that the bank holding company stock was listed on the New York Stock Exchange and zero otherwise.

The remaining five measures were computed from a two year moving period of quarterly observations and include three quarterly measures of earnings variability and the quarterly growth of earnings and assets.²⁷ The growth rate for both earnings and assets was calculated as the slope coefficient of the log-linear regression of earnings or assets versus time. This specification produced a proxy for the respective annual growth rates with assets and earnings transformed to $\log_{10}$ forms and time defined in years and quarters thereof. The earnings variability measures included were calculated from quarterly earnings measures scaled by their market value at the end of the time period $t-1$, book value at the end of time period t , or total assets at the end of

²⁷For some of the bank holding companies not in operation in 1968, only four quarterly observations were available to compute the accounting measures for 1969. For most of the bank holding companies, the accounting measures were computed from eight quarterly observations of the previous two year period. For example, in 1969 the measures were computed from both 1968 and 1969 observations; in 1970 the measures were computed from 1969 and 1970 observations, etc., hence a two year moving period.

time period t . The market value scaling with a one period lag was included because of the high degree of association with market risk reported by the Beaver, Kettler, and Scholes study [5]. Each of the three earnings variability measures was calculated as the standard deviation of the scaled quarterly earnings over the two year moving period.

Model Building

The models developed and tested in this dissertation were of multiple regression form. The first of these models used annual cross-sectional data for each of the five sub-periods 1969-1973:²⁸

$$Y_i = \alpha_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_n X_{ni} + e_i \quad (14)$$

where:

- Y_i = the estimate of the beta coefficient from the market model for bank holding company i ,
- α_0 = the intercept term,
- β_n = multiple regression coefficient for the accounting measure n ,
- X_{ni} = the accounting measure n for holding company i ,
- e_i = error term associated with bank holding company i .

²⁸The regression coefficients of the multiple regression models are also commonly referred to as beta coefficients. In the remainder of the dissertation, the beta coefficients computed from the market model of equation (7) will be referred to as market risk where any confusion might arise.

The second regression model tested combined both time series and cross-sectional data. The estimates of the market beta coefficients together with accounting measures for the entire 1969-1973 period were combined (pooled) to construct a model of the following form:

$$Y_{it} = \alpha_{0t} + \beta_{1t}X_{1it} + \beta_{2t}X_{2it} + \dots + \beta_{nt}X_{nit} + e_{it} \quad (15)$$

where:

Y_{it} = the estimate of the beta coefficient from the market model for holding company i and time period t ,

α_{0t} = the intercept term for time period t ,

β_{nt} = multiple regression coefficient for the accounting measure n and time period t ,

X_{nit} = the accounting measure n for holding company i and time period t ,

e_{it} = error term associated with banking holding company i and time period t .

The pooled regression model of equation (15) had 215 total observations (five periods times forty-three bank holding companies) in contrast with the model of equation (14) which had only forty-three observations for each of five annual subperiods. The regression coefficients of equation (14) thus provided estimates of the accounting measure coefficients for each of the annual subperiods 1969-1973, while those of equation (15) provided estimates of the same coefficients for the overall study period.

The technique used to identify the accounting measures that were associated with market risk for each of the five annual subperiods and the total five year period was stepwise multiple regression.²⁹ The final estimating equations that resulted from these multiple regression models for the respective time periods were based primarily on the consideration of the change in $\bar{R}^2$ as additional variables were included.³⁰ Additional accounting measures were added until the improvement of the $\bar{R}^2$ was adjudged to be minimal or non-significant. The number of accounting measures included in the final estimating equation was controlled in STEP SUPRA through consideration of the F-values of those accounting measures not in the estimating equation. By increasing (lowering) the STEP SUPRA control F-value for inclusion, less (more) accounting measures were necessarily included in the estimating equation.

The use of a multiple regression model with pooled data for prediction purposes presupposes that the regression

²⁹The author is indebted to the Bureau of Labor Statistics for furnishing computer source decks and listings of STEP SUPRA, a stepwise multiple regression program, and SUPRB, a general multiple regression program.

³⁰The adjusted coefficient of determination is computed as: $\bar{R}^2 = 1 - [((1 - R^2)(T - 1))/(T - K)]$ where T = total number of observations; K = total number of parameters, including the constant term. The R^2 will necessarily increase as additional variables are added, while $\bar{R}^2$ may not. When comparing estimating equations with different numbers of independent variables, $\bar{R}^2$ is preferred. When predicting values of a specific variable, maximizing $\bar{R}^2$ will lead to the regression equation with the least residual variance [57, p. 21].

coefficients of the independent variables (accounting measures in this case) are relatively stable over time and with a larger number of observations the model should provide better estimates of the true values of the coefficients. Tests of these stability assumptions for the subperiod coefficients were made through the use of dummy variables.³¹ A description of the dummy variable technique is presented below for the simple case of one independent variable. The technique was extended to include testing of n independent variables.

Assume that the relationship of the accounting measure X to the market risk measure Y is postulated to be of the following form:³²

$$Y = \gamma_1 + \beta X + e \quad \text{for time period one,} \quad (16)$$

and

$$Y = \gamma_2 + \beta X + e \quad \text{for time period two,} \quad (17)$$

with $\gamma_1 \neq \gamma_2$ but β common to both periods.

With the β coefficient postulated to be the same in both periods, then all the data can be combined to obtain as efficient an estimate as possible. Using dummy variables, the relationship can be written as:

³¹See Johnston [32] and Rao and Miller [57] for a detailed discussion of the dummy variable technique.

³² γ , β , and e are used to represent one by k column vectors of the dependent variable, independent variables, and error terms respectively. X represents a k by n data matrix with the insertion of a column of units for the intercept term γ .

$$Y = \alpha_1 + \alpha_2 D_2 + \beta X + e \quad (18)$$

where

D_2 = a dummy variable that takes on the value of zero in period one and one in period two.

Taking the conditional expectations of equation (18):

$$E(Y/D_2 = 0) = \alpha_1 + \beta X \quad (19)$$

and

$$E(Y/D_2 = 1) = \alpha_1 + \alpha_2 + \beta X \quad (20)$$

where by comparison with equation (16) and equation (17)

$\alpha_1 = \gamma_1$ = intercept in period one,

$\alpha_1 + \alpha_2 = \gamma_2$ = intercept in period two,

$\alpha_2 = \gamma_2 - \gamma_1$ = difference between the two intercepts of period one and two.

A significance test on the dummy variables coefficient α_2 indicates whether there is any significant differences between the intercepts of period one and period two. If the t-value of the dummy variable coefficient is greater than the critical t-value, the hypothesis of a common intercept term is rejected.

The dummy variable technique can be extended to include simultaneous testing of n intercepts and n slope coefficients. With four time periods and one accounting measure, differences among the four intercepts and four slope

coefficients can be tested with the following equation:³³

$$Y = \alpha_1 + \alpha_2 D_2 + \alpha_3 D_3 + \alpha_4 D_4 + \beta_1 X + \beta_2 (D_2 X) + \beta_3 (D_3 X) + \beta_4 (D_4 X) + e \quad (21)$$

where

$$D_t = \begin{cases} \text{one for an observation in period } t, \\ t=2,3,4, \text{ and zero otherwise.} \end{cases}$$

Tests of significance of differences between intercepts and/or slope coefficients for time periods two through four versus the base time period one can be made through significance tests of the dummy α and β coefficients.

The dummy variable technique described above was used to determine the stability of the intercepts and accounting measure regression coefficients as identified by the pooled regression model of equation (15) for the pooled data observations (all periods considered as one). An apparent lack of stability of the coefficients of these accounting measures from subperiod to subperiod would suggest that accounting measure regression coefficients from the pooled regression should not be used for subperiod (yearly) forecasting. Stability of the coefficients would suggest the opposite, since more observations should provide better estimates of the accounting measure regression coefficients.

³³Note that equation (18) and equation (21) have one less dummy variable than the number of time periods for when all dummy variables are zero then equation (21) for example estimates: $Y = \alpha_1 + \beta_1 X + e$.

The results to be presented in Chapter V indicated that the latter was the case.³⁴

Market Risk Forecasting and Validation

One criteria that has been used extensively to judge the performance of econometric models is their predictive ability. Two common measurements that have been frequently used in empirical research to appraise the prediction error inherent in an econometric model are Mean Square Error (MSE) and Mean Absolute Error (MAE). MSE is a second moment of forecasting error expressed mathematically below as:

$$\text{MSE} = (1/n) \sum (A_i - P_i)^2 \quad (22)$$

where

n = number of predictions in the forecast,

A_i = actual or realized values $A_1, A_2, \dots, A_n$,

P_i = predictions $P_1, P_2, \dots, P_n$ of the model being tested.

The MAE is found by summing the errors in all of the forecast predictions, ignoring the sign of the errors, and dividing by the number of predictions:

$$\text{MAE} = (1/n) \sum |A_i - P_i| \quad (23)$$

where n , A_i , and P_i are defined as in equation (22) above and $|A_i - P_i|$ represents the absolute value of the difference

³⁴Evidence of a change in the simple subperiod correlation between individual accounting measures and market risk from subperiod to subperiod can be found by examining the correlation coefficients of Appendix G.

between the actual and predicted values.

The criteria on which the multiple regression model of equation (16) and the instrumental variables model of equation (10) were judged included both measurements of prediction error as defined above. The standard for comparison of prediction error was the error of a naive forecasting model that assumed no change in the market risk as computed by the market model from one subperiod to the next (see the Beaver, Kettler, and Scholes study [5] in Chapter II for justification).

For each annual subperiod 1970, 1971, 1972, and 1973, forecasts were made using three models: (1) the naive model; (2) the instrumental variables model (IV Model); and (3) the multiple regression model (MR Model). Each model used necessary information generated from the previous 1969, 1970, 1971, and 1972 subperiods. These forecast models were thus of the extrapolative type, i.e., they attempted to forecast market risk in the next annual subperiod from the model specifications of the previous subperiod.

The first model was the naive forecasting model described above. Forecasts of future subperiod market risk (beta coefficients) assumed that the market risk as measured by the market model would not change in the subsequent annual subperiod.

The second model was of the instrumental variables type discussed in Chapter II. The instrumental variables

model utilized accounting measures in each of the 1969 through 1972 subperiods to remove the inherent measurement error of the market risk of the same years as calculated by the market model.³⁵ Estimates of the market risk, $(\hat{b}_i)$, often referred to as beta hat, from the instrumental variables equation were used to forecast market risk in the 1970 through 1973 subperiods by assuming no change in the market risk from its present beta hat estimate, $(\hat{b}_i)$.

The final model, the multiple regression model of equation (14), was used to forecast subperiod market risk using the following procedure. The accounting measures in the subperiods 1969 through 1972, together with estimates of the market risk for the same subperiod, were used to build a multiple regression model for each subperiod. The actual or realized values of the accounting measures in the subsequent subperiods were then substituted into each of the subperiod models to forecast market risk for the subsequent subperiods 1970 through 1973.³⁶

³⁵The instrumental variables chosen for each subperiod were the same variables used in the multiple regression models of equation (14) and equation (15). Choosing the instrumental variables in this way allowed for direct comparison of the forecasting error between the models.

³⁶The reader should not be confused by the fact that the IV Model is also a type of multiple regression model. Whereas the MR Model used the subsequent realized values of the accounting measures as forecast inputs, the IV model used only their current values. For example, the MR Model used 1969 values of accounting measures to first establish the relationship between market risk and accounting measures

The reliability of the forecasts from the multiple regression model thus depended on (1) a strong relationship between accounting measures and market risk, (2) reasonable stability of the subperiod regression coefficients over time, and (3) the use of actual or realized values of necessary accounting measures for each subperiod forecast. The use of actual or realized values of the accounting measures as inputs into the subperiod estimating equations were not entirely realistic since forecasts of these measures would also be required. This oversimplification was considered necessary to isolate the prediction error inherent in the multiple regression model as apart from the error attributed to forecasts of accounting measures. In the following chapter, a comparison of the predictive ability of the three models discussed above is presented.

for that year. Forecasts of 1970 values of market risk were then made by substituting 1970 values of the accounting measures into the 1969 estimating equation. Forecasts using the IV Model, however, were made (1) by using the value of the market risk predicted by the 1969 estimating equation ($\hat{b}_i = b_i - e_i$) and (2) by assuming that market risk would not change from its 1969 $\hat{b}_i$ estimate even though the accounting measures might change from their 1969 values.

CHAPTER V

FINDINGS

This chapter presents the findings with respect to the predictive ability of the naive model, the instrumental variables (IV Model), and the multiple regression (MR Model) discussed in Chapter IV. The first section presents the subperiod regression equations and subperiod forecast results based on the use of a different set of accounting measure inputs for each subperiod. It was noted in Chapter IV that multiple regression models using pooled data provided better coefficient estimates (because of the larger number of observations) when the underlying causal relationships from subperiod to subperiod were relatively stable. A pooled data regression model was constructed to determine (1) which accounting measures were most important in explaining market risk over the entire five year study period, and (2) to examine the stability over time of the relationship of these important accounting measures with market risk. Finally, the subperiod forecast results are presented based on the use of a common set of accounting measure inputs (identified by the pooled regression model) for each subperiod regression model.

Subperiod Estimating Equations³⁷

The subperiod estimating equations presented in Table 6 below resulted from allowing each stepwise regression to continue until the $\bar{R}^2$ of the estimating equation did not increase significantly with the inclusion of additional accounting measures.

