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A RE-EXAMINATION OF
STOCK-MARKET RISK

by

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ABSTRACT

The purpose of the research undertaken in this thesis is two-fold: a) to test the relationship between a security analyst's perception of risk based upon financial statement data and overall market return and b) to determine the relationship between the practitioners concept of risk and risk as outlined in the literature. The main data sources for the thesis were the Financial Post computer tape from which "accounting" measures of risk were derived and stock exchange price quotations from which "economic" or "traditional" risk measures were determined. "Accounting" measures of risk considered included the coefficient of variation, standard deviation and mean-absolute deviation of the earnings stream variables, net operating income, net income and net income plus depreciation. The "traditional" or "economic" measures computed were the standard deviation of return and the beta coefficient or volatility index. Arguments were then presented for the relevance of each measure in describing stock market risk.

To determine any relationship among various risk measures, a correlation and sectoral analysis was undertaken. The correlation analysis indicated a significant relationship existed among <u>certain</u> "accounting" and "economic" risk measures and in general, this relationship was supported by the sectoral analyses.

To indicate the relationship among the risk measures and overall return, a graphical analysis was undertaken. Mixed results were obtained in this analysis, with certain measures of risk displaying a more significant risk/return relationship than did others.

Thus, it appears that there does exist some degree of association between "accounting" and "traditional" measures of risk as indicated by the analyses undertaken in this thesis. What the literature is measuring as risk could possibly then be a reflection of what the security analyst views as stock market risk. However, there may be other factors which play an important role in the practitioners formation of risk estimates, factors which are, as of yet, non-quantifiable.

F. J. Brooks-Hill, Chairman

ACKNOWLEDGEMENTS

This thesis would not have been attempted nor completed were it not for the inspiration, guidance and encouragement given me by my thesis advisor, Professor F. J. Brooks-Hill. His counsel and advice were, at times, badly needed.

In addition, the assistance of Mr. Koit Teng, Senior Analyst at the U.B.C. Computing Centre in helping to develop the necessary computer programmes applicable in this research, is not to be underestimated. Further, Miss Catherine Giles worked patiently and consistently over one summer in the most tedious task of collecting stock price data.

To all of the above, I owe a considerable debt of gratitude and last, but certainly not least, I wish to thank a most favourite "school teacher" from Penticton who I'm sure, would prefer to remain anonymous at this stage. Her unfathomable diligence, encouragement and optimism provided me with much of the moral support necessary to complete this thesis, especially during the latter stages. To quote a good friend, she also "deserves all the happiness the world can hold."

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CHAPTER I

INTRODUCTION AND BACKGROUND

A. Focus of Research

This thesis reviews and tests the hypothesis that security analysts or practitioners perceive risk associated with an individual security in the stock market by reference to accounting or financial statement data. The traditional measure of risk in the literature has been the variance or dispersion of individual security returns around the mean. A more recent concept of risk is the beta coefficient or volatility index. (These measures will be discussed more fully later in this and the following chapters.)

The purpose of this thesis is then two-fold: a) to test the relationship between the analyst's perception of risk from accounting data and overall market return - i.e. the risk/return tradeoff, and b) to determine the relationship between the practitioner's concept of risk and risk as outlined in the literature - i.e. a comparison of risk measures. If a relationship is found between accounting and economic measures of risk, this thesis postulates that the traditional measures of risk are merely reflections of the impact of security analyst or practitioner perceptions upon the actions of investors in the stock market.

B. Background

The research undertaken in effect constitutes a re-examination of the concept of stock-market risk, with reference to the actions of the participants themselves. When one talks to these practitioners, they appear very reluctant to discuss risk in terms that the literature seems to suggest - i.e. they disclaim any knowledge of a conscious effort to consider risk by reference to the dispersion or variance of security returns about the mean. Nor for that matter, do they consider any other measure of return dispersion. The question then becomes: What, in fact, do they consider in their asset selection procedures? On the other hand, it did seem evident that they were at least aware of risk in that they will not accept extremely risky investments but will accept some degree of risk or uncertainty inherent in particular investments. The best evidence of risk averse investment behavior is that portfolio managers tend to hold more securities than would be defensible in light of capital market imperfections. Therefore, one may conclude that they turn to diversification as a means of reducing risk. Thus it seems that at least inherently the practitioners by their actions consider some degree of risk associated with a particular asset.

i) Questions Raised

How do practitioners or fund managers estimate the risk associated with particular securities comprising their portfolio? Upon what do portfolio managers base their decisions as to the certainty of return for an individual security? How confident are they in their estimates once they are formed?

In order to estimate a confidence level for a particular security's expected return, it may be worthwhile to examine the underlying components of the informational process upon which fund managers base their decisions. It appears that this information is derived from three sources: the reports of security analysts; what the portfolio managers hear from other people on the street or in the market place (for convenience "street talk"); and finally, their own personal biases.

Assuming that "street talk" is influenced by analysts' findings and randomly generated rumors and that personal biases are randomly distributed across the market, the focus of this study is limited solely to the accounting information available to the analyst. Thus, the problem essentially becomes one of determining what the analyst considers in forming his estimate of the value of the security which he is currently analysing. First of all, an analysis of the firms past financial history is undertaken by reference to company financial statements. Based upon this information, the analyst then forms expectations as to the future financial conditions of the particular enterprise in the light of expectations of the overall economy, the industry in which the firm is situated and the future management of the company. From his analyses, the security analyst is able to form expectations as to the future earnings power of the business and attaches, either consciously or unconsciously, a degree of certainty to his predictions.

Essentially, the question becomes two-fold: how does the analyst form a measure of risk and upon what bases does he generate a degree of confidence in his forecast? It appears that one of these bases concerns the management of the company and the analyst's in-depth interviews with them. This, of course, is not quantifiable. Another base mentioned previously may be that the analyst in some way intuits estimates of the future financial position of the firm when he investigates its financial history. In this case, it appears reasonable that one of the variables that the analyst may consider is the variance or fluctuations of the earnings stream since ultimately it is the net income that accrues to the owners (equity shareholders).

The stability (or volatility) of the earnings stream of a particular company may be conceptualized in a variety of ways, all by reference to the firms financial statement data. Reported net income (NI) is one way. However, this figure may not be that relevant due, *inter alia*, to the fluctuations caused by debt repayment, extraordinary gains and losses and so forth. Net operating income (NOI) may be more appropriate. In addition, as a proxy for cash flows, net income plus depreciation (NI + D) may be considered. From a statistical point of view, measures of dispersion such as the standard deviation(or variance) of individual returns about their mean, the mean-absolute deviation and coefficient of variation for each of these earnings-stream variables may be easily computed. It may be that if a security analyst were to utilize these measures that he could form an estimate of the risk associated with the return of an individual security. Asset selection procedures can be greatly simplified by this technique. Figure 1 illustrates diagrammatically the informational flow upon which practitioners may base their decisions and in addition, outlines possible interrelationships between "accounting" and "traditional" measures of risk. It is fairly straightforward and no explanation is required.