The estimating equations are presented in tabular rather than equation form. The MR Model written in equation form for 1969 would be (see Table 6 with accompanying footnotes):

$$Y = -2.29 + .174X_2 + .044X_3 + 1.53X_4 + .038X_5 + 94.8X_6 + e \quad \bar{R}^2 = .597 \quad (24)$$

For the entire five year study period 1969-1973, sixteen of the twenty-four accounting measures entered one or more of the annual subperiod estimating equations. Summary statistics for each subperiod regression are presented in Appendixes J-1 through J-5.³⁸

Presented below in Table 7 are the summary measures of forecast error based on a forecasting strategy that used 1969 through 1972 estimating equations (based on different

³⁷The results presented in this chapter were based on the use of market risk estimates as computed from the Standard and Poor's Composite Index. The results based on market risk estimates as computed from the New York Stock Exchange Index were essentially the same except the $\bar{R}^2$ values of the estimating equations were slightly lower.

³⁸Since the dissertation methodology was concerned only with constructing minimum variance MR Models for purposes of prediction, the verification of all assumptions of the MR Models were not considered necessary.

TABLE 6

SUBPERIOD ESTIMATING EQUATIONS^a

Accounting Measures	1969	1970	1971	1972	1973
Constant	α_0	-2.98 ^b (-4.66)	-1.26 ^b (-2.73)	-.748 (-1.733)	-.079 (-0.71)
Variability of Weekly Returns	x_1	20.4 ^b (5.99)	15.6 ^b (2.88)	11.7 (1.50)	16.9 ^b (6.38)
Log _e Total Assets	x_2	.174 ^b (3.89)	.190 ^b (2.94)	-.072 (1.51)	x
Income Differences to Assets	x_3	94.8 (1.69)	91.0 ^b (3.07)	253.2 ^b (2.10)	-105.4 ^b (-2.75)
Dividend Payout	x_4	1.53 ^b (2.68)	.737 (1.97)	x	x
Debt to Equity	x_5	.038 ^b (2.40)	.037 ^b (3.26)	x	x
Number of Sub-sidiaries	x_6	.044 ^b (2.50)	-.017 ^b (2.34)	x	x
Quarterly Earnings to Market Value	x_7	x	x	61.2 (2.33) ^b	x
Owners per Million Shares	x_8	x	x	x	.000010 (-1.82)
Quarterly Earnings to Total Assets	x_9	x	x	x	-428.6 ^b (-2.95)

TABLE 6. --Continued

Accounting Measures	1969	1970	1971	1972	1973
Market Value	X ₁₀	x	x	x	.00010 ^b (3.96)
Annual Earnings Growth	X ₁₁	x	x	-4.21 ^b (-2.83)	x
Annual Asset Growth	X ₁₂	x	x	-4.49 ^b (-2.46)	.568 (1.68)
Book Value	X ₁₃	x	.00035 (-1.98)	x	x
Capital to Risk Assets	X ₁₄	x	8.95	x	x
Listed on New York Stock Exchange	X ₁₅	x	- .219 ^b (-2.95)	x	x
Loans to Deposits	X ₁₆	x	x	.135 ^b (2.10)	.088 ^b (2.04)
$\bar{R}^2$		.597	.812	.284	.494 .807

^a Coefficients given first; t-values in parenthesis.^b Significant at .05 level.^c Variable did not enter stepwise regression in the respective subperiod.

TABLE 7
FORECAST ERROR OF SUBPERIOD MODELS USING
DIFFERENT ACCOUNTING MEASURES

Forecast Period	Model	MSE	MAE	% Times Superior To Naive Model	% Times Superior To IV Model	% Times Superior To MR Model
1970	Naive	.0995	.2376	--	46.51	53.49
	IV Model	.0747	.2190	53.49	--	46.51
	MR Model	.0757	.2198	46.51	53.49	--
1971	Naive	.1304	.2871	--	58.14	32.56
	IV Model	.1230	.2929	41.86	--	37.21
	MR Model	.0726	.2280	67.44	62.79	--
1972	Naive	.1728	.3558	--	32.56	37.21
	IV Model	.1420	.3210	67.44	--	51.16
	MR Model	.1571	.3173	62.79	48.84	--
1973	Naive	.2310	.3802	--	53.49	51.16
	IV Model	.1930	.3637	46.51	--	46.51
	MR Model	.2102	.3858	48.84	53.49	--

accounting measures) to forecast market risk for subperiods 1970 through 1973. The summary measures include the MSE, MAE, and the percentage of times each model gave a superior forecast in relation to the other two models. This additional measure was calculated as the number of times each model gave superior forecasts of market risk (closer to the actual value) in relation to the other two models divided by the number of forecasts (forty-three per subperiod). It would be possible for a model to have a higher percentage of predictions nearer the actual values but still have a higher MAE and/or MSE if some of the predictions were extremely bad. Forecast values of market risk of the naive, the IV Model,

and the MR Model described above are presented in the Appendixes K-1 through K-4.

The forecast errors of the subperiod models compared favorably with those of the BKS study [5]. The MSE and MAE of the study were .093 and .239 for their naive model and .089 and .230 for their instrumental variables model respectively.³⁹ The MSE of the subperiod models were of the same relative magnitudes as the MSE found by Blume [8] for the four forecast periods beginning July, 1933 and ending June, 1961. Blume's market risk forecast results for the individual security are presented below in Table 8.

TABLE 8

MSE OF NAIVE MARKET RISK FORECASTS
FOR THE INDIVIDUAL SECURITY

Forecast Period	Unadjusted	Adjusted
7/33 - 6/40	.1929	.1808
7/40 - 6/47	.1747	.1261
7/47 - 6/54	.1203	.1087
7/54 - 6/61	.1305	.1013

Summarizing the forecast results as presented in Table 7, there was some evidence to indicate that the forecast error of the IV Model and the MR Model was lower than

³⁹These forecast errors were for the individual security when accounting measures in period one (1947-1956) were used to forecast market risk in period two (1957-1965).

that of a concurrent naive model which assumed no change in market risk from one subperiod to the next. In comparison with forecast error of other studies for different time periods, the magnitude of the forecast error for the IV Model and MR Model was lower in some subperiods and higher in others.

The Pooled Relationship Of Accounting Measures
And Market Risk: 1969 - 1973

Results of the pooled regression model of equation (15) presented in Table 9 below revealed that four accounting measures, (1) variability of weekly returns, (2) $\log_e$ total assets, (3) income differences to assets, and (4) dividend payout, were most important in explaining market risk over the entire study period. The adjusted coefficient of determination ($\bar{R}^2$) for the estimating equation was .439. Additional summary data are presented in Appendix L.

TABLE 9
RESULTS OF THE POOLED REGRESSION

Accounting Measures		Regression Coefficient	Standard Error	T-Statistic
Constant	α_0	-1.383	0.177	-7.801 ^a
Variability of Weekly Returns	x_1	20.465	2.333	8.769 ^a
$\log_e$ Total Assets	x_2	0.104	0.017	6.125 ^a
Income Differences To Assets	x_3	74.541	21.879	3.407 ^a
Dividend Payout	x_4	0.893	0.238	3.743 ^a

^aSignificant at the .05 level.

The stability of the four accounting measures in Table 9 was determined through the use of the dummy variable technique as described in Chapter IV. The dummy variables equation for four accounting measures and five time periods is presented in equation (25) below:

$$\begin{aligned}
 Y = & \alpha_1 + \alpha_2 D_2 + \dots + \alpha_5 D_5 + \beta_1 X_1 + \dots \\
 & \beta_4 X_4 + \beta_5 (D_2 X_1) + \dots + \beta_8 (D_2 X_4) + \\
 & \beta_9 (D_3 X_1) + \dots + \beta_{12} (D_3 X_4) + \beta_{13} (D_4 X_1) \\
 & + \beta_{16} (D_4 X_4) + \beta_{17} (D_5 X_1) + \dots + \\
 & \beta_{20} (D_5 X_4) + e
 \end{aligned} \tag{25}$$

The results of the dummy variables equation are summarized in Table 10. Additional summary data are presented in Appendix M.

Referring to Table 10, an examination of the regression coefficients indicated that the intercept terms in subperiods 1972, 1973, and 1974 were significant. In Chapter IV it was demonstrated that a significance test of these dummy intercepts (slope coefficients) was based on no difference between the intercepts (slope coefficients) of the base period and intercepts (slope coefficients) of the subsequent subperiods. In subperiods 1971, 1972, and 1973, at least one of the slope coefficients was significant, indicating a change in the slope coefficient from the 1969 base subperiod.

Both the intercept term and the slope coefficients

TABLE 10
DUMMY VARIABLES REGRESSION

Dummy Variables	Regression Coefficient	Standard Error	T-Statistic
α_1	-2.433	0.445	-5.464 ^a
$\alpha_2^{D_2}$	0.698	0.564	1.238
$\alpha_3^{D_3}$	2.143	0.584	3.668 ^a
$\alpha_4^{D_4}$	1.425	0.601	2.370 ^a
$\alpha_5^{D_5}$	1.608	0.569	2.824 ^a
$\beta_1^{X_1}$	12.527	5.951	2.122 ^a
$\beta_2^{X_2}$	0.238	0.036	6.523 ^a
$\beta_3^{X_3}$	121.806	48.507	2.460 ^a
$\beta_4^{X_4}$	1.416	0.523	2.706 ^a
$\beta_5 (D_2 X_1)$	9.051	7.605	1.190
$\beta_6 (D_2 X_2)$	-0.091	0.051	-1.784
$\beta_7 (D_2 X_3)$	-29.209	66.502	-0.439
$\beta_8 (D_2 X_4)$	-0.524	0.769	-0.682
$\beta_9 (D_3 X_1)$	1.456	9.443	0.154
$\beta_{10} (D_3 X_2)$	-0.218	0.050	-4.300 ^a
$\beta_{11} (D_3 X_3)$	-96.827	67.459	-1.435
$\beta_{12} (D_3 X_4)$	-0.881	0.798	-1.103
$\beta_{13} (D_4 X_1)$	6.205	8.442	0.735
$\beta_{14} (D_4 X_2)$	-0.158	0.052	-3.032 ^a
$\beta_{15} (D_4 X_3)$	-194.198	91.932	-2.112 ^a
$\beta_{16} (D_4 X_4)$	-1.035	0.753	-1.374
$\beta_{17} (D_5 X_1)$	9.200	7.151	1.286
$\beta_{18} (D_5 X_2)$	-0.125	0.050	-2.500 ^a
$\beta_{19} (D_5 X_3)$	-166.839	83.272	-2.004
$\beta_{20} (D_5 X_4)$	-1.939	0.732	-2.650 ^a

^aSignificant at .05 level.

in subperiod 1970 were non-significant. This suggested that although the relationship between accounting measures and market risk was changing over time, the relationship may not change significantly between annual subperiods. Since the dummy regression indicated instability of intercepts and slope coefficients for time periods greater than one year, the forecasts presented later in this chapter did not use pooled data.

Subperiod Forecasts Using Accounting Measures
Identified By The Pooled Regression Model

The forecast performance presented earlier in this chapter as measured by the magnitude of the MSE and MAE of the MR Model using different accounting measures versus the naive and IV Models was favorable but somewhat inconclusive. Since the accounting measures identified by the pooled regression model were most important in explaining market risk over the entire study period, the forecast strategy of this section was based on subperiod estimating equations that used common accounting measures in each subperiod. This type of forecast strategy assumed that certain fundamental accounting measures were most important in predicting market risk even though other accounting measures also appeared to be important in certain isolated subperiods.

The estimating equations for the forecast periods 1970 through 1973 are presented below in Table 11. Summary statistics for each forecast period are presented in Appendixes N-1 through N-5.

TABLE 11

ESTIMATING EQUATIONS FOR SUBPERIOD MARKET RISK FORECASTS
USING COMMON ACCOUNTING MEASURES^a

Accounting Measures	1969	1970	1971	1972	1973	
Constant	α_0	-2.43 ^b (-4.51)	-1.73 ^b (-6.17)	-0.290 (-0.94)	-1.00 (-1.93)	0.825 ^b (-3.11)
Variability of Weekly Returns	x_1	12.62 (1.75)	21.67 ^b (5.64)	14.08 ^b (2.36)	18.83 ^b (2.44)	21.82 ^b (7.37)
Log _e Total Assets	x_2	0.238 ^b (5.38)	0.146 ^b (4.97)	0.019 (0.675)	0.080 (1.65)	0.112 ^b (4.42)
Income Differences to Assets	x_3	121.8 (2.03) ^b	92.59 ^b (2.57)	24.97 (0.671)	-72.39 (-0.72)	-45.03 (-0.901)
Dividend Payout	x_4	1.41 (2.23) ^b	0.891 (1.95)	0.535 (1.09)	0.351 (0.545)	-0.52 (-1.37)
$\bar{R}^2$		.505	.708	.112	.218	.678

^aCoefficients given first; t-values in parenthesis.

^bSignificant at the .05 level.

An examination of the regression coefficients of the accounting measures in Table 11 confirmed the instability indicated by the dummy variables equation in that the coefficients of income differences to assets and dividend payout appeared to change dramatically from 1969 to 1973. Although the coefficients of the accounting measures appeared to change over time, the relationships from subperiod to subperiod were apparently stable enough to produce the superior forecast results presented in Table 12. Forecast values of the naive, the IV Model, and the MR Model for the common accounting measures identified by the pooled regression are presented in Appendixes 0-1 through 0-4.

TABLE 12
FORECAST ERROR OF SUBPERIOD MODELS USING
COMMON ACCOUNTING MEASURES

Forecast Period	Model	MSE	MAE	% Times Superior To Naive Model	% Times Superior To IV Model	% Times Superior To MR Model
1970	Naive	.0995	.2376	--	48.84	39.53
	IV Model	.0598	.2066	51.16	--	53.49
	MR Model	.0423	.1744	60.47	46.51	--
1971	Naive	.1304	.2871	--	60.47	34.88
	IV Model	.1175	.2869	39.53	--	34.88
	MR Model	.0601	.2103	65.12	65.12	--
1972	Naive	.1728	.3558	--	32.56	41.86
	IV Model	.1301	.3083	67.44	--	51.16
	MR Model	.1306	.3026	58.14	48.86	--
1973	Naive	.2310	.3802	--	41.86	25.58
	IV Model	.1813	.3454	58.14	--	23.26
	MR Model	.0715	.2124	74.42	76.74	--

The extremely low forecast error for the subperiod regression models when variability of weekly returns, $\log_e$ of total assets, income differences to assets, and dividend payout were used to forecast market risk provided overwhelming evidence to support the use of extrapolative regression models. The magnitudes of MSE and MAE of the subperiod regression models were significantly lower than the forecast errors of the Beaver, Kettler, and Scholes study [5] and the Blume study [8] discussed earlier in this chapter. The MSE of the subperiod regression models was on average less than 50 per cent of the MSE of the naive model. The MR Model significantly outperformed the IV Model in three of the four subperiods examined; and in the 1972 forecast period, the forecast results were essentially the same for both models.

Chapter VI, which follows, summarizes the empirical results presented in this chapter, presents some tentative conclusions concerning the use of extrapolative multiple regression models for market risk forecasts, and offers suggestions for further areas of research.

CHAPTER VI

SUMMARY AND CONCLUSIONS

In Chapter I it was noted that bank holding companies now face an ever expanding set of investment opportunities. The passage of the 1970 Amendment to the Bank Holding Company Act of 1956 cleared the way for bank holding companies to begin operations in an approved group of bank related activities through acquisition of companies engaged in these activities or through formation of new subsidiaries.

The individual investor constantly faces a myriad of investment opportunities. Since the pioneering work of Markowitz [45], a body of theory has been developed to assist the risk averse investor in the selection of a portfolio of risky securities from the many alternatives available. This body of theory is commonly referred to as portfolio theory. The cornerstone of portfolio theory is the Expected Return-Variance of Return Rule (E-V Rule). The rule suggests that an investor should make portfolio decisions based on considerations of both risk and expected return. An efficient set of portfolios can be generated by the E-V Rule when portfolios are chosen such that for a

given E , V would be minimized or for some V , E would be maximized. The investor must then choose from among this efficient portfolio set based on his expected return-variance of return (risk-return) tradeoff preferences.

Alternative measures of risk have been developed as proxies for the variance of security returns, the most common of these measures being the beta coefficient as computed from a single index model similar to that of equation (7). The single index model allows for the separation of the variability of a security's return into both systematic and unsystematic components (see Chapter II for a detailed discussion). Empirical evidence indicates that the unsystematic portion of a portfolio's variability of return can be effectively reduced by including large numbers of securities in the portfolio (diversification). The systematic component of the variability of return, which reflects the variability inherent to the comovement of a portfolio's return with the return of a market index, cannot be completely eliminated. Since the investor cannot eliminate this systematic component of variability through diversification, it has been commonly used as a measure of risk (market risk) in the literature of portfolio theory.

Viewing the bank holding company as an investor that manages a portfolio of assets in both banking and other bank related areas, the problem of choosing an optimal portfolio of assets is closely akin to the problem of choosing an

optimal portfolio of securities. Portfolio theory would have the bank holding company choose an asset portfolio from an efficient set. Choosing from an efficient set would require that the bank holding company further specify its risk-return tradeoff preferences.

This dissertation was concerned with the ability of a bank holding company to forecast changes in its market risk resulting from acquisitions of additional banks and/or other companies operating in approved bank related areas. The ability to forecast changes in its market risk prior to a major acquisition would allow the bank holding company to evaluate major acquisition decisions on the basis of the risk-return criteria described above.

The most common market risk forecast models found in the literature were the naive models of Blume [8] and Levy [28]. These naive models were based on empirical findings that the beta coefficient appeared to remain relatively stable over time, especially the beta coefficient of a portfolio containing a large number of securities. Naive forecast strategies that assume no change in the beta coefficient from time period to time period have been intuitively appealing due to their simplicity, but forecasts of the beta coefficient of the individual security have been subject to considerable error as presented in Table 8 of Chapter V.

Recent empirical studies by Beaver, Kettler, and Scholes (BKS) [5], Breen and Lerner [10], and Gonedes [27]

were concerned with demonstrating an association between market risk and accounting measures. These studies were successful in identifying a statistically significant association between certain accounting measures and market risk (as measured by the beta coefficient) although the association differed markedly from study to study. The BKS study went further than the other two studies and utilized the observed association between market risk and accounting measures to demonstrate that superior forecasts of market risk could be made by using the associated accounting measures as instrumental variables (IV Model) to remove the inherent measurement error contained in market risk estimates computed from a market model such as equation (7).

The ultimate goal of this dissertation was to examine multiple regression models (MR Models) to determine if such models could consistently provide forecasts of bank holding company market risk that were superior to those of concurrent naive and IV Models. Forecast superiority was evaluated on the basis of the forecast error as measured by the Mean Square Error (MSE) and Mean Absolute Error (MAE) of concurrent market risk predictions from the naive, the IV Model and the MR Model. If bank holding company management were to evaluate acquisition opportunities on the basis of the risk-return criteria presented in Chapter I and Chapter II, the validity of this decision criteria would depend on their ability to predict any anticipated change in market risk of the holding

company prior to the merger and/or acquisition.

It was suggested in Chapter II that an investigation of the relationships of market risk and accounting measures might provide a link between acquisition decisions and the subsequent market revaluation of risk resulting from a bank holding company acquisition and/or change in policy. Given those structural characteristics (as evidenced by accounting measures) that give rise to specific levels of market risk, bank holding company management acquisition decisions could be made on the basis of the perceived impact on their market risk due to the expected changes in structure that would accompany the acquisition. The suggested vehicle through which such changes in structure would be evaluated prior to an acquisition was the construction of pro forma accounting statements. Given a potential set of acquisition alternatives and the estimated pro forma accounting statements for the bank holding company as combined with each of the alternatives, the expected change in bank holding company market risk could be evaluated on the basis of the market risk predicted for each possible acquisition combination. The final selection of the most desirable alternatives would then depend on which alternative provided the optimal risk-return profile as desired by management.

Given the need to forecast market risk for a bank holding company prior to a merger and/or acquisition, this dissertation focused primarily on the forecast ability of

the MR Model rather than the actual observed relationship of accounting measures and market risk even though it was recognized that the forecast ability of the MR Model was linked directly with these relationships. The MR Models utilized to forecast market risk resulted from a stepwise regression procedure such that additional accounting measures were included only if the $\bar{R}^2$ of the MR Model was significantly improved by the inclusion of an additional accounting measure. Such a procedure was designed to find those MR Models with minimum residual variance (see footnote 30, page 53). Under these conditions there were no assurances that the coefficients of the accounting measures of the MR Model were unbiased estimates of the true relationship between bank holding company market risk and accounting measures even though the MR Model predicted well.

In addition, the unavailability of price and/or accounting data for many bank holding companies precluded the selection of a truly random bank holding company sample. The finding that bank holding company market risk was strongly associated with (1) variability of weekly returns, (2) $\log_e$ total assets, (3) income differences to assets, and (4) dividend payout applied specifically to the forty-three bank holding companies of the sample for the 1969 through 1973 time period. Only logical inferences as to the relationship of market risk and accounting measures for bank holding companies not included in the sample should be drawn.

The importance of finding four accounting measures closely associated with market risk was that bank holding company accounting measures, when used in conjunction with MR Models, provided a means for making superior forecasts of market risk. Of secondary importance was the relationship between market risk and accounting measures per se, since it appeared possible that for other accounting measures and other time periods, new relationships might be found which gave equal or superior forecast results.

Superior forecasts of market risk in the bank holding company industry based on the use of MR Models were reasoned to depend on finding (1) a strong relationship between market risk and accounting measures and (2) reasonable stability of the relationships over time.

The findings of Chapter V indicated that for the sample bank holding companies and the time period 1969 through 1973 a significant relationship between accounting measures and market risk could be identified. These identified relationships were stable enough to provide superior forecasts of market risk when actual or realized values of the accounting measures of the forecast period were used as model inputs.

The forecast strategy of identifying a different set of important explanatory accounting measures for each forecast period by allowing accounting measures to enter the model through a stepwise regression procedure provided some-

what mixed forecast results. The MSE of the subperiod forecasts were consistently lower than the MSE of a naive model using the same data inputs. The magnitude of MSE was larger, however, than the MSE of the naive model of the Blume study [8] and the MSE of the instrumental variables model of the BKS study [5] in two of the four forecast subperiods.

The final forecast strategy examined involved the use of a common set of accounting measures for each subperiod forecast as identified by a pooled regression model. The dummy variables technique was used to determine if subperiod cross-sectional data should be pooled to provide a larger number of observations on which to base estimates of accounting measure regression coefficients. The results favored a non-pooled approach. Many of the dummy intercepts and dummy slope coefficients for the 1971, 1972, and 1973 subperiods were significant, indicating a shift in the relationship of certain accounting measures with market risk over time, while the dummy intercept and dummy slope coefficients for the 1970 subperiod were non-significant.

Although the relationships identified by the pooled regression between market risk and accounting measures changed over time, they were stable enough from one annual subperiod to the next to provide superior forecasts of market risk. The MSE of the subperiod regression models were on average 50 per cent lower than the MSE of the naive model using the same data inputs. The magnitude of the MSE of the subperiod

regression models was significantly lower in three of the four forecast subperiods than the MSE reported by Blume [8] and BKS [5].

Conclusions

Two important conclusions appeared to be warranted by the evidence presented in this dissertation. The first conclusion concerned the evidence of the relationship between accounting measures and market risk for the bank holding company industry. The $\bar{R}^2$ of the subperiod multiple regression models explained as much as 80 per cent or more of the variance of market risk in two of the five subperiods examined (see Table 6). Compared with the association presented in the results of previous empirical studies, it must be concluded that accounting measures of the bank holding company industry are indeed impounded in market-based risk measures.

Although the sample companies of this dissertation were not industrial companies as in [5], [10], and [27], the results of this dissertation provide additional evidence of a statistically significant relationship between accounting measures and market risk. The stronger relationships reported in this dissertation between bank holding company market risk and accounting measures are attributed to (1) shorter forecast periods, (2) the use of alternate accounting measure specifications, and (3) a greater homogeneity of accounting measures for sample bank holding companies versus

industrial companies. Of these three, primary significance is attached to the use of shorter annual forecast periods which utilized weekly rather than monthly or quarterly returns to compute market risk. The results of this dissertation indicated that market risk appeared to change over time in response to changes in bank holding company structure and/or changes in policy (as evidenced by changes in accounting measures), and that such changes in market risk could best be captured when annual forecast periods (rather than longer four or seven year periods) were used.

The most important conclusion concerned the feasibility of the extrapolative multiple regression models (MR Models) for providing superior forecasts of market risk. The findings of Chapter V provided overwhelming evidence to support the conclusion that such models offer considerable potential for providing superior forecasts of market risk when actual or realized values of accounting measures are used as forecast inputs.

The use of actual or realized values of accounting measures as MR Model inputs was somewhat unrealistic in that forecasts of accounting measures would also be required. Present techniques for forecasting pro forma accounting statements include (1) the per cent of sales method, (2) simple regression models, and (3) multiple regression models. All of these techniques are based on first determining the relationship of individual accounting measures with sales and

then forecasting the level of each measure based on the expected sales of the forecast period. The usefulness of market risk forecasts prior to a merger in a real world situation would thus depend on the ability of bank holding company management to also forecast relevant accounting measures.

It would be possible in a real world situation to make predictions of changes in market risk prior to an acquisition using the present rather than the pro forma values of the relevant accounting measures as inputs for the MR Model. For example, after determining the relationship between market risk and accounting measures for the 1969 subperiod, forecasts of 1970 market risk could be made by (1) combining the relevant 1969 accounting measures of the bank holding company and potential acquisition and (2) using the combined measures as inputs for the 1969 MR Model. The resulting forecast of market risk for 1970 would not depend in any way on pro forma estimates of combined accounting measures. It must be pointed out, however, that the methodology of this dissertation was based on the use of the actual or realized values of accounting measures as measured for an annual subperiod or at the year end. Thus the measures fully reflected any changes in earnings, size, dividend payout, etc., that had taken place during the annual subperiod whether such changes resulted from an acquisition, change in management policy, or whatever. The methodology of this dissertation did not allow for forecasts of market

risk using present rather than realized values of combined accounting measures as MR Model inputs and whether such a forecasting strategy could provide superior forecasts of market risk could not be answered by this study.

Implications For Further Research

A tool that offers great promise for solving the simultaneous problems of forecasting both market risk and accounting measures is simulation. Computer simulation models can provide solutions to a larger number of decision alternatives provided the necessary decision criteria or framework are included in the model. Although bank holding company management may not be able to forecast accounting measures with certainty, they may be able to express their beliefs concerning levels of accounting measures in terms of subjective probability statements. These probability statements, coupled with MR Models, could be used to simulate values of future market risk for a larger number of trial values of accounting measures. The outcome of such a simulation would be a distribution of possible market risk values. Using the expected value and standard deviation of this distribution, probability statements as to the possible values of market risk for the decision under consideration would be available.