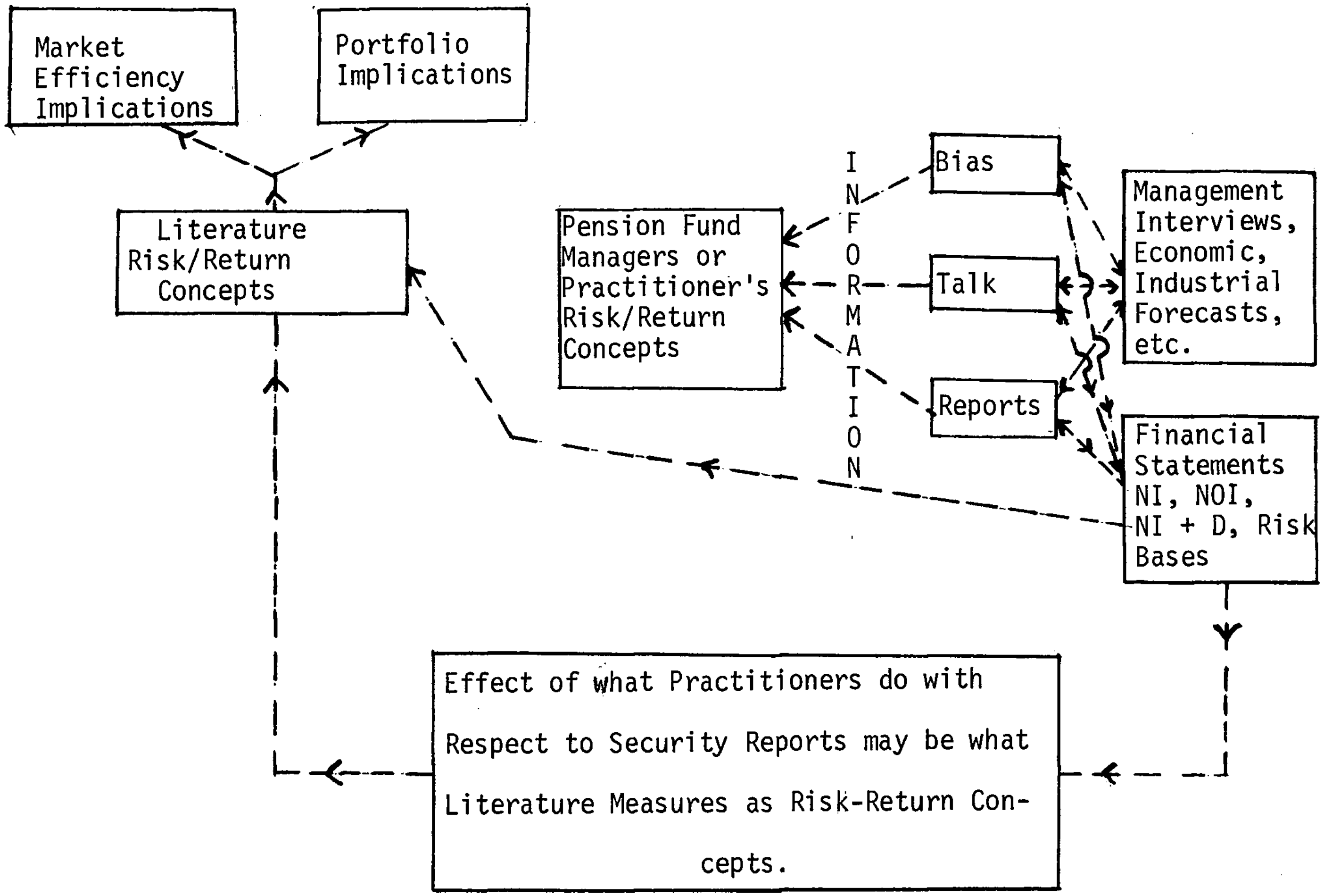

FIGURE 1. RISK/RETURN RELATIONSHIPS AND INTERRELATIONSHIPS BETWEEN ECONOMIC AND ACCOUNTING MEASURES

In summary, the central hypothesis underlying this thesis is that risk is perceived by practitioners in the market place in a very different manner than is suggested by the literature. It is the dual purpose of this thesis to examine the risk/return tradeoff utilizing the "new" measures of risk (based on the variability of a firms earnings stream over time) as well as to compare these "new" measures with the traditional concepts of risk as outlined in the literature. If the relationship is fairly close, it may well be that what the literature is viewing as risk is really the effect of what the practitioners intuit as risk. This point will be more fully developed later in this thesis.

C. Format of Thesis

The layout of a thesis is largely a matter of personal choice. This thesis shall take the following form: Chapter I dealt mainly with the purpose(s) of the proposed research along with a brief background as to how the research came to mind. Hypotheses will be explained and relationships to be tested outlined. Chapter II describes the data sources for the project and in addition, discusses the methodology to be undertaken. Computational equations are developed with respect to calculating the various "accounting" and "traditional" measures of stock-market risk. In Chapter III, tests and results of relationships among the various risk measures developed in the previous chapter are outlined and Chapter IV deals with an analysis of the risk/return relationships for the various risk measures previously discussed. Finally, Chapter V presents the conclusions and results of analyses undertaken and suggests areas of future research. Appendix tables follow the final chapter and are referred to extensively throughout the thesis.

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CHAPTER II

DATA AND METHODOLOGY

This chapter is divided into two main sections: 1) the data, and 2) methodology. The first section deals with sources of data, relevance of the time period and the development of the ultimate sample to be utilized in the analyses. The second section, methodology, presents the actual computational equations for each of the "traditional" as well as "accounting" measures of risk plus relevant assumptions underlying each measure.

A. The Data

Data sources utilized for this research can be subdivided into two components: the data necessary for determining the "accounting" measures of risk and the data necessary for calculating the "traditional" risk measures.

i) Accounting Data

In determining the "accounting" measures of risk the Financial Post Computer Services Library tape was utilized for three reasons: 1) ease of access, 2) readily available financial statement figures, and 3) a fairly representative time period (1958-67) over which financial statement figures were available. Essentially this "library" consists of 68 data items on an annual basis for 279 Canadian firms, ranging from standard balance sheet and income statement figures to various adjustments for accounting changes, tax losses, stock splits and share-volume outstanding.

For the purposes of this thesis, of particular interest were the annual figures of net operating income, net income and depreciation for each firm. As mentioned previously, the net income figure may not be that accurate since it might reflect extraordinary items and the like. Accordingly, this figure was adjusted for non-recurring items as well as changes in accounting practice to allow for relevant comparisons with other measures.

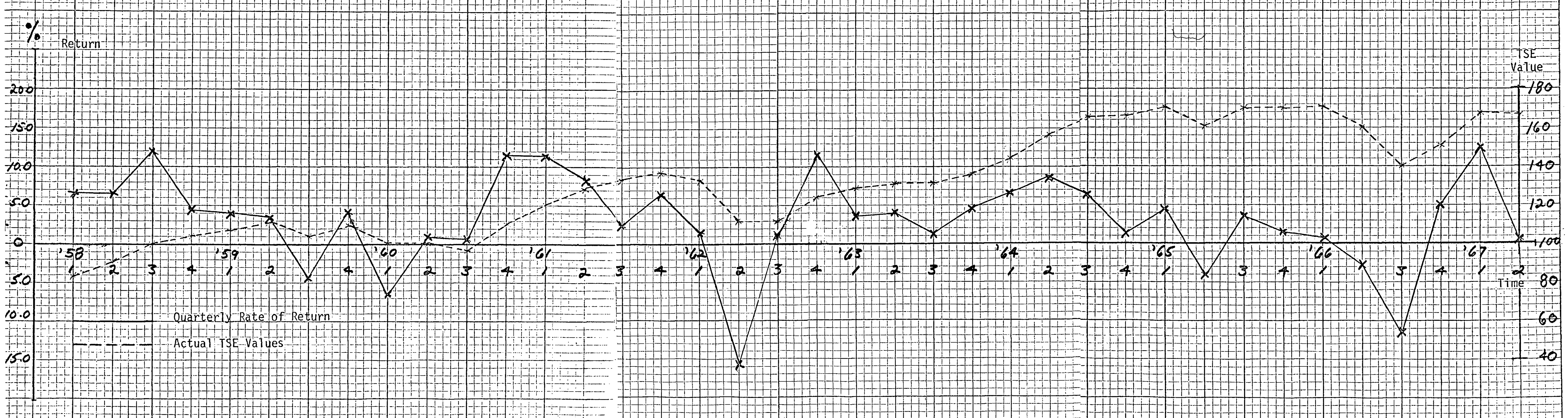
Since it is desirable to compute the "accounting" measures of risk with the most complete information available, those firms having quite sparse financial data (i.e. less than seven annual figures for NOI, NI, and NI $\pm$ D) were eliminated from the initial sample. The sample was now reduced to 224 upon which to carry out analyses of price and dividend behavior over the ten-year period. The financial figures of the companies remaining in the sample given by the Financial Post tape were then checked, on a random basis against the actual annual reports and no significant deviations were noted in the comparisons. Hence, the remaining sample of 224 firms was then considered in order to develop the "traditional" measures of risk as outlined in the literature.

ii) Stock Price Data

As the "traditional" risk measures are based upon both individual and market returns (of which price and dividend figures are the two components), quarterly prices and dividends were collected over the period December, 1957 to December, 1967. Most of this data was obtained from various issues of the Toronto Stock Exchange (TSE) Review, although some firm quotations were found in the Montreal and Vancouver Exchange periodicals. Also computed were the quarterly "market" rate of return figures based upon the TSE composite industrial index and quarterly "risk-free" rates of return based on 90-day Treasury Bill yields. Tables 1 and 2, Appendix A present these values, the significance of which shall become apparent later in this chapter. Figure 2 following, graphs the quarterly rates of market return over the ten-year period and as can be seen, the time span is sufficiently long to eliminate any bias that may result when the stock market is in either a "bull" or "bear" position. Also any firms having less than seven complete years of price and dividend data were eliminated from the sample. In addition where data was lacking for only two or three consecutive quarters and could not be extrapolated based upon previous months figures, these firms also were dropped out of the sample. Based upon this screening procedure, the ultimate sample used throughout this research fell to 114 companies which represented firms listed upon the Toronto, Montreal or Vancouver Stock Exchanges. A complete listing of firms represented in the sample is contained in Table 1, Appendix E.

In summary then, the data for the proposed research encompassed the period 1958-1967 and consisted of a sample of 114 firms, complete with respect to NOI, NI and NI + D data as well as quarterly prices and dividends. "Market" and "risk-free" rates of return were also computed. In the following section of this chapter, the discussion focuses upon the methodology involved in the actual analysis of the data.

FIGURE 2. MOVEMENT OF TSE INDEX, ACTUAL AND RETURN BY QUARTER, 1958 to 2nd QUARTER 1967



Source: TSE Review, Various issues. For particular values of rate of return, see Table 2, Appendix A.

B. The Methodology

The first step undertaken was to calculate both the "traditional" and "accounting" measures of risk. The computational equations utilized in the determination of these measures as well as some of the relevant assumptions inherent in their derivation are described below.

However, before discussing these measures it is useful to outline the methodology involved in computing the return per quarter for an individual stock as these figures play a crucial role in the development of the two traditional measures.

Formula 1 defines return (expressed as a percentage) as consisting primarily of capital appreciation plus dividends:[1]

$$R_{jt} = \frac{P_c - P_o}{P_o} + \frac{D_{jt}}{P_o} \qquad (1) \qquad \begin{array}{l} j = 1 \ . \ . \ . \ 114 \text{ stocks} \\ t = 1 \ . \ . \ . \ 40 \text{ quarters} \end{array}$$

where: R_{jt} = return on j^{th} stock for t^{th} quarter,

D_{jt} = dividend on j^{th} stock for t^{th} quarter,

P_c = closing price of stock at end of quarter,

P_o = opening price of stock at beginning of quarter or previous quarter's closing price.

From a total of 41 prices and dividends per firm over the ten-year period, 40 quarterly returns were calculated using Formula 1. These 40 returns are then used in calculating the variance or standard deviation of return upon which attention shall now be focused.

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[1]For the purposes of this thesis, all prices and dividends have been adjusted for stock splits and stock dividends.

i) "Traditional" Measures of Risk

In the literature, the two most common measures of risk associated with an individual security are the variance or standard deviation or return and the beta coefficient or volatility index.

a) Standard Deviation of Return

The standard deviation or variance of return about the mean is calculated in accordance with Formula 2:

$$V_{Rj} = \frac{\sum_{i=1}^{40} Rij^2}{n} - \left[\frac{\sum_{i=1}^{40} Rij}{n}\right]^2 \quad \text{or} \quad s_{Rj} = \left[V_{Rj}\right]^{1/2} \qquad (2)$$

$i = 1 \; . \; . \; . \; . \; 40$ quarters,

$j = 1 \; . \; . \; . \; . \; 114$ stocks

where: V_{Rj} = variance of return of j^{th} stock over entire period,

Rij = return on j^{th} stock in the i^{th} quarter,

n = sample size, i.e. 40 quarters, and

s_{Rj} = standard deviation of return of j^{th} stock over entire period.

The greater the standard deviation or variance of return about the mean value, the greater the risk associated with that particular security. Table 1, Appendix B shows the various standard deviations per coded stock over the ten-year period. Variance of return is not reported as it is simply the square of the standard deviation and such a small number is not that meaningful in this context.

Considering the appropriateness of the standard deviation as a measure of risk, several disadvantages may be pointed out: a) returns and underlying stock prices are assumed to be normally distributed; b) a measure of downside risk instead of both the upside and downside liability as variance measures may be more relevant - in other words, semivariance is more appropriate; and c) variance is an absolute amount when a relative figure may be more desirable. However, these arguments against the use of variance or standard deviation may be countered as follows. With respect to the first criticism, that of non-normality of underlying distributions, if a distribution is "normal," only the first two moments - the mean and variance - are needed to completely describe the distribution. Higher moments such as skewness and kurtosis (third and fourth moments respectively) are not of use since the normal distribution is neither skewed nor abnormally peaked. Even when the underlying distribution is not normal, evidence has shown that the distribution of returns is a special type of stable Paretian distribution which has the important property of stability under addition.[2] In addition, Fama and Roll have pointed out that in assuming normality, no serious aberrations in the results will appear.[3]

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[2]See for example, Eugene F. Fama, "Portfolio Analysis in a Stable Paretian Market," Management Science, Vol. 11, January 1965, pp. 404-419; and Benoit Mandlebrot, "The Variation of Speculative Prices," Journal of Business, Vol. 36, October 1963, pp. 394-419.

[3]Eugene Fama, "The Behavior of Stock-Market Prices," Journal of Business, Vol. XXXVIII (January 1965), pp. 34-105; and Richard Roll, "The Efficient Market Model Applied to U. S. Treasury Bill Rates," Unpublished Ph.D. thesis, Graduate School of Business, University of Chicago, 1968. See also E. F. Fama and R. Roll, "Some Properties of Symmetric Stable Distributions," Journal of the American Statistical Association, Vol. 63, September 1968, pp. 817-36.

The argument for the use of semi-variance and not variance, raises three points: a) in developing an appropriate risk measure, it seems natural to consider both the deviations above and below the mean return rather than simply the ones below (the negative deviations) - compare a capital budgeting problem where only the "costs" are considered instead of both costs and benefits; b) there is a greater statistical "familiarity" with the standard deviation measure; and c) although not necessarily the case, there are additional costs involved in calculating the semi-variance and from a practical standpoint at least, these may be prohibitive. Further, it is unclear, at least to this author that most distributions, given a large enough sample, are sufficiently different from symmetrical to warrant the use of the semi-variance technique.

The third criticism suggesting that a relative concept as opposed to the absolute variance or standard deviation figure is desirable, emphasizes use of the coefficient of variation (standard deviation divided by the mean) to eliminate the magnitude problem. However, in this case, since return is measured in price relatives, the same effect is achieved and there is no need to consider the coefficient of variation.

Thus, one of the "traditional" measures of risk associated with a particular security employed in this thesis is the standard deviation (or variance) of security returns. Evidence was presented why this is not an unwise choice.

b) The Beta Coefficient

In addition to the standard deviation or variance of return, another "traditional" measure of the risk associated with a particular security is the "beta coefficient" or "volatility index," developed most notably by Markowitz and Sharpe.[4] Basically, this model asserts that the return of an individual security can be broken down into two elements, a market or systematic component, reflecting a comovement of the individual security's return with that of the average return of all other securities in the market and an individualistic or unsystematic element which moves independently of the market return and is unique to the individual security. Examples of the latter component affecting a security's return might well include a cut in dividends, a strike, worker attitudes, management abilities and other factors unique to the firm or the industry. In a portfolio context, it is argued that the risk associated with this individualistic component of security return can be diversified away with the result that all the covariance between security returns is due to a single common market factor. Algebraically, this market model may be presented as Formula 3 below:

$$\tilde{R}_{jt} = \alpha_j + \beta_j' \tilde{R}_{mt} + \tilde{\xi}_{jt} \qquad (3)$$

j = 1 . . . . 114 stocks

t = 1 . . . . 40 quarters

where: $E(\tilde{\xi}) = 0$

$r(\tilde{R}_m, \tilde{\xi}_j) = 0$

$r(\tilde{\xi}_j, \tilde{\xi}_k) = 0 \qquad j \neq k$

[4]Harry M. Markowitz, Portfolio Selection: Efficient Diversification of Investments (New York: John Wiley and Sons Inc., 1959); and William F. Sharpe, Portfolio Theory and Capital Markets (New York: McGraw-Hill Inc., 1970).

$\tilde{R}_{jt}$ = return on security j, in t^{th} quarter,

$\tilde{R}_m$= quarterly return on all other securities in the market (hereafter called "market return"),

$\tilde{\xi}_{jt}$ = the individualistic component of security j's return in the t^{th} quarter (supposedly diversified away in a portfolio context),

α_j, β_j = intercept and slope associated with the linear relationship, and

r = partial correlation coefficient

The particular equation utilized in this thesis is a form of the above equation but is adjusted by a "risk-free" rate of return in order to examine the risk premium of the market and the individual securities. This equation is outlined in Formula 4 and has the same assumptions and symbols as does Formula 3 with the exception that $\tilde{R}_{ft}$ refers to the quarterly risk-free rate:

$$\tilde{R}_{jt} - \tilde{R}_{ft} = \alpha_j + \beta_j (\tilde{R}_{mt} - \tilde{R}_{ft}) + \tilde{\xi}_{jt} \qquad (4)$$

j = 1 . . . . 114 stocks
t = 1 . . . . 40 quarters

where: $\tilde{R}_{jt}$, $\tilde{R}_{mt}$ = security and market rates of return as specified in Formula 3 above,

$\tilde{R}_{ft}$ = quarterly risk-free rate of return in the market place, and

α_j, β_j, ξ_j = parameters and residual as specified also in Formula 3 above.

At this point it is desirable to explain the derivation of the "risk-free" rate of return (R_f) and the "market" rate of return (R_m) as utilized in Formulae 3 and 4. As a proxy for a "risk-free" rate of return on the market, a reasonable measure is the average yield on 3-month Treasury Bills. This quarterly yield may be calculated by dividing by four the annualized yield (per cent) on 3-month Treasury Bills at the end of each quarter (weekly tender on Thursdays following Wednesday date shown). These quarterly rates are shown in Table 1, Appendix A.

The market rate of return is calculated in a slightly different manner. In this case, the TSE industrial index can be utilized as a reasonable proxy to calculate the quarterly market rate. Added to this rate will be a quarterly market dividend adjustment of .009.[5] Formula 5 shows the computation of the market rate of return in algebraic terms:

$$R_{mj} = \frac{R_{mjc} - R_{mjo}}{R_{mjo}} + .009 \qquad (5)$$

$j = 1 \ . \ . \ . \ . \ 114$ stocks

where: R_{mj} = quarterly market return of j^{th} stock, over 40 quarters,

R_{mjc} = closing market return of j^{th} stock at end of quarter,

R_{mjo} = opening market return of j^{th} stock at beginning of quarter, and

.009 = quarterly market dividend adjustment (constant per quarter).

[5]The annual dividend given by the TSE index is in the order of 4% over the time period considered or about .009% per quarter utilizing a geometric average.

Table 2, Appendix A outlines the various quarterly market returns (percentages) for the period 1958-1967.

Regressions of the form of Equation 4 were run for each stock over the ten-year period and the resulting beta coefficients (the β_j's in Equation 4) indicating the relationship between the actual stock "risk premium" (R_{jt} - R_{ft}) and market "risk premium" (R_{mt} - R_{ft}) are listed by firm code in Table 1, Appendix B along with the standard deviation of return.

In summary, the purpose of this section of the chapter was to develop the two "traditional" measures of security risk.

ii) Accounting Measures of Risk

This thesis postulates that practitioners or fund managers view risk in a different manner than does the literature. Security analysts may generate their estimates of the risk associated with a unique security *inter alia*, upon financial statement figures. Of particular importance is the historical earnings stream of the individual firm. This earnings stream of a firm may be viewed as net operating income (NOI), net income (NI) and net income plus depreciation over the ten-year period. Statistical methods can be undertaken to calculate the degree of risk associated with each of these flows. Three such measures of risk for each earnings stream are the standard deviation, mean-absolute deviation and the coefficient of variation. These measures were utilized in this thesis and will be discussed in turn.

a) Standard Deviation

The standard deviation of each earnings stream flow was calculated according to Formula 6 which is essentially the same as Formula 2 but with slight symbolic modification:

$$V_{Ej} = \frac{\sum_{i=1}^{10} Eij^{2}}{n} - \left[\frac{\sum_{i=1}^{10} Eij}{n}\right]^{2} \quad \text{or} \quad s_{Ej} = \left[V_{Ej}\right]^{1/2} \qquad (6)$$

$i = 1 \ldots .\ 10$ years

$j = 1 \ldots .\ 114$ stocks

where: V_{Ej} = variance of earnings stream of j^{th} stock over entire period,

Eij = earnings stream of j^{th} stock per i^{th} year,

n = sample size, i.e. 10 years, and

s_{Ej} = standard deviation of the earnings stream of j^{th} stock over entire period.