As suggested by Breen and Lerner [10], the search for accounting measures specifications that better reflect

the relationship between accounting measures and market risk should be continued. One multivariate tool that offers a potential solution to the identification of fundamental accounting measures that explain market risk is factor analysis. Factor analysis attempts to redefine a large number of associated variables by a much smaller number of factors which explain the underlying association. The reduction of a large number of alternative accounting measures to a smaller number of fundamental accounting factors related to size, diversification, etc., could lead (1) to better definitions of the fundamental accounting measures, (2) to more stable observed relationships between accounting measures and market risk over time, and (3) ultimately to superior forecast results.

As discussed in Chapter III, beta coefficients can be used to make predictions of expected security returns. Estimates of the beta coefficient based on the extrapolative multiple regression models presented in this dissertation may provide the investor with better estimates of expected return given some expected level of the market. Studies that focused on providing estimates of expected return should be re-examined in light of the improved beta coefficient forecasting technique presented herein.

Market risk estimates derived from extrapolative multiple regression model (MR Model) forecasts may also provide better estimates of market risk for inputs into the single index model as compared to market risk estimates derived

from historical data. Studies that examined the ex post performance of efficient portfolios should be re-examined using these new market risk estimates as model inputs.

Finally, as noted earlier in Chapter II of this dissertation, three recent empirical studies involved with the determination of the relationship of industrial company accounting measures and market risk have met with mixed success. A statistically significant relationship was observed in two of the three studies [5] [27]. It is suggested that additional studies of these industrial company types be undertaken to determine if the methodology presented in this dissertation for forecasting market risk is applicable to other industry types. If the methodology is able to provide additional insights into the general relationships of accounting measures of other industry types and market risk, resulting in superior forecasts of market risk, then the contributions of this dissertation to current financial research will be even more valuable.

BIBLIOGRAPHY

1. Alderfer, Clayton P., and Bierman, Harold. "Choices with Risk: Beyond the Mean and Variance." Journal of Business, XLII (July, 1970), 341-53.
2. Ball, Ray, and Brown, Philip. "An Empirical Evaluation of Accounting Income Numbers." Journal of Accounting Research, VI (Autumn, 1968), 159-77.
3. Bankers Handbook. Homewood, Illinois: Dow-Jones-Irwin, Inc., 1966.
4. Barron's National Business and Financial Weekly. New York, N. Y.: Dow Jones & Co., Inc.
5. Beaver, William H.; Kettler, Paul; and Scholes, Myron. "The Association Between Market Determined and Accounting Determined Risk Measures." Accounting Review, XLV (October, 1970), 644-82.
6. ———. "The Information Content of Annual Earnings Announcements." Empirical Research in Accounting: Selected Studies, 1968. A Supplement to Vol. VI of the Journal of Accounting Research.
7. Block, Frank E. "Beta Evaluation." The Wall Street Transcript, July 3, 1972, pp. 29055-56.
8. Blume, Marshall. "On the Assessment of Risk." The Journal of Finance, XXVI (March, 1971), pp. 1-10.
9. Brealey, R. A. An Introduction to Risk and Return from Common Stocks. Cambridge, Mass.: The M. I. T. Press, 1969.
10. Breen, William J., and Lerner, Eugene M. "Corporate Financial Strategies and Market Measures of Risk and Return." The Journal of Finance, XXVIII (May, 1973), 339-51.

11. _____ . "Use of β in Regulatory Proceedings." Bell Journal of Economics and Management Science, III (Autumn, 1972), 612-21.
12. Brown, Philip, and Ball, Ray. "Some Preliminary Findings on the Association Between the Earnings of a Firm, Its Industry, and the Economy." Empirical Research in Accounting: Selected Studies, 1967. A Supplement to Vol. V of the Journal of Accounting Research.
13. Business Conditions. Federal Reserve Bank of Chicago, July, 1970.
14. Cootner, Paul. "Stock Market Indexes--Fallacies and Illusions." Commercial and Financial Chronicle, September 19, 1966, pp. 18-19.
15. Drzycimski, Eugene F. "A Study of the Determinants of Common Stock Prices and Price-Relatives for a Selected Sample of Large Commercial Banks." Unpublished Ph.D. dissertation, Michigan State University, 1966.
16. Dukes, William P., and Brewer, Virgil L. "Banks Versus Related Bank Holding Companies: A Risk-Return Comparison." Proceedings: Southwestern Finance Association. Bureau of Business Research, The University of Texas at Austin, 1974.
17. Durand, David. Bank Stock Prices and the Bank Capital Problem. New York: National Bureau of Economic Research, 1957.
18. Evans, J. L., and Archer, S. H. "Diversification and the Reduction of Dispersion: An Empirical Analysis." The Journal of Finance, XXII (December, 1968), 761-67.
19. Fama, Eugene. "The Behavior of Stock Market Prices." Journal of Business, XXXVII (January, 1965), 35-105.
20. _____; Fisher, Lawrence; Jensen, Michael C.; and Roll, Richard. "The Adjustment of Stock Prices to New Information." International Economic Review, X (February, 1969), 1-21.

21. _____ . "Efficient Capital Markets: A Review of Theory and Empirical Work." The Journal of Finance, XXV (May, 1970), 383-417.
22. Fisher, Lawrence. "Some New Stock Market Indexes." Journal of Business, XXXIX (January, 1966), 191-225.
23. _____ , and Lorie, James H. "Some Studies of Variability on Investments in Common Stocks." Journal of Business, XLIII (April, 1970), 99-134.
24. _____ . "Rates of Return on Investments in Common Stocks: The Year-by-Year Record, 1926-65." Journal of Business, XXXVII (January, 1964), 1-21.
25. Fredman, A. J., and Wert, J. E. "Bank Stocks Have Entered a New Epoch." Banking, January, 1970, pp. 49-50, 90.
26. Friend, Irwin, and Blume, Marshall. "Measurement of Portfolio Performance Under Uncertainty." American Economic Review, LX (September, 1970), 561-75.
27. Gonedes, Nicholas J. "Evidence on the Information Content of Accounting Numbers: Accounting-Based and Market-Based Estimates of Systematic Risk." Journal of Finance and Quantitative Analysis, VII (June, 1973), 407-43.
28. _____ . "Properties of Accounting Numbers: Models and Tests." Report No. 7115, Center for Mathematical Studies in Business and Economics, University of Chicago, March, 1971.
29. Grube, R. Corwin. "Estimation of Beta Risk Components for Reduction of Prediction Error in Portfolio Models." Unpublished Ph.D. dissertation, Michigan State University, 1973.
30. Hadar, Joseph, and Russell, W. R. "Rules for Ordering Uncertain Prospects." American Economic Review, LIX (March, 1969), 25-34.
31. Jensen, Michael C. "Risk, the Pricing of Capital Assets, and the Evaluation of Investment Portfolios." Journal of Business, XLII (April, 1969), 167-247.

32. Johnston, J. Econometric Methods. New York: McGraw-Hill Book Company, 1972.
33. King, Benjamin. "Market and Industry Factors in Stock Price Behavior." Journal of Business, XXXIX (January, 1966), 139-90.
34. Kohn, Donald L., and Zoellner, John F. "The Amended Bank Holding Company Act." Monthly Review. Federal Reserve Bank of Kansas, May, 1971.
35. Kuh, E., and Meyer, J. R. "Correlation and Regression Estimates When the Data are Ratios." Econometrica, XXXIII (October, 1965), 400-16.
36. Latané, H. A., and Young, W. E. "Test of Portfolio Building Rules." The Journal of Finance, XXIV (September, 1969), 595-612.
37. Levy, Haim, and Sarnat, Marshall. "Alternative Efficiency Criteria: An Empirical Analysis." Journal of Finance, XXV (December, 1970), 1153-58.
38. Levy, Robert A. "On the Short-Term Stationarity of Beta Coefficients." Financial Analysts Journal, XXVII (November-December, 1971), 55-62.
39. Litner, John. "Security Prices, Risk and Maximal Gains from Diversification." Journal of Finance, XX (December, 1965), 587-616.
40. ———. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." Review of Economics and Statistics, XLVII (February, 1965), 13-37.
41. Long, Hugh W., and Dyl, Edward A. "Portfolio Selection: A Three Parameter Model." Proceedings of the Eighth Annual Meeting of the Southwestern Finance Association. Bureau of Business Research, The University of Texas at Austin, 1970, 109-32.
42. Lorie, James H., and Hamilton, Mary T. "Stock Market Indexes." Modern Developments in Investment Management. Edited by James Lorie and Richard Brealey. New York: Praeger Publishers, 1972, pp. 68-83.

43. Madansky, A. "Spurious Correlation Due to Deflating Variables." Econometrica, XXXII (October, 1964), 652-55.
44. Mao, James C. T., and Brewster, John F. "An E-S_n Model of Capital Budgeting." Engineering Economist, Winter, 1970, pp. 103-21.
45. Markowitz, Harry. "Portfolio Selection." Journal of Finance, VII (March, 1952), 77-91.
46. . Portfolio Selection: Efficient Diversification of Investments. New York: John Wiley & Sons, Inc., 1959.
47. Martin, John D., and Brewer, Virgil L. "Portfolio Analysis: Responsiveness = Variance?" The Business Symposium. Published by the Graduate Students Society in Business Administration, Texas Tech University, July, 1972.
48. Miller, Merton H., and Modigliani, Franco. "Some Estimates of the Cost of Capital to the Electric Utility Industry, 1954-1957." American Economic Review, LVI (June, 1966), 333-91.
49. Moody's Bank and Finance Manual. New York: Moody's Investors Service, Inc., 1969-1973 editions.
50. Moody's Dividend Record - Annual. New York: Moody's Investors Service, Inc., 1967-1973 editions.
51. Mossin, Jan. "Equilibrium in a Capital Asset Market." Econometrica, XXXIV (October, 1966), 768-83.
52. Nadler, Paul S. "One Bank Holding Companies: The Public Interest." Harvard Business Review, May-June, 1969, pp. 107-13.
53. "The One Bank-Holding Company--History, Issues, and Pending Legislation." Business Conditions. Federal Reserve Bank of Chicago, July, 1970.
54. Pearson, Karl. "On a Form of Spurious Correlation Which May Arise When Indices Are Used in the Measurement of Organs." Proceedings of the Royal Society of London, LX (1897), 489-98.

55. Philips, G. Edward, and Mayne, Lucille S. "Income Measures and Bank Stock Values." Empirical Research in Accounting: Selected Studies, 1970. A Supplement to Vol. VIII of the Journal of Accounting Research.
56. Porter, Burr R. "A Comparison of Stochastic Dominance and Mean-Variance Portfolio Models." Proceedings: Southwestern Finance Association. Bureau of Business Research, The University of Texas at Austin, 1971, pp. 93-112.
57. Rao, P., and Miller, R. L. Applied Econometrics. Belmont: Wadsworth Publishing Company, 1971.
58. Schick, Richard A., and Verbrugge, James A. "Analysis of Bank Price Earnings Ratios." Proceedings: Southwestern Finance Association. Bureau of Business Research, The University of Texas at Austin, 1974.
59. Sharpe, William F. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." Journal of Finance, XIX (September, 1964), 425-42.
60. _____. Portfolio Theory and Capital Markets. New York: McGraw-Hill Book Company, 1970.
61. _____. "A Simplified Model for Portfolio Analysis." Management Science, X (January, 1963), 277-93.
62. _____, and Cooper, Guy M. "Risk-Return Classes of New York Stock Exchange Common Stocks, 1931-1967." Financial Analysts Journal, XXVIII (March-April, 1972), 46-54.
63. Standard and Poor's Annual Dividend Record. New York: Standard and Poor's Corporation, 1963-1966 editions.
64. Staubus, George J. "The Association of Financial Accounting Variables with Common Stock Values." The Accounting Review, XL (January, 1965), 119-34.
65. Value Line Investment Survey. New York: Arnold Bernhard & Company, Inc.

66. Van Horne, James C. "Capital-Budgeting Decisions Involving Combinations of Risky Investments." Management Science, XIII (October, 1966), 84-92.
67. Wall Street Journal. January 3, 1969 - December 28, 1973.
68. Williams, John B. The Theory of Investment Value. Cambridge, Mass.: Harvard University Press, 1938.
69. Wise, John. "Linear Estimation for Linear Regression Systems Having Infinite Variances." Unpublished paper presented at Berkeley-Stanford Mathematic Economics Seminar, October, 1963.
70. Zinbarg, Edward D. "Modern Approaches to Investment Risk." Financial Executive, February, 1973, pp. 44-61.

APPENDIXES

APPENDIX A

DEFINITIONS OF BANK HOLDING COMPANY TERMS

1. Holding Company - Any company that holds the stock of another company for the purpose of exercising control over it.
2. Bank Holding Company - In general usage, any company which owns or controls one or more banks. However, a bank holding company as defined in the Bank Holding Company Act of 1956 is one which controls two or more banks. Such companies must register with the Board of Governors of the Federal Reserve System and are commonly referred to as "registered bank holding companies."
3. One-Bank Holding Company - The amendment to the Bank Holding Company Act of 1956 signed on December 31, 1970, defined a one-bank holding company to be a company which has control over any bank or over any bank holding company. A company is considered to have control if it directly or indirectly, or acting through one or more persons, owns or controls 25 per cent or more of any class of the voting shares or if it controls in any manner the election of a majority of the directors. Also, the Board is authorized to determine that a company has control if it finds that it directly or indirectly exercises a controlling interest over management or policies even in those cases where it owns less than 25 per cent of the voting shares. There is a presumption that any company owning less than 5 per cent of the voting shares does not have control.
4. Multiple-Bank Holding Company - A bank holding company, however defined, that owns or controls two or more banks. Also, known as multi-bank holding company.
5. Holding Company Affiliate - A legal term fully defined in the Banking Act of 1933. Generally, it pertains to any organization which owns or controls any one bank either through stock ownership or through any means that allow it to elect a majority of the bank's directors.

APPENDIX A.--Continued

6. Subsidiary - A legal term fully defined in the Bank Holding Company Act of 1956. Generally, any company owned and controlled by another.

Source: "The One-Bank Holding Company--History, Issues, and Pending Legislation," Business Conditions, Federal Reserve Bank of Chicago, July, 1970.

APPENDIX B

SAMPLE BANK HOLDING COMPANIES^a

<u>Compustat Name</u>	<u>Compustat Region</u>	<u>No. of Banks^b</u>
Bank of New York Co Inc	Banks-Money Center-NYC	8
Bankers Trust New York Corp	Banks-Money Center-NYC	9
Charter New York Corp	Banks-Money Center-NYC	10
Chase Manhattan Corp	Banks-Money Center-NYC	4
Chemical New York Corp	Banks-Money Center-NYC	3
Citicorp	Banks-Money Center-NYC	2
Manufacturers Hanover Corp	Banks-Money Center-NYC	4
Morgan (J P) & Co	Banks-Money Center-NYC	1
First Chicago Corp	Bks-Money Center- Outside NYC	1
Shawmut Assn Inc	Bks-Money Center- Outside NYC	11
Fidelity Corp - Penn	Banks-Regional-Eastern	1
First Empire State Corp	Banks-Regional-Eastern	3
First Pennsylvania Corp	Banks-Regional-Eastern	1
Franklin New York Corp	Banks-Regional-Eastern	1
Girard Co	Banks-Regional-Eastern	1
Hartford Natl Corp	Banks-Regional-Eastern	1
Hospital Trust Corp	Banks-Regional-Eastern	1
Industrial Natl Corp	Banks-Regional-Eastern	1
Lincoln First Banks	Banks-Regional-Eastern	5
Marine Midland Banks	Banks-Regional-Eastern	10
Philadelphia Natl Corp	Banks-Regional-Eastern	1
Provident Natl Corp	Banks-Regional-Eastern	1
Cameron Finl Corp	Banks-Regional-Southeastern	1
First & Merchants	Banks-Regional-Southeastern	3
First Natl Hldg Corp		
Atlanta	Banks-Regional-Southeastern	1
NCNB Corp	Banks-Regional-Southeastern	1
Southeast Banking Corp	Banks-Regional-Southeastern	18
United Virginia Bank- shares	Banks-Regional-Southeastern	13
Equimark Corp	Banks-Regional-Midwestern	1
First Bank System Inc	Banks-Regional-Midwestern	88
First Wisconsin Corp	Banks-Regional-Midwestern	17
Indiana Natl Corp	Banks-Regional-Midwestern	1
Marine Corp	Banks-Regional-Midwestern	15
Northwest Bancorp	Banks-Regional-Midwestern	78
Pittsburgh Natl Corp	Banks-Regional-Midwestern	1
Society Corp	Banks-Regional-Midwestern	12

APPENDIX B.--Continued

<u>Compustat Name</u>	<u>Compustat Region</u>	<u>No. of Banks^b</u>
Colorado Natl Bankshares	Banks-Regional-South- western	8
United Banks of Colorado	Banks-Regional-South- western	12
Bankamerica Corp	Banks-Regional- West Coast	1
Crocker National Corp	Banks-Regional- West Coast	1
U S Bancorp	Banks-Regional- West Coast	1
Wells Fargo & Co	Banks-Regional- West Coast	1
Western Bancorp	Banks-Regional- West Coast	23

^aBank holding companies appear as listed on the Compustat Tapes.

^bNumber of banks controlled by the bank holding company listed by Moody's Bank and Finance Manual as of December 31, 1972.

APPENDIX C

DEFINITION OF ACCOUNTING RISK MEASURES^a

Average Payout	=	$\frac{\sum_{t=1}^T \text{cash dividends paid to common stockholders}_t}{\sum_{t=1}^T \text{income available for common stockholders}_t}$
Average Asset Growth	=	$\ln \left[\frac{\text{total assets}_{9\text{or}10}}{\text{total assets}_1} \right] / T$
Average Leverage	=	$\frac{\sum_{t=1}^T \text{total senior securities}_t}{\text{total assets}_t} / T$
Average Asset Size	=	$\sum_{t=1}^T \ln (\text{total assets}_t) / T$
Average Liquidity	=	$\frac{\sum_{t=1}^T \text{current assets}_t}{\text{current liabilities}_t} / T$
Earnings Variability	=	$\left(\sum_{t=1}^T (E_t/P_{t-1} - [\bar{E}/P])^2 / T \right)^{1/2}$
Accounting β	=	$\frac{\sum_{t=1}^T (E_t/P_{t-1} - [\bar{E}/P]) (M_t - \bar{M})}{\sum_{t=1}^T (M_t - \bar{M}) (M_t - \bar{M})}$ $= \frac{\text{Covar } (E_t/P_{t-1}, M_t)}{\text{Var } (M_t)}$

APPENDIX C.--Continued

where

$$E_t/P_{t-1} = \frac{\text{income available for common stockholders}_t}{\text{market value of common stock}_{t-1} \text{ (valued at fiscal year end)}}$$

$$M_t = \left(\sum_{t=1}^T E_{it}/P_{it-1} \right) / N$$

$$\bar{M} = \left(\sum_{t=1}^T M_t \right) / T$$

$$T = \text{number of years in subperiod (10 in period 1 and 9 in period 2).}$$

$$N = \text{number of NYSE Compustat firms for which earnings and price data were available for year } t.$$

^aAll of the definitions above should carry a subscript *i* to denote security *i*. The definitions apply only to the BKS study [5] as presented in Chapter II.

APPENDIX D

SUBPERIOD MARKET RISK COEFFICIENTS COMPUTED FROM
THE STANDARD AND POOR'S COMPOSITE INDEX

	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
Bank of New York Co Inc	0.615	0.767	0.335	0.095	0.269
Bankers Trust New York Corp	1.171	0.775	0.389	0.520	0.753
Charter New York Corp	1.103	1.348	0.533	0.292	0.452
Chase Manhattan Corp	1.001	1.074	0.231	0.811	0.819
Chemical New York Corp	1.288	1.086	0.425	0.347	0.624
Citicorp	1.385	0.847	0.627	0.872	1.657
Manufacturers Hanover Corp	0.797	0.689	0.572	0.651	0.802
Morgan (J P) & Co	0.804	0.829	0.705	1.032	1.184
First Chicago Corp	0.345	0.495	0.464	0.608	0.625
Shawmut Assn Inc	0.342	0.288	0.491	0.137	0.114
Fidelity Corp - Penn	0.639	0.739	0.486	-0.028	0.462
First Empire State Corp	0.380	0.452	0.548	-0.005	0.454
First Pennsylvania Corp	0.882	0.984	0.753	0.368	1.133
Franklin New York Corp	0.694	0.513	0.735	1.150	0.731
Girard Co	0.662	0.899	0.632	0.186	0.603
Hartford Natl Corp	0.230	0.336	0.318	-0.036	0.583
Hospital Trust Corp	0.152	0.282	0.373	0.014	0.167
Industrial Natl Corp	0.328	0.187	0.063	0.477	0.710
Lincoln First Banks	0.700	0.569	0.571	0.180	0.559
Marine Midland Banks	1.175	0.694	0.544	-0.098	0.554
Philadelphia Natl Corp	1.071	1.070	0.746	0.099	0.456
Provident Natl Corp	0.455	0.206	0.682	-0.079	0.586
Cameron Finl Corp	0.449	0.691	0.358	0.509	0.706
First & Merchants	0.314	0.140	0.807	0.702	0.624
First Natl Hldg Corp Atlanta	0.442	0.679	0.227	0.187	1.038
NCNB Corp	0.714	0.882	0.497	-0.302	0.930
Southeast Banking Corp	0.558	0.598	0.885	0.361	0.209
United Virginia Bankshares	0.348	0.127	0.549	0.257	0.625
Equimark Corp	-0.101	0.611	0.200	0.393	0.482
First Bank System Inc	0.672	0.588	0.696	0.120	0.769
First Wisconsin Corp	0.606	0.101	0.214	0.167	0.212
Indiana Natl Corp	0.128	0.053	0.507	-0.035	0.742
Marine Corp	0.323	0.083	0.117	0.179	0.201
Northwest Bancorp	0.770	0.498	0.322	0.141	0.477
Pittsburgh Natl Corp	0.467	0.353	0.220	0.558	0.528
Society Corp	0.101	0.113	0.372	0.057	0.165
Colorado Natl Bankshares	0.638	0.107	0.359	-0.280	0.369
United Banks of Colorado	0.589	0.262	0.472	0.270	1.042
Bankamerica Corp	1.051	0.844	0.443	0.110	0.758
Crocker National Corp	1.379	1.259	0.421	0.407	0.815
U S Bancorp	-0.142	0.323	0.382	0.888	0.708
Wells Fargo & Co	-0.008	1.028	0.785	-0.055	0.824
Western Bancorp	1.315	0.754	0.778	0.473	0.766

APPENDIX E

SUBPERIOD MARKET RISK COEFFICIENTS COMPUTED FROM THE
NEW YORK STOCK EXCHANGE COMPOSITE INDEX

	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
Bank of New York Co Inc	0.595	0.780	0.296	0.072	0.172
Bankers Trust New York Corp	1.130	0.752	0.249	0.499	0.634
Charter New York Corp	1.020	1.376	0.412	0.306	0.382
Chase Manhattan Corp	0.961	1.085	0.244	0.777	0.659
Chemical New York Corp	1.235	1.072	0.313	0.339	0.528
Citicorp	1.311	0.841	0.515	0.858	1.111
Manufacturers Hanover Corp	0.751	0.682	0.518	0.650	0.521
Morgan (J P) & Co	0.757	0.816	0.593	1.022	0.743
First Chicago Corp	0.340	0.532	0.244	0.598	0.456
Shawmut Assn Inc	0.309	0.296	0.388	0.135	0.071
Fidelity Corp - Penn	0.656	0.744	0.424	-0.055	0.367
First Empire State Corp	0.355	0.474	0.386	0.013	0.437
First Pennsylvania Corp	0.853	1.007	0.638	0.407	0.669
Franklin New York Corp	0.634	0.536	0.465	1.149	0.532
Girard Co	0.632	0.903	0.561	0.209	0.436
Hartford Natl Corp	0.221	0.335	0.305	-0.049	0.574
Hospital Trust Corp	0.161	0.283	0.286	0.015	0.120
Industrial Natl Corp	0.342	0.224	0.052	0.451	0.485
Lincoln First Banks	0.661	0.573	0.360	0.190	0.306
Marine Midland Banks	1.124	0.655	0.542	-0.110	0.390
Philadelphia Natl Corp	1.009	1.084	0.624	0.057	0.543
Provident Natl Corp	0.442	0.211	0.603	-0.035	0.633
Cameron Finl Corp	0.438	0.695	0.249	0.479	0.521
First & Merchants	0.296	0.148	0.749	0.726	0.366
First Natl Hldg Corp Atlanta	0.430	0.731	0.149	0.185	0.770
NCNB Corp	0.692	0.891	0.409	-0.274	0.775
Southeast Banking Corp	0.540	0.599	0.711	0.405	0.188
United Virginia Bankshares	0.347	0.142	0.493	0.277	0.385
Equimark Corp	-0.095	0.652	0.137	0.400	0.261
First Bank System Inc	0.650	0.586	0.565	0.077	0.456
First Wisconsin Corp	0.589	0.125	-0.049	0.178	0.194
Indiana Natl Corp	0.125	0.091	0.354	-0.027	0.833
Marine Corp	0.317	0.078	0.085	0.175	0.129
Northwest Bancorp	0.745	0.545	0.205	0.143	0.313
Pittsburgh Natl Corp	0.461	0.364	0.209	0.543	0.453
Society Corp	0.130	0.109	0.214	0.056	0.116
Colorado Natl Bankshares	0.614	0.108	0.297	-0.272	0.323
United Banks of Colorado	0.564	0.299	0.427	0.257	0.849
Bankamerica Corp	0.993	0.859	0.448	0.110	0.608
Crocker National Corp	1.320	1.252	0.246	0.384	0.525
U S Bancorp	-0.153	0.339	0.147	0.912	0.483
Wells Fargo & Co.	0.034	1.056	0.581	-0.094	0.573
Western Bancorp	1.234	0.724	0.610	0.443	0.553