Accordingly, given Formula 6, the standard deviation for each earnings stream variable (NOI, NI, and NI + D) was computed and the resulting magnitudes noted in column 1 of Tables 1, 2 and 3, Appendix C.

With respect to the appropriateness of such a measure, much of what has been said already in the previous section under "Standard Deviation of Return" is applicable here and will not be repeated.

b) Coefficient of Variation

Since the standard deviation of return is already a measure of relative dispersion based upon price relatives, the standard deviations of earnings stream variables, on the other hand represent absolute magnitudes. To overcome this problem of magnitude differential, the coefficients of variation of the various earnings stream variables were computed per Formula 7 below:

$$COV_{Ej} = s_{Ej}/\overline{E}j \tag{7}$$

j = 1 . . . 114 stocks

where: COV_{Ej} = coefficient of variation of earnings stream variable of j^{th} stock over 10 year period,

s_{Ej} = standard deviation of earnings stream variable of j^{th} stock over 10 years, (see Formula (6)), and

$\overline{E}j$ = mean value of earnings stream variable of j^{th} stock over 10 year period.

In column 2 of Tables 1, 2 and 3, Appendix C are listed the various coefficients of variation for each stock over the period 1958-67.

c) Mean-Absolute Deviation

A third measure of risk and one that offers direct support to the standard deviation of the earnings stream variables is the mean-absolute deviation statistic. Formula 8 shows the algebraic derivation of this measure:

$$M.A.D._{Ej} = \frac{\sum_{i=1}^{10} |Ej - \overline{E}_j|}{n} \tag{8}$$

i = 1 . . . . 10 years

j = 1 . . . . 114 stocks.

where: $M.A.D._{Ej}$ = mean-absolute deviation of the earnings stream variable of the j^{th} stock, over the ten-year period,

Ej = earnings stream value per annum of the j^{th} stock,

$\bar{E}j$ = mean value of earnings stream variable of j^{th} stock over 10 years, and

n = sample size, i.e. 10 years.

This statistic was calculated for each earnings stream variable (NOI, NI, and NI + D) over the entire sample 114 stocks and the results noted in column 3 of Tables 1, 2 and 3 of Appendix C.

In summary then, three accounting measures of risk were calculated based upon financial statement figures. To this author, the most meaningful measure for comparison with the "traditional" measures of security risk is the measure of relative dispersion, the coefficient of variation for each earnings stream variable. Further tests shall be undertaken utilizing only this measure of security risk.

In conclusion, this chapter has focused upon a discussion of the sources of data for this thesis and the development of the "traditional" and "accounting" measures or risk associated with a particular security. The "traditional" measures to be utilized in further analyses are the standard deviation of return and the beta coefficient or volatility index. Only one accounting measure of risk, the coefficient of variation statistic for each earnings stream variable (NOI, NI, and NI + D) is to be considered.

Given the above measures, tests were carried out in order to: a) determine if any significant relationship exists among these various risk measures, and to b) report any significant relationships between the risk measures and the particular returns of a stock over time. Chapter IV discusses the results of tests involving risk measures alone ((a) above) while Chapter V describes the results when the risk/return tradeoffs were analysed.

* * * * * *

CHAPTER III

RELATIONSHIPS AMONG RISK MEASURES

An examination of the relationships among both the "accounting" and "traditional" measures of security risk is the purpose of this chapter and discussion shall now focus upon the development of specific tests to indicate if any relationship does indeed exist among the various risk measures. A correlation analysis was performed on the risk measures and the movement of two variables are noted. Further tests were carried out to support the results obtained from this correlation analysis.

A. The Tests

i) Correlation Analyses

Often a bivariate population may be non-normal and when this is so, calculation of a correlation coefficient by the usual method is not valid. Even though the distributions underlying the traditional risk measure may be considered normal, there is no guarantee that the distributions of accounting risk measures will be normal. Nevertheless, one may still wish to examine whether these two variables are independent or whether they vary in the same or opposite directions. One of the best-known procedures in which a correlation coefficient may be computed between two variables where neither variable may be normal, involves <u>ranking</u> both variables and then calculating the Spearman rank correlation coefficient, given by Formula 9:

$$r_s = 1 - \frac{6 \sum_{i=1}^{n} d_i^2}{n(n^2 - 1)} \qquad (-1 \leq r_s \leq 1) \qquad i = 1 \ldots 114 \tag{9}$$

where: r_s = rank correlation coefficient between two risk measures,

d = differences in ranks between the two measures, and

n = sample size, i.e. 114 stocks.

As indicated above, the range of values of r_s, may be from -1 (complete discordance) to +1 (complete concordance).

A total of ten Spearman rank correlation coefficients were calculated involving both the "traditional" and "accounting" measures of security risk in pairs. To test for statistical significance, T-tests were performed on each of these rank coefficients and the results, along with the actual coefficients themselves are summarized in matrix form in <u>Table 3, Appendix A</u>.

ii) <u>Sectoral Analyses</u>

To further support these rank correlation coefficients, additional statistics were computed. In the first place, the range of each measure of risk was divided into thirds and each corresponding tertiary sector was compared to see how many pairs of firms changed sectors over the ten-year period. The number of firms (pairs) that did in fact change sectors is also noted in each cell of the matrix in Table 3, Appendix A, just below the magnitudes of the Spearman correlation coefficients.

Secondly, and again to further substantiate the rank correlation coefficients, a "mean" and "median" analysis was carried out in order to indicate the number of stocks common to two particular measures of risk. With reference to the "mean" analysis, the number of stocks above the mean of one risk measure was expressed as a percentage of the number of stocks above the mean of the other measure. These percentages are shown in Table 4, Appendix A. In addition, the number of companies common to both measures above the mean was compared to the number of companies above the mean for the other measure. The resulting percentages are also shown in Table 4, Appendix A.

A "median" analysis was also undertaken in a similar fashion to the "mean" analysis except that the ratio of the number of stocks above the median of one measure to the number of stocks above the median of the other measure was omitted. Obviously, this ratio would be meaningless and constant at 1.0. The results of this analysis are portrayed in Table 5, Appendix A.

In summary, a correlation analysis was undertaken as well as other related tests to determine if any significant relationship exists between "accounting" and "traditional" measures of risk as developed in the previous chapter.

B. The Results

i) The Correlation Analysis

Based upon the results shown in Table 3, Appendix A, several conclusions were drawn with respect to the significance of the relationships between risk measures. Noted was a lack of statistical significance (at both the .05 and .01 levels) and low magnitudes of all rank correlation coefficients involving the accounting measures of risk (COV) based upon NOI, NI and NI + D and the beta coefficient. This result indicates acceptance of the null hypothesis that there is no significant correlation betweeen these measures - in other words, statistical independence. But the question may now be raised: Should one expect any significant relationship to exist in this case? In the opinion of this author, since individual stocks and not portfolios are being analysed, no relationships ought to be expected. The beta coefficient analysis eliminates the stochastic or unique element of individual asset return which may have a great effect upon the risk of a particular asset. Utilizing the beta coefficient concept involves assuming away all stochastic or residual elements of individual asset return through diversification. This assumption is invalid when one looks at the return of an individual stock.

With respect to the other measures, the individualistic element is not assumed away and its presence may very well result in higher rank correlation coefficients (as well as statistical significance) being obtained when measures other than those involving the beta coefficient are considered. This hypothesis is borne out in Table 3, Appendix A.

The two "traditional" measures of risk (standard deviation and the beta coefficient) when correlated together do show statistical significance with a relatively high rank coefficient (.593). Justification of this observation may be derived from the fact that each measure is based upon an underlying distribution of security returns. Thus, correlation is to be expected.

It is also important in Table 3, Appendix A, to note the statistical significance of the correlation coefficients between the standard deviation of return and the coefficients of variation for each of the earnings stream variables. It is disappointing to find a moderate lack of power in the coefficient which describes the degree of association between the pairs of measures, i.e. correlation coefficients of only .425, .454 and .474.[6] The highest coefficient (.474 above) for "accounting" and "traditional" measures of risk was obtained when the standard deviation of return and the coefficient of variation for NI + D were correlated. This was expected for two reasons: a) NI + D is more of a "cash flow" concept and perhaps a higher coefficient reflects its importance in estimating the risk associated with an individual security, and b) NI + D reflects both "business" and "financial" risk whereas NOI reflects only "business" risk.

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[6]Beaver, Kettler and Scholes in their paper "Market and Accounting Determined Risks," The Accounting Review, Vol. XLV, No. 4, October 1970, pp. 654-82, show a rank correlation coefficient of .45 between a market determined measure of risk and an earnings stream variable over the period 1957-65. Their market risk measure was the beta coefficient but evidence does indicate the range of .42 to .47 for the rank coefficient is reasonable.

One further observation may be made before concluding this section and this concerns the high degree of correlation indicated between the various accounting measures. *A priori* reasoning would expect this to be the case and this is borne out with the rank correlation coefficients approximately .86 in all cases.

The results of this section may now be summarized:

1) no significant relationships were indicated between the accounting measures and the beta coefficient, with the correlation coefficients of relatively low magnitudes (.192 to .218);

2) when the two "traditional" measures of security risk were correlated together, a significant relationship was observed with a correlation coefficient of .593;

3) the correlation coefficients obtained when comparing the standard deviation of return and the other accounting measures, although of only moderate power (.425 to .474) were statistically significant;

4) the "best" correlation coefficient (.474) between an "accounting" and "traditional" measure of risk which was statistically significant occurred when the standard deviation of return and the coefficient of variation of net income plus depreciation were compared; and

5) as expected, when correlated among themselves, the accounting measures generally displayed high rank correlation coefficients (.764 to .867).