APPENDIX F

MEAN VALUES OF SUBPERIOD ACCOUNTING MEASURES

	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
<u>Size</u>					
Market Value	382	395	429	559	557
Book Value	253	270	289	315	340
Total Assets	7.83	7.93	7.06	8.24	8.41
<u>Leverage</u>					
Total Debt to Equity	15.76	16.22	17.09	18.82	21.08
Total Debt to Assets	.918	.921	.920	.922	.928
<u>Diversification</u>					
Number of Banks	7.58	7.95	8.30	8.76	9.12
Number of Subsidiaries	1.95	3.30	4.27	5.16	6.09
Number of Banks & Subsidiaries	9.53	11.25	12.58	13.93	15.23
<u>Earnings Variability</u>					
Quarterly Earnings to Market Value	.0035	.0042	.0040	.0038	.0043
Quarterly Earnings to Book Value	.0047	.0037	.0038	.0037	.0038
Quarterly Earnings to Assets	.00027	.00022	.00023	.00021	.00020
<u>Income</u>					
Income Differences to Assets	.00134	.00080	.00048	.00045	.00040
Income to Assets	.0069	.0071	.0067	.0060	.0055
<u>Earnings Growth</u>					
Quarterly Earnings Growth	.172	.107	.044	.047	.059
Annual Earnings Growth	.073	.046	.021	.028	.033
<u>Asset Growth</u>					
Quarterly Asset Growth	.089	.099	.127	.180	.169
Annual Asset Growth	.055	.043	.059	.068	.083

APPENDIX F.--Continued

	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
<u>Miscellaneous</u>					
Owners/Million					
Shares	4301	3262	3095	2835	2702
Capital to Risk					
Assets	.095	.093	.093	.091	.081
Dividend Payout	.474	.451	.451	.446	.440
Listed on New York					
Exchange	.255	.325	.295	.441	.452
Rate of Return on					
Security Portfolio	.046	.044	.047	.046	.050
Loans to Deposits	1.84	1.56	1.49	1.51	1.48
Variability of Weekly					
Returns	.028	.031	.025	.026	.034

APPENDIX G

SUBPERIOD ACCOUNTING MEASURE CORRELATIONS
WITH MARKET RISK^a

	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
<u>Size</u>					
Market Value	.584	.465	.117	.369	.625
Book Value	.577	.473	.103	.406	.557
Total Assets	.678	.662	.237	.409	.514
<u>Leverage</u>					
Total Debt to Equity	.545	.615	.148	.123	.264
Total Debt to Assets	.381	.315	.156	.153	.254
<u>Diversification</u>					
Number of Banks	.110	-.090	-.050	-.139	-.124
Number of Subsidiaries	.372	-.090	-.088	-.038	.142
Number of Banks & Subsidiaries	.153	-.068	-.065	-.140	-.085
<u>Earnings Variability</u>					
Quarterly Earnings to Market Value	-.166	-.176	-.208	.133	-.387
Quarterly Earnings to Book Value	-.032	-.040	-.031	.221	-.278
Quarterly Earnings to Assets	-.120	-.132	-.089	.113	-.276
<u>Income</u>					
Income Differences to Assets	-.255	.120	.107	-.216	.186
Income to Assets	-.412	-.379	-.026	-.094	-.015
<u>Earnings Growth</u>					
Quarterly Earnings Growth	-.200	.271	.067	-.320	.123
Annual Earnings Growth	-.114	-.053	-.025	-.388	-.015
<u>Asset Growth</u>					
Quarterly Asset Growth	.337	-.045	.071	-.018	.509
Annual Asset Growth	.224	-.031	.105	-.379	.468

APPENDIX G.--Continued

	<u>1969</u>	<u>1970</u>	<u>1971</u>	<u>1972</u>	<u>1973</u>
<u>Miscellaneous</u>					
Owners/Million					
Shares	-.190	-.146	-.081	-.091	-.368
Capital to Risk					
Assets	-.283	-.115	-.001	-.136	-.185
Dividend Payout	.350	.273	-.095	.185	-.177
Listed on New York					
Stock Exchange	.577	.521	-.022	.315	.203
Rate of Return on					
Security Portfolio	-.124	.161	-.041	.293	-.064
Loans to Deposits	.200	.247	-.053	.396	.546
Variability of Weekly					
Returns	.365	.706	.388	.395	.741

^aBased on the use of the Standard & Poor's Composite Index to calculate market risk. The correlation coefficients reported are the simple correlation coefficients between each accounting measure and market risk.

APPENDIX H

DATA ITEMS ON THE ANNUAL OR QUARTERLY COMPUSTAT
TAPES USED TO COMPUTE ACCOUNTING MEASURES^a

<u>Item No. (I)</u>		<u>Units</u>
<u>Annual</u>		
1	Cash and Due from Banks	MM\$
2	U. S. Treasury Securities	MM\$
8	Total Investment Securities	MM\$
23	Loans (Gross)	MM\$
36	Total Assets (Gross)	MM\$
50	Total Time and Savings Deposits	MM\$
76	Total Liabilities (Excluding Valuation Reserves)	MM\$
85	Total Equity Capital	MM\$
99	Total Book Value	MM\$
100	Total Capital Accounts	MM\$
115	Total Interest and Dividends on Investments	MM\$
164	Net Income Available for Common	MM\$
194	Net Income Per Share - Excluding Extraordinary Items	MM\$
196	Common Shares Used in Calculating Earnings Per Share	MM
201	Common Dividends Per Share Paid	\$&¢
205	Market Price - Close	\$&Mills
232	Adjustment Factor (Cumulative)	Ratio
<u>Quarterly</u>		
27	Total Assets (Gross)	MM\$
73	Total Book Value	MM\$
127	Net Income Available for Common	MM\$
140	Common Shares Used in Calculating Quarterly Earnings Per Share	MM\$
161	Market Price - 3rd Month of Quarter - Close	\$&Mills
165	Adjustment Factor (Cumulative)	Ratio

^aAs per Compustat definitions of data items and units of measurement.

APPENDIX I

DEFINITION OF ACCOUNTING MEASURES IN TERMS
OF COMPUSTAT DATA DEFINITIONS

<u>Accounting Measure</u>	<u>Data Definition</u>
<u>Size</u>	
Market Value ^d	DATA(205,J) * DATA(196,J) ^a
Book Value	DATA(99,J)
Total Assets ^c	LOG _e DATA(36,J)
<u>Leverage</u>	
Total Debt to Equity ^d	DATA(76,J) / DATA(85,J)
Total Debt to Assets ^c	DATA(76,J) / DATA(36,J)
<u>Diversification</u>	
Number of Banks	b
Number of Subsidiaries	b
Number of Banks & Subsidiaries	b
<u>Earnings Variability</u>	
Quarterly Earnings to Market Value ^c	b
Quarterly Earnings to Book Value	b
Quarterly Earnings to Assets	b
<u>Income</u>	
Income Differences to Assets ^e	[DATA(164,J) - DATA(164,J-1)] / DATA(36,J)
Income to Assets ^e	DATA(164,J) / DATA(36,J)
<u>Earnings Growth</u>	
Quarterly Earnings Growth ^d	b
Annual Earnings Growth	LOG _e $\frac{[\text{DATA}(164,J) / \text{DATA}(196,J)]}{[\text{DATA}(164,J-1) / \text{DATA}(196,J-1)]}$

APPENDIX I.--Continued

<u>Accounting Measure</u>	<u>Data Definition</u>
<u>Asset Growth</u>	
Quarterly Asset Growth	^b
Annual Asset Growth ^c	$\text{LOG}_e [\text{DATA}(36,J)/\text{DATA}(36,J-1)]$
<u>Miscellaneous</u>	
Owners/Million Shares	^b
Capital to Risk Assets	$\text{DATA}(100,J)/[\text{DATA}(36,J)-\text{DATA}(1,J)-\text{DATA}(2,J)]$
Dividend Payout ^{c,d}	$\text{DATA}(201,J)/\text{DATA}(194,J)$
Listed on New York Stock Exchange	^b
Rate of Return on Security Portfolio ^f	$\text{DATA}(115,J)/\text{DATA}(8,J)$
Loans to Deposits ^e	$\text{DATA}(23,J)/\text{DATA}(50,J)$
Variability of Weekly Returns	^b

^aThe letter J refers to the Jth time period.

^bSee Text of Chapter IV for definition.

^cAppeared in the BKS study [5].

^dAppeared in the Breen and Lerner study [10].

^eAppeared in the Gonedes study [27].

^fAppeared in the Schick and Verbrugge study [58].

APPENDIX J-1

1969 SUBPERIOD--SUMMARY REGRESSION MEASURES^a

Total Sum of Squares	6.695
Regression Sum of Squares	4.319
Sum of Squared Residuals	2.376
F-Statistic for Significance of All Coefficients: F(5,37)	13.451
Standard Error of the Estimate	0.253
Multiple R ²	0.645
Multiple $\bar{R}^2$	0.597
Durbin-Watson Statistic	1.738
Sum of Residuals	-0.220 x 10 ⁻⁵
% of Residuals Within One Standard Error of Zero	76.744
% of Residuals Within Two Standard Errors of Zero	95.349
% of Residuals Within Three Standard Errors of Zero	100.000

^aThe summary regression measures in Appendixes J-1 through J-5 are for the subperiod estimating equations of the MR Model as presented in Table 6.

APPENDIX J-2

1970 SUBPERIOD--SUMMARY REGRESSION MEASURES

Total Sum of Squares	5.100
Regression Sum of Squares	4.304
Sum of Squared Residuals	0.796
F-Statistic for Significance of All Coefficients: F(7, 35)	27.012
Standard Error of the Estimate	0.150
Multiple R^2	0.843
Multiple $\bar{R}^2$	0.812
Durbin-Watson Statistic	2.400
Sum of Residuals	0.391×10^{-6}
% of Residuals Within One Standard Error of Zero	72.093
% of Residuals Within Two Standard Errors of Zero	100.000
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX J-3

1971 SUBPERIOD--SUMMARY REGRESSION MEASURES

Total Sum of Squares	1.678
Regression Sum of Squares	0.591
Sum of Squared Residuals	1.087
F-Statistic for Significance of All Coefficients: F(4, 38)	5.166
Standard Error of the Estimate	0.169
Multiple R^2	0.352
Multiple $\bar{R}^2$	0.284
Durbin-Watson Statistic	2.448
Sum of Residuals	-0.417×10^{-6}
% of Residuals Within One Standard Error of Zero	67.442
% of Residuals Within Two Standard Errors of Zero	95.349
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX J-4

1972 SUBPERIOD--SUMMARY REGRESSION MEASURES

Total Sum of Squares	4.792
Regression Sum of Squares	2.774
Sum of Squared Residuals	2.017
F-Statistic for Significance of All Coefficients: F(7, 35)	6.876
Standard Error of the Estimate	0.240
Multiple R^2	0.579
Multiple $\bar{R}^2$	0.494
Durbin-Watson Statistic	2.131
Sum of Residuals	0.231×10^{-6}
% of Residuals Within One Standard Error of Zero	72.093
% of Residuals Within Two Standard Errors of Zero	97.674
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX J-5

1973 SUBPERIOD--SUMMARY REGRESSION MEASURES

Total Sum of Squares	3.911
Regression Sum of Squares	3.284
Sum of Squared Residuals	0.627
F-Statistic for Significance of All Coefficients: F(7, 35)	26.194
Standard Error of the Estimate	0.133
Multiple R^2	0.839
Multiple $\bar{R}^2$	0.807
Durbin-Watson Statistic	2.378
Sum of Residuals	0.300×10^{-6}
% of Residuals Within One Standard Error of Zero	72.093
% of Residuals Within Two Standard Errors of Zero	97.674
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX K-1

1970 FORECAST VALUES OF MARKET RISK USING
THE 1969 SUBPERIOD ESTIMATING EQUATION
OF TABLE 6

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.61510	0.54323	0.64660	0.26875	0.76748	1
1.17145	1.15080	1.21762	0.30400	0.77473	2
1.10299	1.17273	0.99174	0.32661	1.34755	3
1.00102	1.14651	1.23582	0.32581	1.07353	4
1.28780	0.85347	0.90157	0.28171	1.08633	5
1.38465	1.20472	1.25837	0.32686	0.84652	6
0.79670	0.83007	0.88225	0.29299	0.68862	7
0.80395	0.95026	0.91886	0.28079	0.82875	8
0.34528	0.47023	0.42054	0.32968	0.49465	9
0.34172	0.47657	0.34618	0.28474	0.28825	10
0.63854	0.70989	1.32959	0.46438	0.73872	11
0.38020	0.52902	0.44507	0.28440	0.45191	12
0.88189	0.57654	0.62339	0.27128	0.98433	13
0.69379	0.54132	0.53185	0.30330	0.51332	14
0.66171	0.47105	0.53851	0.28672	0.89936	15
0.22987	0.31691	0.51156	0.27504	0.33552	16
0.15193	0.22668	0.11976	0.32492	0.28219	17
0.32843	0.32916	0.19330	0.35219	0.18670	18
0.70005	0.68125	0.61906	0.30297	0.56947	19
1.17534	1.20369	1.24819	0.43211	0.69432	20
1.07085	0.42074	0.45943	0.26767	1.06953	21
0.45542	0.31325	0.14741	0.30998	0.20595	22
0.44881	0.45056	0.70242	0.29221	0.69133	23
0.31421	0.47334	0.40246	0.28677	0.14013	24
0.44180	0.57226	0.46216	0.26972	0.67927	25
0.71395	0.66449	0.65898	0.29885	0.88186	26
0.55849	0.50846	0.67547	0.31829	0.59828	27
0.34843	0.68571	0.45655	0.41501	0.12696	28
-0.10135	0.21292	0.38945	0.31085	0.61106	29
0.67205	0.58777	0.57669	0.27571	0.58828	30
0.60566	0.45921	0.51571	0.27719	0.10057	31
0.12761	0.40028	0.40620	0.29996	0.05316	32
0.32339	0.22631	0.15295	0.29154	0.08340	33
0.76973	0.72693	0.93112	0.37864	0.49825	34
0.46719	0.25380	0.22378	0.29246	0.35324	35
0.10147	0.24564	0.04123	0.32224	0.11254	36
0.63814	0.23592	0.18302	0.32284	0.10705	37
0.58945	0.44328	0.33804	0.28910	0.26177	38
1.05141	1.16724	1.20652	0.35325	0.84364	39
1.37891	1.08709	0.99973	0.29874	1.25867	40
-0.14156	0.32427	0.49708	0.26530	0.32264	41
-0.00780	0.69261	0.74145	0.28550	1.02756	42
1.31495	1.29744	1.09691	0.34317	0.75399	43