More will be said about these results in the final chapter but now, discussion will shift to the results obtained by sectoral analyses of the various risk measures.

ii) Sectoral Analyses

As was mentioned before, to further substantiate the results of the correlation analysis, a sectoral analysis was undertaken. The range of values for each risk measure (beta, COV_{NOI}, COV_{NI}, $COV_{NI + D}$, and $s.d._R$) was subdivided into thirds and the number of firms (pairs) that changed sectors was noted in Table 3, Appendix A. As expected, a high number of "switches" indicated a relatively low correlation coefficient.

Upon analysis of the median and mean matrices in Tables 4 and 5, Appendix A, additional support is given to the validity or reasonableness of the rank correlation coefficients. In the "median" matrix of Table 5, it is generally observed that the greater the percentage of "common" elements or stocks above the median when comparing two measures of risk, the higher the correlation coefficient. Even including comparisons involving the beta coefficient and accounting measures, this is the case although theoretically, this comparison may be rejected for reasons previously stated.

Thus, from the "median" analysis, further support is given to the validity of the rank correlation coefficients. However, when one scrutinizes the "mean" matrix of Table 4, Appendix A, somewhat conflicting results appear. To repeat, the "bracketed" percentage figures in each cell represent the number of stocks common to both measures above the mean divided by the number of stocks common to one measure above the mean. Again, some support for the calculated correlation coefficients is indicated in that generally a greater percentage of common elements above the mean were associated with higher rank coefficients.

However, when one looks at the number of stocks above the mean of one risk measure over the number of stocks above the mean of the other, inconclusive results are obtained. Referring to Table 4 if one disregards all comparisons involving the beta coefficient (for reasons previously explained), absolute deviations range from approximately -36 to +54 or a range of 90 percentage points. This result is indicative of quite substantial fluctuations. However, this may be due to the fact that extreme COV values are not included in the computation of the mean NI figure (see Table 2, Appendix C). As a consequence, a fewer number of stocks may be above the mean than the analysis indicates, the high figures would be readjusted substantially downward and this would bring the NI figures more in line with the NOI and NI + D figures.

Summarizing this section, the following results are relevant: 1) when the range for each measure of risk was subdivided into thirds, the greater the number of "switches" occurring outside of corresponding sectors, the lower the correlation coefficient (this lent support to the values of the coefficients obtained under section B i) of this chapter); 2) with respect to the "median" analysis, further support was given to the previously computed values of the correlation coefficient as it was observed that the greater the percentage of "common" stocks above the median when comparing two risk measures, the higher the coefficient; 3) inconclusive results were noted when the "mean" analysis was undertaken and complete support for the values of the correlation coefficients was not indicated by the results.

This completes the discussion concerning relationships among the various risk measures. The two "traditional" measures of risk show statistical significance when correlated with each other (as expected), but when correlated with the various "accounting" measures of security risk, only one (the standard deviation of return) displays any statistical significance. When a sectoral analysis was undertaken, in general, the values of the rank correlation coefficients were supported, inconclusive evidence being observed in only one instance. However, one important point to be discussed later, concerns the "lack of power" of the correlation coefficients obtained when the "accounting" measures of risk and the standard deviation of return were considered. This observation shall be made more relevant in the final chapter, Chapter V, when all previous results are summarized and integrated into a more meaningful whole.

Having dealt with a comparison of the various risk measures, attention shall now focus upon the second purpose of this thesis: to determine any existing relationship between the various measures of risk and overall return in the market.

* * * * * *

CHAPTER IV

RELATIONSHIPS AMONG RISK AND RETURN

A second purpose of the research undertaken in this thesis is to test the strength of the relationship between the analysts perception of risk based upon accounting data and overall security return in the market. A specific test designed to show any existing relationship between risk and overall market return was devised and will be described in the next section. Following that, the results in the next section obtained in applying the test shall be discussed.

A. The Test

To test the relationship outlined in the previous section between risk and overall market return, a graphical analysis was undertaken in which the risk/return tradeoff was described. Figures 1 through 11, Appendix D present, in graphical form, the various measures of risk, beginning with the two "traditional" measures (Figures 1 and 2) plotted against average annual return (per cent) over the ten-year period, 1958-67. For each earnings stream variable, three measures of risk are plotted against return: standard deviation, mean-absolute deviation and the coefficient of variation. "Risk" is measured upon the vertical axis, "return" along the horizontal. From the theory of "efficient capital markets," one would expect higher returns associated with higher degrees of risk. Whether this relationship exists or not is discussed in the following section.

B. Results

When one considers the standard deviation and beta coefficient measures of risk plotted against average annual rates of return in Figures 1 and 2 respectively in Appendix D, marked upward-sloping trend lines can readily be distinguished. The slope of the trend line involving the beta coefficient is slightly less steep than that involving the standard deviation/return tradeoff. This is to be expected since the former measure should produce a lower return per unit of risk on account of the individualistic or unique element of risk of the individual security being diversified away. However, these are the "traditional" measures of risk - what about the "accounting" measures? How well do they perform in a risk/return tradeoff? As can be seen from the graphs in Appendix D, the standard deviation and mean-absolute deviation of all the accounting measures display no significant trend when plotted against average annual return over the ten-year period. (see Figures 3, 4, 6, 7, 9 and 10.) In addition, in each case, there are generally consistent outliers occurring at high extreme values which would tend to pull a trend line up and lead to a somewhat more positive risk/return tradeoff than normal.

Nevertheless, when Figures 5, 8 and 11 of Appendix D are considered (COV for NOI, NI and NI + D respectively), slight upward trends may be distinguished, especially with respect to the COV for NOI and NI + D (Figures 8 and 11). For two reasons this may be expected: 1) the correlation coefficients for these two measures, as previously noted, were highly significant in the order of about .42 to .47 and 2) the NOI and NI + D earnings stream variables are more "cash-flow" concepts than is the NI variable. Further, it may be significant that NOI reflects only "business" risk and NI + D considers both "business" and "financial" risk although this relationship is unclear. In addition, when one compares COV_{NOI} and $COV_{NI + D}$ (Figures 8 and 11) with Figure 1 of Appendix D involving the standard deviation of return, the slopes are not significantly different. This observation lends further support for significant, but not that high, ranked correlation coefficients (.425 to .474). Comparing Figure 1 with the other accounting risk measures (standard deviation and mean-absolute deviation of each earnings stream variable), no real similarities in trend can be distinguished.

Thus, generally speaking, the risk/return tradeoff or relationship is shown to exhibit a moderate upward-sloping trend when one considers the COV measures of accounting risk plotted against overall market return. This was not the case when the standard deviation and mean-absolute deviation of NOI, NI, and NI + D was examined, for in these cases, magnitude differentials may greatly distort any underlying trends. In other words, an increase in risk is accompanied by additional return, which is what one would expect based upon *a priori* reasoning. When the "traditional" measures of risk were plotted as in Figures 1 and 2, Appendix D, much more significant, positive sloping trend lines were distinguished.[7] This also supports what would be expected of the risk/return tradeoff.

This completes the discussion of the relationships existing between the two "traditional" measures of security risk and the various accounting measures when compared to overall market return over the years 1958 to 1967. In the next and final chapter, conclusions shall be drawn based upon the results of this and the previous chapters and also implications and possible areas for future research shall be outlined.

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[7]The mean value of the beta coefficient incidentally was found to be about .9354 over the ten-year period. This is consistent with other independent empirical evidence.

CHAPTER V

CONCLUSIONS AND FURTHER RESEARCH IMPLICATIONS

It has been the purpose of this thesis to investigate different measures of risk associated with individual securities in the stock market. In particular, this thesis set about to do two things: a) to test any correspondence between what security analysts perceive as risk (based upon accounting information and specifically, earnings stream variability), and two "traditional" or economic measures of risk, the variance or standard deviation of return and the beta coefficient, and b) to show any existing relationship between the various "accounting" measures (as well as "traditional" measures) and overall market returns. As a proxy for risk based upon "accounting" information, the coefficients of variation of net operating income, net income and net income plus depreciation were utilized.

A. Conclusions and Implications

Given the two-fold purpose of this thesis, and the analyses outlined in previous chapters, general conclusions may be drawn with respect to each "dual" purpose. Concerning the relationship among various risk measures, a correlation analysis was undertaken, the results of which are briefly summarized below:

i) there does indeed exist a statistically significant correspondence but moderate lack of power to explain the variation between certain measures of accounting risk (namely, coefficients of variation for the earnings stream variables) and one "traditional" measure of risk, the standard deviation of return;

ii) since the beta coefficient is more directly and aptly concerned with portfolio analysis, no significant correspondence was expected nor found when the beta coefficient and the "accounting" measures were compared;

iii) the low magnitudes of the correlation coefficients obtained in ii) above were generally suspected to be due to the elimination of the individualistic risk component of a security return;

iv) when risk measures were correlated amongst themselves, i.e. "traditional" versus "traditional," "accounting" versus "accounting," as expected, significant relationships having higher magnitude coefficients were noted; and

v) the "best" correlation coefficient (.474) between an "accounting" and "traditional" measure of risk was observed to occur when the standard deviation of return and coefficient of variation of net income plus depreciation (NI + D) were compared.

Further support for the values of these correlation coefficients was obtained through a sectoral analysis of each risk measure involved. These conclusions can be stated below:

i) by analysing the movement of stocks among various sectors and the communality (or lack of it) of elements between the various measures, the results lent further support to the validity of the magnitude of the correlation coefficients; and

ii) further support was forthcoming by way of a "median" and "mean" analysis, although not entirely conclusive support.

With respect to existing relationships between various measures of risk and overall return in the market, several relevant conclusions may also be noted, based upon a graphical analysis to test for any dominant or significant relationship. These conclusions may also be briefly summarized:

i) both the "accounting" measures of risk (coefficients of variation for each earnings stream variable) and the "traditional" measures displayed upward or positive trend lines (the "traditional" measures to a more marked degree), when plotted against overall return in the market; and

ii) no dominant trends were ascertainable when the other measures of "accounting" risk, standard deviation and mean-absolute deviation of NOI, NI, and NI + D, were examined in the context of a risk/return tradeoff.