APPENDIX K-2

1971 FORECAST VALUES OF MARKET RISK USING
THE 1970 SUBPERIOD ESTIMATING EQUATION
OF TABLE 6

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.76748	0.88209	0.72094	0.16953	0.33505	1
0.77473	0.94233	0.84872	0.20271	0.38856	2
1.34755	1.32499	0.84553	0.20901	0.53270	3
1.07353	1.14009	0.98949	0.18928	0.23104	4
1.08633	0.94067	0.74631	0.18944	0.42483	5
0.84652	0.85205	0.84472	0.21742	0.62710	6
0.68862	0.76582	0.93055	0.18891	0.57155	7
0.82875	1.01002	0.93961	0.19385	0.70474	8
0.49464	0.50794	0.61231	0.17767	0.46355	9
0.28825	0.23243	0.23709	0.17567	0.49103	10
0.73872	0.75118	0.26677	0.21318	0.48615	11
0.45191	0.51341	0.37607	0.18157	0.54755	12
0.98433	0.70940	0.60714	0.16131	0.75286	13
0.51332	0.48171	0.54206	0.19426	0.73484	14
0.89936	0.80953	0.81235	0.19658	0.63167	15
0.33552	0.32939	0.27697	0.18747	0.31781	16
0.28219	0.18155	0.15149	0.21195	0.37329	17
0.18670	0.12393	0.32678	0.17621	0.06273	18
0.56947	0.27473	0.27108	0.18332	0.57130	19
0.69431	0.76052	0.56451	0.26026	0.54357	20
1.06953	1.01015	0.65006	0.15863	0.74575	21
0.20594	0.32078	0.37703	0.20105	0.68182	22
0.69133	0.51526	0.55734	0.17723	0.35845	23
0.14013	0.25143	0.33009	0.16746	0.80672	24
0.67927	0.60534	0.31432	0.18003	0.22726	25
0.88186	0.88539	0.58956	0.17804	0.49670	26
0.59828	0.48226	0.62572	0.19511	0.88514	27
0.12696	0.25524	0.33998	0.18984	0.54934	28
0.61106	0.76461	0.43766	0.24617	0.20011	29
0.58828	0.50209	0.35766	0.16775	0.69551	30
0.10057	0.33293	0.22990	0.17619	0.21413	31
0.05316	0.22655	0.08064	0.17859	0.50663	32
0.08340	0.06766	-0.27203	0.22906	0.11675	33
0.49825	0.58642	0.36893	0.18361	0.32204	34
0.35324	0.28141	0.14342	0.19661	0.21951	35
0.11254	0.09857	0.12367	0.19267	0.37197	36
0.10705	0.06171	0.18312	0.19266	0.35890	37
0.26177	0.48341	0.36294	0.17293	0.47233	38
0.84364	0.93140	0.63159	0.28128	0.44331	39
1.25867	0.98442	0.72982	0.18628	0.42058	40
0.32264	0.58143	0.31139	0.16687	0.38200	41
1.02756	0.77625	0.58879	0.21765	0.78452	42
0.75399	0.68288	0.73218	0.21324	0.77785	43

APPENDIX K-3

1972 FORECAST VALUES OF MARKET RISK USING
THE 1971 SUBPERIOD ESTIMATING EQUATION
OF TABLE 6

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.33505	0.40089	0.30023	0.19669	0.09514	1
0.38855	0.55041	0.61355	0.25050	0.52025	2
0.53270	0.49998	0.46900	0.20504	0.29197	3
0.23104	0.44719	0.48007	0.49043	0.81069	4
0.42482	0.42329	0.48511	0.27562	0.34718	5
0.62710	0.50098	0.43693	0.63204	0.87184	6
0.57155	0.158456	0.58872	0.29612	0.65128	7
0.70474	0.42698	0.53774	0.32208	1.03194	8
0.46355	0.47142	0.61141	0.26446	0.60816	9
0.49103	0.43741	0.36514	0.21390	0.13684	10
0.48615	0.49393	0.60518	0.18689	-0.02807	11
0.54755	0.42616	0.52037	0.19361	-0.00492	12
0.75285	0.50359	0.57325	0.20045	0.36778	13
0.73484	0.73964	0.99893	0.25384	1.15029	14
0.63167	0.59216	0.53483	0.18690	0.18578	15
0.31781	0.43738	0.41454	0.20440	-0.03611	16
0.37329	0.28187	0.22509	0.25448	0.01359	17
0.06273	0.25374	0.42607	0.21866	0.47728	18
0.57130	0.46320	0.52724	0.18762	0.17998	19
0.54357	0.52096	0.49613	0.22471	-0.09832	20
0.74575	0.68964	0.66832	0.18214	0.09885	21
0.68182	0.47383	0.51385	0.19588	-0.07870	22
0.35845	0.51794	0.47472	0.19599	0.50861	23
0.80672	0.41476	0.48401	0.20359	0.70155	24
0.22726	0.43217	0.58332	0.20183	0.18665	25
0.49670	0.57714	0.74968	0.19618	-0.30196	26
0.88514	0.67153	0.32335	0.19541	0.36073	27
0.54934	0.37822	0.56750	0.19132	0.25747	28
0.20011	0.41985	0.43962	0.20820	0.39273	29
0.69551	0.62283	0.74447	0.19244	0.11968	30
0.21413	0.56547	0.33149	0.19090	0.16748	31
0.50663	0.41130	0.59290	0.19900	-0.03500	32
0.11675	0.17676	0.20435	0.26041	0.17906	33
0.32204	0.41709	0.43452	0.19439	0.14148	34
0.21951	0.45291	0.58569	0.18427	0.55751	35
0.37197	0.43466	0.35097	0.21853	0.05691	36
0.35890	0.23838	0.46833	0.26781	-0.27953	37
0.47233	0.57370	0.46069	0.21885	0.26981	38
0.44331	0.56093	0.65053	0.59367	0.11046	39
0.42058	0.47983	0.54456	0.20290	0.40702	40
0.38200	0.62194	0.61654	0.18675	0.88779	41
0.78452	0.57171	0.57716	0.21570	-0.05496	42
0.77785	0.67089	0.59762	0.27042	0.47294	43

APPENDIX K-4

1973 FORECAST VALUES OF MARKET RISK USING
THE 1972 SUBPERIOD ESTIMATING EQUATION
OF TABLE 6

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.09514	0.20286	0.30860	0.30534	0.26905	1
0.52025	0.29526	0.02979	0.36636	0.75273	2
0.29197	0.50918	-0.28191	0.35532	0.45237	3
0.81069	0.76871	0.56827	0.31112	0.81946	4
0.34718	0.31646	0.19627	0.29201	0.62427	5
0.87184	0.79489	0.69319	0.39229	1.65747	6
0.65128	0.71561	0.24308	0.36030	0.80218	7
1.03194	0.89275	0.61766	0.35106	1.18386	8
0.60816	0.56959	-0.04186	0.36036	0.62490	9
0.13684	0.13063	0.26192	0.32443	0.11390	10
-0.02807	0.29825	0.21605	0.29049	0.46235	11
-0.00492	-0.12786	0.30712	0.32950	0.45383	12
0.36778	0.24325	0.25428	0.32972	1.13317	13
1.15029	1.09968	0.49349	0.42956	0.73109	14
0.18578	0.10392	0.27377	0.33465	0.60267	15
-0.03611	0.06215	0.33235	0.26904	0.58333	16
0.01359	0.01510	0.59850	0.81850	0.16662	17
0.47728	0.20235	0.44494	0.39069	0.70953	18
0.17998	0.17873	0.68657	0.40590	0.55903	19
-0.09832	0.26406	0.60947	0.37245	0.55404	20
0.09885	0.44094	0.92665	0.33726	0.45583	21
-0.07870	0.14922	0.20905	0.31640	0.58636	22
0.50861	0.23454	0.24851	0.36815	0.70594	23
0.70155	0.41980	0.29205	0.30135	0.62388	24
0.18664	0.18585	0.39305	0.34995	1.03801	25
-0.30196	0.07559	0.00366	0.35243	0.92978	26
0.36073	0.23181	0.15741	0.42744	0.20884	27
0.25747	0.13599	0.11341	0.32383	0.62482	28
0.39273	0.26893	0.53104	0.31952	0.48184	29
0.11968	0.51791	0.28945	0.26948	0.76920	30
0.16748	-0.06815	0.04022	0.25559	0.21225	31
-0.03500	0.35211	0.37315	0.44448	0.74177	32
0.17905	0.26177	0.19412	0.39057	0.20126	33
0.14148	0.17126	0.22528	0.25681	0.47718	34
0.55751	0.28291	0.19220	0.27718	0.52834	35
0.05691	0.02319	0.07772	0.26537	0.16541	36
-0.27953	-0.02943	0.18254	0.28226	0.36899	37
0.26981	0.35279	1.21169	0.81281	1.04194	38
0.11046	0.18628	0.07557	0.35606	0.75768	39
0.40702	0.28071	0.35041	0.30858	0.81541	40
0.88779	0.24335	0.30067	0.37003	0.70824	41
-0.05496	0.10685	0.18746	0.34340	0.82447	42
0.47294	0.33938	0.29459	0.28579	0.76553	43

APPENDIX L

SUMMARY REGRESSION MEASURES
POOLED OBSERVATIONS^a

Total Sum of Squares	25.618
Regression Sum of Squares	11.530
Sum of Squared Residuals	14.087
F-Statistic for Significance of All Coefficients: F(4,210)	42.972
Standard Error of the Estimate	0.259
Multiple R ²	0.450
Multiple $\bar{R}^2$	0.439
Durbin-Watson Statistic	1.779
Sum of Residuals	-0.711 x 10 ⁻⁴
% of Residuals Within One Standard Error of Zero	72.558
% of Residuals Within Two Standard Errors of Zero	94.418
% of Residuals Within Three Standard Errors of Zero	99.534

^aThese summary measures are for the pooled estimating equation presented in Table 9.

APPENDIX M

SUMMARY REGRESSION MEASURES
DUMMY VARIABLES^a

Total Sum of Squares	25.618
Regression Sum of Squares	15.407
Sum of Squared Residuals	10.210
F-Statistic for Significance of All Coefficients: F(24,190)	11.945
Standard Error of the Estimate	0.231
Multiple R ²	0.601
Multiple $\bar{R}^2$	0.551
Durbin-Watson Statistic	2.079
Sum of Residuals	-0.589 x 10 ⁻⁵
% of Residuals Within One Standard Error of Zero	75.813
% of Residuals Within Two Standard Errors of Zero	96.279
% of Residuals Within Three Standard Errors of Zero	99.534

^aThese summary measures are for the dummy variables estimating equation presented in Table 10.

APPENDIX N-1

SUMMARY REGRESSION MEASURES
1969 SUBPERIOD^a

Total Sum of Squares	6.695
Regression Sum of Squares	3.702
Sum of Squared Residuals	2.993
F-Statistic for Significance of All Coefficients: F(4,38)	11.748
Standard Error of the Estimate	0.281
Multiple R ²	0.553
Multiple $\bar{R}^2$	0.506
Durbin-Watson Statistic	1.742
Sum of Residuals	-0.162 x 10 ⁻⁷
% of Residuals Within One Standard Error of Zero	81.395
% of Residuals Within Two Standard Errors of Zero	95.349
% of Residuals Within Three Standard Errors of Zero	100.000

^aThe summary regression measures in Appendixes N-1 through N-5 are for the subperiod estimating equations of the MR Model as presented in Table 11.