Accordingly, given these results what can be implied with respect to the original purposes of this thesis as outlined in Chapter I? It was noted in the first chapter that, besides testing for significant relationships between various risk measures and determining if there exists any significant risk/return tradeoff for each measure of security risk, a further postulate of the thesis emphasized that the "traditional measures of risk are merely reflections of the impact of a security analyst or practitioner perceptions upon the actions of investors in the stock market" (Chapter I, p. 1).

Based upon the above correlation and sectoral analyses, there appears to be some degree of association between the "accounting" measures of risk and at least, one "traditional" measure, the standard deviation of return. However, correlation analysis in no way, indicates direction of causality. In other words, what the literature may be measuring as risk could just as easily as not be a reflection of what the practitioners or security analysts view as risk. Other factors such as "street talk" and management interviews play perhaps an even more important role than the traditional measures in the formation of risk estimates by a security analyst. The above point appears relevant, given the lack of power of the low correlation coefficients observed when the "accounting" measures were compared to the standard deviation of return.

To be sure, the informational process of the security analyst obviously does play a major role in the formation of risk estimates for a particular security. An indication of the importance of financial statement data has been outlined in this thesis but there are other variables in this informational process that defy quantification. As to whether the "traditional" measures reflect the actions of the participants in the market place, they may or may not based upon the correlation and sectoral analyses undertaken in this thesis. On the other hand, a fairly good relationship evolved when the "accounting" and "traditional" risk measures were compared to overall return on the market. Therefore, the significance of this thesis lies in the fact that risk measures based upon financial or accounting information may not be totally irrelevant in determining the future value of a security. Further research and more rigorous testing may be needed. The results in this thesis may only "whet the appetite."

B. Areas of Future Research

Based upon analyses undertaken in this thesis, several areas of future research may be enumerated. The first and somewhat most obvious is to utilize the same methodology as outlined above but develop additional "traditional" measures of security risk - such as semi-variance, covariance and so on - along with further accounting variables such as those utilized by Beaver, Kettler and Scholes.[8] Perhaps also extend the time period and compare the results obtained from using different time period bases.

A further area of proposed research may involve an analysis similar to the above, only for data classified according to asset size. In the opinion of this author, risks associated with securities such as IBM, or General Electric or General Motors may not be strictly comparable to those risks inherent in the stocks of much smaller companies. This would be quite an interesting project and may lead to very significant results.

In addition, the quantification of such nebulous concepts as "street talk" and "in-depth management interviews" would go a long way

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[8]Beaver, Kettler, and Scholes, op. cit., pp. 659-63 and p. 666.

in incorporating these estimates into both the theory of security analysis and its logical extension into portfolio theory. A related problem occurs in that even if they are "quantified" or "quantifiable," are these concepts comparable to other variables? As more and more new research is carried out, no doubt procedures will be developed for the accurate refinement of such terms. A further area of proposed enquiry, and perhaps the most readily achieved, concerns a methodological problem that arose during the collection of data for this thesis. It would be most helpful to future researchers in the area of security and portfolio analysis to have at their disposal a magnetic tape or some other computer storage device of historical price and dividend data say per quarter and beginning in the early fifties and updated constantly. The Financial Post has already put on tape annual selected financial statement data. Combine this tape with the price and dividend one already proposed and the result would be invaluable tools for anyone who desired to undertake future research in this area.

Obviously, there are other areas of proposed research but, to this author at least, the ones listed above are some of the more important. The field of security analysis and its extension into portfolio theory is of quite recent origin and there exist many areas where new, original research can be undertaken which may have the potential to yield fruitful benefits to both the researcher and the whole body of associated knowledge.

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BIBLIOGRAPHY

Books

Croxton, F. E. and Cowden, D. J. Applied General Statistics. Second Edition. Englewood Cliffs, New Jersey: Prentice-Hall Inc., 1955.

Latane, H. A. and Tuttle, D. L. Security Analysis and Portfolio Management. New York: The Ronald Press Company, 1970.

Markowitz, Harry M. Portfolio Selection: Efficient Diversification of Investments. New York: John Wiley and Sons Inc., 1959.

Sharpe, William F. Portfolio Theory and Capital Markets. New York: McGraw-Hill Inc., 1970.

Smith, Keith V. Portfolio Management. Theoretical and Empirical Studies of Portfolio Decision-Making. New York: Holt, Rinehart and Winston Inc., 1971.

Articles

Beaver, W. H., Kettler, P., and Scholes, M. "Market and Accounting Determined Risks," The Accounting Review, Volume XLV, No. 4, October, 1970, pp. 654-82.

Fama, Eugene F. "Portfolio Analysis in a Stable Paretian Market," Management Science, Volume II, January, 1965, pp. 404-419.

________. "The Behavior of Stock-Market Prices," Journal of Business, Volume XXVIII, January, 1965, pp. 34-105.

________, and Roll, Richard. "Some Properties of Symmetric Stable Distributions," Journal of the American Statistical Association, Volume 63, September, 1968, pp. 817-36.

Mandlebrot, Benoit. "The Variation of Speculative Prices," Journal of Business, Volume XXXVI, October, 1963, pp. 394-419.

Roll, Richard, "The Efficient Market Model Applied to U. S. Treasury Bill Rates." Unpublished PH.D. thesis, Graduate School of Business, University of Chicago, 1968.

APPENDIX A

MARKET, RISK-FREE RETURNS AND CORRELATION MATRICES

APPENDIX A, TABLE 1

RISK-FREE RATES OF RETURN (R_f), BY QUARTER, 1958-1967*

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
		(Percentages)		
1958	.0090	.0045	.0040	.0059
1959	.0081	.0108	.0125	.0131
1960	.0128	.0081	.0079	.0055
1961	.0083	.0081	.0065	.0064
1962	.0077	.0077	.0135	.0123
1963	.0098	.0090	.0081	.0090
1964	.0094	.0092	.0091	.0092
1965	.0093	.0094	.0099	.0103
1966	.0115	.0127	.0125	.0129
1967	.0117	.0100	.0108	.0123

Source: Bank of Canada Statistical Summaries and Supplements, various issues from 1959.

*For method of calculation, see Chapter II, Subsection B i).

APPENDIX A, TABLE 2

MARKET RATES OF RETURN (R_m), BY QUARTER

1958-1967*

Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
		(Percentages)		
1958	.0669	.0665	.1201	.0439
1959	.0410	.0350	-.0415	.0410
1960	-.0657	.0086	.0056	.1156
1961	.1163	.0821	.0242	.0657
1962	-.0163	-.1570	.0095	.1159
1963	.0385	.0407	.0121	.0480
1964	.0661	.0870	.0637	.0132
1965	.0437	-.0399	.0350	.0152
1966	.0063	-.0274	-.1157	.0504
1967	.1272	.0057	.0344	-.0291

Source: TSE Indices, 4th Edition, February 1, 1968, Toronto Stock Exchange, Toronto, Ontario. See also Figure 2 of this thesis for a graphical representation of the above rates.

*For method of calculation, see footnote 1, Table 1, Appendix A.

APPENDIX A, TABLE 3

RANK CORRELATION COEFFICIENTS AND TERTIARY

SECTOR COMPARISONS

	BETA	COV (NOI)	COV (NI)	COV (NI + D)	s.d.$_R$
BETA	0	r_s = .218 85	r_s = .192 82	r_s = .210 88	r_s = .593* 53
COV (NOI)	r_s = .218 85	0	r_s = .764* 37	r_s = .866* 26	r_s = .425* 72
COV (NI)	r_s = .192 82	r_s = .764* 37	0	r_s = .867* 31	r_s = .454* 61
COV (NI + D)	r_s = .210 88	r_s = .866* 26	r_s = .867* 31	0	r_s = .474* 74
s.d.$_R$	r_s = .593* 53	r_s = .425* 72	r_s = .454* 61	r_s = .474* 74	0

r_s = Spearman rank correlated coefficient.

* = significant at .05 and .01 levels of confidence.

Tertiary Comparison Method: For each measure above, data divided into thirds and each number below r_s in matrix cells represents pairs of firms that have changed sectors when comparing two measures.

APPENDIX A, TABLE 4

MEAN ANALYSIS (PERCENTAGE FIGURES)

NUMERATOR

DENOMINATOR	BETA	COV (NOI)	COV (NI)	COV (NI + D)	s.d.$_R$
BETA	100.0	76.2 (45.7) r_s = .218	96.7 (61.0) r_s = .192	62.7 (45.7) r_s = .210	76.2 (61.0) r_s = .593
COV (NOI)	131.1 (60.0) r_s = .218	100.0	126.6 (91.1) r_s = .764	82.2 (73.3) r_s = .866	100.0 (60.0) r_s = .425
COV (NI)	103.5 (63.1) r_s = .192	78.9 (71.9) r_s = .764	100.0	64.9 (68.4) r_s = .867	78.9 (54.3) r_s = .454
COV (NI + D)	159.4 (72.9) r_s = .210	121.6 (89.1) r_s = .866	154.0 (105.4) r_s = .867	100.0	121.6 (67.5) r_s = .474
s.d.$_R$	131.1 (80.0) r_s = .593	100.0 (60.0) r_s = .425	126.6 (82.2) r_s =.454	82.2 (55.5) r_s = .474	100.0

$$\frac{\text{Number of Stocks above Mean of one Measure}}{\text{Number of Stocks above Mean of Another Measure}} \cdot 100$$

$$\frac{\text{Number of Stocks Common to both Measures above Mean}}{\text{Number of Stocks Common of one Measure above Mean}} \cdot 100$$

Spearman rank correlation coefficient (r_s)

APPENDIX A, TABLE 5

MEDIAN ANALYSIS (PERCENTAGE FIGURES)

NUMERATOR

DENOMINATOR

	BETA	COV (NOI)	COV (NI)	COV (NI + D)	s.d.$_R$
BETA	100.0	56.1 r_s = .218	56.1 r_s = .192	57.8 r_s = .210	70.1 r_s = .593
COV (NOI)	56.1 r_s = .218	100.0	78.9 r_s = .764	84.2 r_s = .866	57.8 r_s = .425
COV (NI)	56.1 r_s = .192	78.9 r_s = .764	100.0	84.2 r_s = .867	63.1 r_s = .454
COV (NI $\pm$ D)	57.8 r_s = .210	84.2 r_s = .866	84.2 r_s = .867	100.0	59.6 r_s = .474
s.d.$_R$	70.1 r_s = .593	57.8 r_s = .425	63.1 r_s = .454	59.6 r_s = .474	100.0

$$\frac{\text{Number of stocks common to both Measures above Median}}{\text{Number of stocks common to one Measure above Median}} \cdot 100$$

Spearman rank correlation coefficient r_s.