APPENDIX N-2

SUMMARY REGRESSION MEASURES
1970 SUBPERIOD

Total Sum of Squares	5.101
Regression Sum of Squares	3.758
Sum of Squared Residuals	1.343
F-Statistic for Significance of All Coefficients: $F(4,38)$	26.574
Standard Error of the Estimate	0.188
Multiple R^2	0.737
Multiple $\bar{R}^2$	0.709
Durbin-Watson Statistic	2.436
Sum of Residuals	-0.182×10^{-5}
% of Residuals Within One Standard Error of Zero	69.767
% of Residuals Within Two Standard Errors of Zero	95.349
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX N-3

SUMMARY REGRESSION MEASURES
1971 SUBPERIOD

Total Sum of Squares	1.678
Regression Sum of Squares	0.330
Sum of Squared Residuals	1.348
F-Statistic for Significance of All Coefficients: $F(4,38)$	2.326
Standard Error of the Estimate	0.188
Multiple R^2	0.197
Multiple $\bar{R}^2$	0.112
Durbin-Watson Statistic	2.218
Sum of Residuals	0.529×10^{-6}
% of Residuals Within One Standard Error of Zero	67.442
% of Residuals Within Two Standard Errors of Zero	97.674
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX N-4

SUMMARY REGRESSION MEASURES
1972 SUBPERIOD

Total Sum of Squares	4.792
Regression Sum of Squares	1.402
Sum of Squared Residuals	3.390
F-Statistic for Significance of All Coefficients: $F(4,38)$	3.930
Standard Error of the Estimate	0.299
Multiple R^2	0.293
Multiple $\bar{R}^2$	0.218
Durbin-Watson Statistic	2.171
Sum of Residuals	-0.352×10^{-5}
% of Residuals Within One Standard Error of Zero	74.419
% of Residuals Within Two Standard Errors of Zero	95.349
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX N-5

SUMMARY REGRESSION MEASURES
1973 SUBPERIOD

Total Sum of Squares	3.912
Regression Sum of Squares	2.775
Sum of Squared Residuals	1.137
F-Statistic for Significance of All Coefficients: $F(4,38)$	23,192
Standard Error of the Estimate	0.173
Multiple R^2	0.709
Multiple $\bar{R}^2$	0.679
Durbin-Watson Statistic	2.005
Sum of Residuals	-0.829×10^{-6}
% of Residuals Within One Standard Error of Zero	67.442
% of Residuals Within Two Standard Errors of Zero	97.674
% of Residuals Within Three Standard Errors of Zero	100.000

APPENDIX O-1

1970 FORECAST VALUES OF MARKET RISK USING
THE 1969 SUBPERIOD ESTIMATING EQUATION
OF TABLE 11

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.61510	0.58146	0.71481	0.29185	0.76748	1
1.17145	1.06286	1.07085	0.30337	0.77473	2
1.10299	1.02698	1.06955	0.36767	1.34755	3
1.00102	1.21626	1.25081	0.32560	1.07353	4
1.28780	1.08279	1.04873	0.31049	1.08633	5
1.38465	1.13573	1.14935	0.32550	0.84652	6
0.79670	0.86920	0.98275	0.31126	0.68862	7
0.80395	0.97728	1.10930	0.30530	0.82875	8
0.34528	0.80600	0.65150	0.33589	0.49465	9
0.34172	0.52529	0.33066	0.31486	0.28825	10
0.63854	0.80920	0.96264	0.35698	0.73872	11
0.38020	0.39809	0.46146	0.31933	0.45191	12
0.88189	0.83603	0.68988	0.30931	0.98433	13
0.69379	0.50946	0.47542	0.31256	0.51332	14
0.66171	0.44886	0.55027	0.31534	0.89936	15
0.22987	0.27303	0.44366	0.29764	0.33552	16
0.15193	0.36495	0.19894	0.31614	0.28219	17
0.32843	0.49349	0.22399	0.35119	0.18670	18
0.70005	0.54066	0.38761	0.30996	0.56947	19
1.17534	0.83754	0.79838	0.33835	0.69432	20
1.07085	0.56974	0.78548	0.35262	1.06953	21
0.45542	0.59641	0.25868	0.30258	0.20595	22
0.44881	0.35604	0.53228	0.30533	0.69133	23
0.31421	0.48629	0.18370	0.32438	0.14013	24
0.44180	0.48747	0.51308	0.30645	0.67927	25
0.71395	0.66182	0.52545	0.31640	0.88186	26
0.55849	0.40534	0.38028	0.30013	0.59828	27
0.34843	0.55280	0.18998	0.42700	0.12696	28
-0.10135	0.19766	0.38216	0.39926	0.61106	29
0.67205	0.63885	0.65679	0.29896	0.58828	30
0.60566	0.41954	0.45596	0.30194	0.10057	31
0.12761	0.19659	0.22025	0.31984	0.05316	32
0.32339	0.15735	-0.00756	0.33773	0.08340	33
0.76973	0.76631	0.73426	0.30918	0.49825	34
0.46719	0.35529	0.32336	0.31340	0.35324	35
0.10147	0.33053	-0.02693	0.35752	0.11254	36
0.63814	0.12264	0.02914	0.35175	0.10705	37
0.58945	0.36119	0.35336	0.36753	0.26177	38
1.05141	1.10225	1.16922	0.33756	0.84364	39
1.37891	0.95268	0.90174	0.32659	1.25867	40
-0.14156	0.47095	0.62827	0.31821	0.32264	41
-0.00780	0.80787	0.81272	0.33499	1.02756	42
1.31495	1.04288	0.87411	0.32030	0.75399	43

APPENDIX O-2

1971 FORECAST VALUES OF MARKET RISK USING
THE 1970 SUBPERIOD ESTIMATING EQUATION
OF TABLE 11

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.76748	0.67427	0.56570	0.19897	0.33505	1
0.77473	0.88227	0.70148	0.21891	0.38856	2
1.34755	1.08384	0.66883	0.23291	0.53270	3
1.07353	1.07712	0.81724	0.21629	0.23104	4
1.08633	0.91795	0.63363	0.22231	0.42483	5
0.84652	0.92222	0.93593	0.21841	0.62710	6
0.68862	0.79371	0.86315	0.21454	0.57155	7
0.82875	0.93658	0.77810	0.21809	0.70474	8
0.49464	0.59065	0.69136	0.20773	0.46355	9
0.28825	0.24602	0.23608	0.21198	0.49103	10
0.73872	0.93545	0.34367	0.20599	0.48615	11
0.45191	0.54795	0.33249	0.21731	0.54755	12
0.98433	0.73898	0.61747	0.19532	0.75286	13
0.51332	0.49093	0.45825	0.21916	0.73484	14
0.89936	0.58832	0.39920	0.19963	0.63167	15
0.33552	0.43993	0.26527	0.21959	0.31781	16
0.28219	0.18610	0.18728	0.21281	0.37329	17
0.18670	0.33252	0.38277	0.20013	0.06273	18
0.56947	0.38985	0.23544	0.21036	0.57130	19
0.69431	0.76707	0.59923	0.20486	0.54357	20
1.06953	0.92226	0.57308	0.19379	0.74575	21
0.20594	0.24543	0.36683	0.19751	0.68182	22
0.69133	0.59683	0.43410	0.20773	0.35845	23
0.14013	0.12614	0.27431	0.20123	0.80672	24
0.67927	0.60321	0.33489	0.20123	0.22726	25
0.88186	0.61366	0.43639	0.20583	0.49670	26
0.59828	0.39660	0.62765	0.19874	0.88514	27
0.12696	0.19424	0.32046	0.22665	0.54934	28
0.61106	0.66048	0.38481	0.22185	0.20011	29
0.58828	0.58752	0.47278	0.20288	0.69551	30
0.10057	0.49196	0.29678	0.20936	0.21413	31
0.05316	0.25365	0.12449	0.21408	0.50663	32
0.08340	0.00414	-0.23563	0.27395	0.11675	33
0.49825	0.75292	0.49670	0.19832	0.32204	34
0.35324	0.26159	0.18925	0.21132	0.21951	35
0.11254	0.03537	0.06422	0.23450	0.37197	36
0.10705	0.07088	0.00440	0.22413	0.35890	37
0.26177	0.58903	0.49665	0.20076	0.47233	38
0.84364	0.99120	0.64678	0.23354	0.44331	39
1.25867	0.90311	0.54427	0.19999	0.42058	40
0.32264	0.73485	0.50255	0.19511	0.38200	41
1.02756	0.83895	0.64040	0.20803	0.78452	42
0.75399	0.80562	0.78159	0.21608	0.77785	43

APPENDIX O-3

1972 FORECAST VALUES OF MARKET RISK USING
THE 1972 SUBPERIOD ESTIMATING EQUATION
OF TABLE 11

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.33505	0.51388	0.37519	0.20736	0.09514	1
0.38855	0.57693	0.59630	0.20595	0.52025	2
0.53270	0.59144	0.55092	0.23464	0.29197	3
0.23104	0.54642	0.54108	0.22060	0.81069	4
0.42482	0.50342	0.55312	0.23658	0.34718	5
0.62710	0.61437	0.57270	0.23824	0.84184	6
0.57155	0.64181	0.64142	0.22449	0.65128	7
0.70474	0.52938	0.57213	0.21236	1.03194	8
0.46355	0.52269	0.61942	0.21820	0.60816	9
0.49103	0.40388	0.31553	0.22497	0.13684	10
0.48615	0.46175	0.56966	0.20715	-0.02807	11
0.54755	0.48063	0.48349	0.20705	-0.00492	12
0.75285	0.55100	0.57583	0.21220	0.36778	13
0.73484	0.53913	0.85661	0.35458	1.15029	14
0.63167	0.47446	0.41296	0.19972	0.18578	15
0.31781	0.46338	0.43236	0.23731	-0.03611	16
0.37329	0.42011	0.33026	0.22389	0.01359	17
0.06273	0.48602	0.57229	0.24272	0.47728	18
0.57130	0.39034	0.43399	0.19940	0.17998	19
0.54357	0.50752	0.47478	0.20625	-0.09832	20
0.74575	0.55616	0.52834	0.19765	0.09885	21
0.68182	0.47560	0.47487	0.19563	-0.07870	22
0.35845	0.48129	0.37821	0.20223	0.50861	23
0.80672	0.43957	0.49866	0.20144	0.70155	24
0.22726	0.45551	0.51881	0.20312	0.18665	25
0.49670	0.46607	0.56288	0.24338	-0.30196	26
0.88514	0.62274	0.46815	0.19484	0.36073	27
0.54934	0.38511	0.46900	0.20361	0.25747	28
0.20011	0.50221	0.50411	0.21320	0.39273	29
0.69551	0.44759	0.53871	0.21195	0.11968	30
0.21413	0.43595	0.42007	0.19616	0.16748	31
0.50663	0.34703	0.51162	0.20326	-0.03500	32
0.11675	0.22184	0.27764	0.23577	0.17906	33
0.32204	0.47136	0.45911	0.19977	0.14148	34
0.21951	0.36777	0.49176	0.19766	0.55751	35
0.37197	0.33499	0.25890	0.23105	0.05691	36
0.35890	0.34291	0.50201	0.23268	-0.27953	37
0.47233	0.60635	0.47464	0.21093	0.26981	38
0.44331	0.43346	0.50977	0.22736	0.11046	39
0.42058	0.49427	0.54137	0.20269	0.40702	40
0.38200	0.53254	0.49098	0.20184	0.88779	41
0.78452	0.56822	0.54233	0.20926	-0.05496	42
0.77785	0.62211	0.55605	0.20972	0.47294	43

APPENDIX O-4

1973 FORECAST VALUES OF MARKET RISK USING
THE 1972 SUBPERIOD ESTIMATING EQUATION
OF TABLE 11

Naive Beta	IV Model Beta	MR Model Beta	MR Model SEE	Actual Beta	Projec- tion
0.09514	0.19605	0.21070	0.30910	0.26905	1
0.52025	0.45639	0.66506	0.34036	0.75273	2
0.29197	0.36138	0.34284	0.33129	0.45237	3
0.81069	0.51966	0.65575	0.35793	0.81946	4
0.34718	0.48025	0.60526	0.35048	0.62427	5
0.87184	0.48532	0.84927	0.44175	1.65747	6
0.65128	0.58238	0.47367	0.33747	0.80218	7
1.03194	0.49059	0.65323	0.37193	1.18386	8
0.60816	0.53692	0.41947	0.33434	0.62490	9
0.13684	0.03290	0.21675	0.34535	0.11390	10
-0.02807	0.28187	0.24713	0.33688	0.46235	11
-0.00492	0.23144	0.39296	0.34605	0.45383	12
0.36778	0.38270	0.59851	0.35836	1.13317	13
1.15029	0.86248	0.96931	0.52816	0.73109	14
0.18578	0.20246	0.29156	0.30639	0.60267	15
-0.03611	0.19557	0.38949	0.33481	0.58333	16
0.01359	-0.07451	0.41150	0.47105	0.16662	17
0.47728	0.21413	0.55904	0.44427	0.70953	18
0.17998	0.21888	0.42990	0.33800	0.55903	19
-0.09832	0.35656	0.62960	0.33456	0.55404	20
0.09885	0.37611	0.54429	0.33893	0.45583	21
-0.07870	0.20513	0.45098	0.34369	0.58636	22
0.50861	0.13823	0.53004	0.36750	0.70594	23
0.70155	0.14777	0.22947	0.32310	0.62388	24
0.18664	0.24052	0.49998	0.38962	1.03801	25
-0.30196	0.29662	0.50274	0.36948	0.92978	26
0.36073	0.18138	0.21904	0.38710	0.20884	27
0.25747	0.17967	0.38117	0.33980	0.62482	28
0.39273	0.36244	0.40354	0.34877	0.48184	29
0.11968	0.35935	0.45417	0.32602	0.76920	30
0.16748	0.17208	0.18003	0.31475	0.21225	31
-0.03500	0.25156	0.70792	0.45496	0.74177	32
0.17905	-0.04620	-0.03048	0.33820	0.20126	33
0.14148	0.24837	0.30330	0.31091	0.47718	34
0.55751	0.32536	0.27195	0.31491	0.52834	35
0.05691	-0.01592	0.15143	0.33986	0.16541	36
-0.27953	0.18036	0.09867	0.35950	0.36899	37
0.26981	0.08900	0.82243	0.51186	1.04194	38
0.11046	0.47440	0.54360	0.35673	0.75768	39
0.40702	0.44432	0.62077	0.33426	0.81541	40
0.88779	0.23390	0.50603	0.37283	0.70824	41
-0.05496	0.34771	0.69141	0.36187	0.82447	42
0.47294	0.49361	0.58181	0.33260	0.76553	43