APPENDIX B

AVERAGE ANNUAL RETURN AND TRADITIONAL MEASURES OF RISK

APPENDIX B, TABLE 1

RETURN AND TRADITIONAL RISK MEASURES[1]
SELECTED STOCKS, 1958-67

Stock	Average Annual Return (%)	Beta Coefficient		Standard Deviation	
		Magnitude	Rank	Magnitude	Rank
001	8.36	.676398	24	.0775	15
018	11.32	.646171	21	.1082	58
021	10.68	1.365533	107	.1088	59
030	1.44	.310174	3	.0355	2
033	-0.80	.411987	5	.0756	14
037	32.40	1.163869	92	.1436	92
051	30.72	.915839	55	.1318	86
078	16.48	.762435	34	.1240	81
087	6.56	.601491	17	.0700	6
102	18.92	1.003545	66	.1223	78
104	13.24	.475746	71	.0560	4
105	5.52	.807566	39	.0860	25
108	13.80	1.256283	98	.1364	89
111	10.36	.520163	12	.0815	18
117	8.72	.669440	22	.0727	11
135	10.20	.728880	29	.0950	41
141	7.76	1.285816	103	.1157	72
144	19.80	1.128401	86	.1637	104
150	13.96	1.270107	101	.1311	85
156	11.84	.796914	38	.0960	44
159	13.56	.679163	25	.0712	8
165	9.48	1.013409	71	.0941	38
171	9.96	.905270	52	.0917	33

Continued . . .

Appendix B, Table 1 - Continued

Stock	Average Annual Return (%)	Beta Coefficient		Standard Deviation	
		Magnitude	Rank	Magnitude	Rank
177	4.28	.506481	9	.0561	5
195	17.76	1.101863	79	.1443	95
204	5.92	1.142513	89	.1094	60
207	13.40	.810219	41	.1287	84
213	18.44	1.201669	96	.2009	111
219	5.04	.864392	45	.1230	79
231	4.20	.197390	1	.0316	1
243	7.88	1.108533	80	.1482	96
252	13.44	.701946	27	.0926	34
279	4.20	.896671	49	.0932	35
282	47.92	.365081	4	.2375	114
285	18.52	.824488	42	.0820	19
288	13.28	.586956	15	.0983	47
294	12.96	.767248	35	.0875	27
300	8.08	.563894	14	.0710	7
315	13.64	.291657	2	.0914	32
318	6.80	1.036773	75	.0834	21
319	12.88	.739119	32	.1347	88
336	16.84	1.164382	93	.0820	20
339	3.24	1.075374	78	.1158	73
348	21.68	1.522138	110	.2340	113
354	17.18	1.555255	111	.1121	67
357	2.76	.509156	10	.0781	16
360	8.52	.840186	43	.1031	52
361	-0.36	.974302	60	.1413	91
363	9.60	1.008755	69	.1033	53
366	7.04	1.178676	94	.1021	51
369	18.64	1.030428	72	.1573	98

Continued . . .

Appendix B, Table 1 - Continued

Stock	Average Annual Return (%)	Beta Coefficient		Standard Deviation	
		Magnitude	Rank	Magnitude	Rank
372	13.80	.998227	64	.1010	50
375	9.16	.891119	48	.1147	71
381	7.00	.760502	33	.0799	17
389	21.44	1.121094	83	.1058	56
393	16.00	.945385	56	.1189	76
402	16.64	1.109638	81	.1213	77
407	4.60	.900370	50	.0845	22
411	20.24	1.073937	77	.1243	82
413	2.52	.554052	13	.0965	47
414	8.60	1.151289	91	.1637	103
417	9.24	1.136112	87	.1062	57
423	12.52	1.149905	90	.1100	61
426	16.76	.869241	46	.1106	64
447	35.36	1.240491	97	.2188	112
450	-7.64	1.337089	105	.1545	97
457	12.88	.986881	63	.1615	101
463	9.68	.771754	36	.0745	12
464	14.80	1.004304	67	.1439	93
466	15.80	1.030503	73	.1979	110
468	9.92	.732043	31	.0721	9
471	6.76	.728483	28	.0725	10
479	21.80	1.007211	68	.1954	109
481	8.08	1.265937	99	.1286	83
485	14.32	.499373	8	.0910	12
489	17.80	1.126773	85	.0945	31
492	7.16	1.059292	76	.0993	40
495	19.36	.803549	40	.0906	30

Continued . . .

Appendix B, Table 1 - Continued

Stock	Average Annual Return (%)	Beta Coefficient		Standard Deviation	
		Magnitude	Rank	Magnitude	Rank
496	16.08	.699342	27	.0746	13
510	13.72	1.123003	84	.1231	80
513	8.68	.954575	58	.1117	66
519	9.52	.882598	47	.1672	105
522	19.16	.962815	59	.1057	55
525	12.32	1.435808	108	.1938	108
546	7.60	1.114440	82	.1121	68
573	11.56	.842380	44	.1113	65
579	18.48	1.977755	114	.1624	102
603	15.84	1.267186	100	.1101	62
612	6.16	.628245	20	.0938	37
628	12.16	.721727	29	.1103	63
633	3.16	.518170	11	.0942	39
647	16.12	.908779	54	.0855	24
657	9.24	.984296	61	.1125	69
663	14.40	.625862	19	.0888	28
676	4.44	.952071	57	.1442	94
678	16.04	.790374	37	.1379	90
687	12.84	.609331	18	.0953	42
691	3.84	1.035398	74	.0854	23
702	7.82	1.002339	65	.0956	43
741	21.76	1.462731	109	.1703	107
753	6.92	1.180282	95	.1575	99
756	16.04	1.655674	113	.1674	106
777	14.40	1.548835	110	.1586	100
786	9.12	.443465	6	.0495	3
789	17.72	.670069	23	.0933	36
798	20.64	1.012344	70	.1008	49
804	1.84	.906806	53	.0963	45

Continued . . .

Appendix B, Table 1 - Continued

Stock	Average Annual Return (%)	Beta Coefficient		Standard Deviation	
		Magnitude	Rank	Magnitude	Rank
813	10.04	1.139135	88	.0863	26
831	9.56	.598421	6	.0897	29
855	5.04	1.354916	106	.1339	87
858	12.60	.986021	62	.1140	70
909	10.00	.903329	51	.1056	54
940	12.92	1.285555	103	.1182	75
949	18.04	1.283032	102	.1175	74

[1] For computation of measures and return, see Chapter II, Subsection B i).

APPENDIX C

ACCOUNTING MEASURES OF RISK

APPENDIX C, TABLE 1

ACCOUNTING RISK MEASURES BASED ON NET OPERATING INCOME[1]
SELECTED STOCKS, 1958-67

	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
Stock	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
001	4,601	78	.11	6	3,840	77
018	2,563	59	.89	114	2,380	61
021	12,516	96	.27	58	10,900	97
030	48,580	112	.28	62	43,400	113
033	2,337	56	.15	14	2,070	57
037	3,976	70	.66	108	3,740	75
051	2,045	52	.34	70	1,790	52
078	814	25	.15	15	656	24
087	72,996	114	.29	67	61,800	114
102	277	9	.16	16	228	9
104	153	6	.14	13	120	6
105	16,982	103	.21	35	15,300	104
108	5,286	82	.34	71	4,750	84
111	1,038	32	.26	52	832	31
117	14,790	100	.35	75	12,600	100
135	3,900	68	.18	21	3,230	68
141	2,302	55	.11	5	1,790	53
144	323	12	.26	56	272	13
150	3,567	65	.39	85	3,280	69
156	328	13	.09	3	224	8
159	3,117	62	.20	33	2,520	62
165	3,406	64	.19	25	2,950	65
171	4,282	73	.12	10	3,670	74
177	1,278	41	.44	90	1,180	45

Continued . . .

Appendix C, Table 1 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
195	1,368	44	.59	104	1,060	42
204	4,954	80	.19	26	4,260	80
207	2,578	60	.17	20	2,090	59
213	1,971	51	.50	96	1,830	54
219	4,797	79	.35	76	3,800	76
231	1,154	37	.22	40	980	38
243	3,799	67	.56	103	3,120	67
252	100	3	.14	12	80	3
279	4,097	71	.11	8	3,030	66
282	448	16	.88	113	392	16
285	9,328	92	.48	94	8,000	92
288	1,346	43	.50	97	1,030	41
294	977	30	.32	68	676	26
300	91	2	.11	4	80	2
315	690	23	.36	83	632	23
318	7,558	89	.23	45	6,790	89
319	355	14	.18	23	290	15
336	15,514	101	.20	30	12,900	101
339	4,993	81	.72	109	4,610	81
348	234	7	.19	27	192	7
354	14,196	99	.28	63	13,000	102
357	1,228	39	.22	42	940	35
360	1,141	36	.46	93	944	36
361	3,708	66	.36	79	2,750	63
363	4,354	75	.19	28	3,980	79
366	14,138	98	.27	59	12,000	98
369	6,293	85	.46	92	4,660	82

Continued . . .

Appendix C, Table 1 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
372	652	21	.18	22	584	21
375	8,533	90	.28	66	7,610	91
381	564	19	.20	34	500	19
389	4,427	77	.17	17	3,570	72
393	1,498	47	.36	84	966	37
402	16,314	102	.24	48	12,100	99
407	2,099	53	.18	24	1,510	50
411	272	8	.22	41	232	10
413	416	15	.41	88	282	14
414	784	24	.50	98	658	25
417	2,346	57	.26	57	1,950	56
423	3,241	63	.25	50	2,780	64
426	952	29	.20	31	812	30
447	1,008	31	.45	91	910	34
450	6,835	86	.36	80	5,460	86
457	3,903	69	.48	95	3,660	73
463	5,430	83	.25	51	4,740	83
464	10,237	94	.43	89	9,220	94
466	7,275	87	.76	111	6,250	87
468	20,855	107	.13	11	15,900	105
471	1,466	45	.05	1	1,280	47
479	1,040	33	.81	112	848	32
481	1,246	40	.40	86	1,030	40
485	110	4	.21	39	90	4
489	49,529	113	.27	61	40,300	112
492	21,870	110	.11	9	17,800	108
495	18,643	106	.63	107	14,100	103

Continued . . .

Appendix C, Table 1 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
496	8,763	91	.17	18	7,540	90
510	863	27	.21	36	790	29
513	1,051	34	.26	53	908	33
519	293	10	.27	60	236	11
522	4,372	76	.33	69	3,480	70
525	1,108	35	.51	100	1,000	39
546	17,490	104	.35	77	16,700	106
573	1,511	48	.20	32	1,370	48
579	22,664	111	.34	72	20,700	111
603	4,223	72	.22	43	3,560	71
612	1,315	42	.73	110	1,070	43
628	151	5	.22	44	114	5
633	508	17	.55	102	430	18
647	20,890	108	.55	101	19,100	109
657	1,479	46	.35	78	1,220	46
663	1,696	51	.36	81	1,630	51
676	9,939	93	.59	105	8,400	93
678	521	18	.11	7	420	17
687	64	1	.08	2	56	1
691	5,906	84	.28	64	4,980	85
702	2,403	58	.34	73	2,070	58
741	892	28	.28	65	736	28
753	2,713	61	.36	82	2,310	60
756	1,205	38	.23	46	1,100	44
777	638	20	.50	99	540	20
786	855	26	.19	29	680	27
789	4,352	74	.26	54	3,870	78
798	1,577	49	.17	19	1,390	49

Continued

Appendix C, Table 1 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
804	687	22	.24	49	610	22
813	21,599	109	.26	55	19,100	110
831	314	11	.21	37	270	12
855	18,525	105	.60	106	16,900	107
858	7,399	88	.34	74	6,260	88
909	13,010	97	.21	38	10,900	96
940	11,491	95	.40	87	9,690	95
949	2,266	54	.23	47	1,890	55

[1] For computation of measures, see Chapter II, Subsection B ii).

APPENDIX C, TABLE 2

ACCOUNTING RISK MEASURES BASED ON NET INCOME[1]
SELECTED STOCKS, 1958-67

	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
Stock	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
001	4,953	94	.30	42	4,120	95
018	784	43	.42	61	703	47
021	8,458	101	.32	46	7,480	101
030	21,245	111	.45	62	18,700	112
033	1,379	56	.26	32	1,230	58
037	1,583	59	.70	92	1,450	60
051	1,789	64	.53	78	1,520	63
078	471	27	.21	18	380	26
087	26,742	113	.38	57	20,600	113
102	90	3	.14	4	76	3
104	163	10	.31	45	113	7
105	6,288	97	.19	9	5,200	97
108	3,318	76	.50	73	3,110	84
111	692	36	.75	93	578	38
117	4,703	92	.46	66	3,590	90
135	1,694	61	.20	11	1,530	64
141	2,645	73	.32	47	2,140	75
144	171	11	.35	52	152	11
150	1,969	68	.57	80	1,620	67
156	155	9	.11	3	122	9
159	1,771	63	.29	41	1,530	65
165	2,116	70	.24	25	1,770	72
171	1,974	69	.15	5	1,450	61
177	700	38	.60	83	665	45

Continued . . .

Appendix C, Table 2 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
195	846	48	.63	86	706	48
204	1,865	65	.25	28	1,650	70
207	902	49	.09	2	764	50
213	996	52	1.05	101	952	55
219	3,372	77	.60	84	2,820	76
231	421	24	.23	23	382	27
243	2,453	72	.99	99	1,940	73
252	62	2	.21	16	43	2
279	4,533	91	.24	27	3,730	91
282	269	18	1.75	107	217	17
285	3,913	86	.47	68	3,290	87
288	815	46	.75	94	569	36
294	656	33	.36	56	454	29
300	104	7	.27	37	75	2
315	534	29	.50	75	492	31
318	3,420	79	.28	39	3,080	83
319	268	17	.35	53	214	16
336	8,733	102	.25	29	7,790	103
339	3,434	80	.99	100	3,000	79
348	140	8	.27	34	119	9
354	12,112	106	.45	63	11,300	108
357	490	28	.21	19	352	24
360	663	34	.56	79	560	35
361	4,072	87	2.74	112	3,030	80
363	1,595	60	.18	8	1,490	62
366	9,509	104	.47	69	7,740	102
369	4,313	88	1.41	106	3,220	85
372	297	19	.22	20	260	18

Continued . . .

Appendix C, Table 2 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
375	4,409	89	.35	54	4,010	94
381	307	20	.27	38	267	20
389	12,518	108	.50	74	10,900	107
393	714	40	.45	65	475	30
402	7,050	100	.39	58	5,500	99
407	2,893	74	.69	90	1,670	71
411	173	12	.46	67	145	11
413	209	13	.52	77	180	14
414	696	37	5.95	114	592	40
417	1,424	57	.41	60	1,170	57
423	3,681	83	.64	87	3,030	81
426	444	25	.27	35	396	28
447	684	35	.60	85	610	42
450	4,863	93	3.44	113	3,970	93
457	3,491	81	1.27	104	3,260	86
463	3,401	78	.26	33	2,840	77
464	6,819	98	.65	88	5,930	100
466	3,259	75	1.96	108	3,030	82
468	17,114	110	.22	21	15,500	110
471	952	51	.08	1	850	52
479	1,172	54	2.61	110	920	54
481	837	47	.89	97	607	41
485	47	1	.23	24	33	1
489	33,146	114	.30	44	27,600	114
492	11,755	105	.15	6	9,560	105
495	6,996	99	.67	89	507	33
496	3,876	85	.20	12	3,300	88
510	234	14	.17	7	197	15
513	337	21	.25	30	284	21

Continued . . .

Appendix C, Table 2 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
519	256	15	1.23	102	173	13
522	1,887	66	.35	51	1,620	68
525	808	45	1.23	103	732	49
546	1,763	62	.19	10	1,550	66
573	783	42	.27	36	631	43
579	12,325	107	.49	72	10,300	106
603	1,930	67	.22	22	1,630	69
612	785	44	.95	98	637	44
628	98	4	.82	95	86	45
633	389	23	1.38	105	322	23
647	16,911	109	.59	82	15,200	109
657	925	50	.58	81	840	51
663	632	32	.25	31	576	37
676	5,339	95	2.70	111	4,560	96
678	701	39	.34	50	682	46
687	104	6	.36	55	90	6
691	4,452	90	.41	59	3,860	92
702	630	31	.24	26	524	34
741	734	41	.45	64	579	39
753	1,475	58	.69	91	1,240	59
756	547	30	.29	40	504	32
777	268	16	.48	71	240	18
786	354	22	.20	13	303	22
789	2,219	71	.32	48	1,990	74
798	1,016	53	.21	17	900	53
804	456	26	.52	96	361	25
813	21,308	112	.51	76	18,000	111

Continued . . .

Appendix C, Table 2 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
831	104	5	.20	14	91	7
855	9,020	103	1.98	109	7,930	104
858	3,510	82	.48	70	2,930	78
909	6,185	96	.20	15	5,360	98
940	3,794	84	.33	49	3,450	89
949	1,200	55	.30	43	1,060	56

[1]For computation of measures, see Chapter II, Subsection B ii).

APPENDIX C, TABLE 3

ACCOUNTING RISK MEASURES BASED ON NET INCOME
PLUS DEPRECIATION
SELECTED STOCKS, 1958-67[1]

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
001	5,413	85	.20	22	4,660	85
018	1,033	43	.29	48	951	46
021	10,183	97	.26	42	9,030	100
030	31,994	112	.30	57	28,500	112
033	1,391	51	.14	7	1,230	52
037	2,243	59	.62	101	2,120	64
051	1,845	56	.43	89	1,590	57
078	525	25	.18	18	410	24
087	52,141	114	.31	58	42,700	114
102	173	8	.19	19	136	7
104	196	9	.26	44	141	9
105	10,445	98	.14	8	9,270	101
108	5,172	84	.41	80	4,910	87
111	682	29	.34	65	582	31
117	10,787	99	.42	84	8,970	99
135	2,862	69	.21	25	2,510	71
141	2,310	61	.17	13	1,870	58
144	227	11	.26	45	208	13
150	2,490	66	.40	79	2,120	65
156	167	7	.07	2	136	8
159	2,373	63	.23	37	2,040	63
165	3,156	73	.21	26	2,650	73
171	2,984	72	.13	5	2,390	70

Continued . . .

Appendix C, Table 3 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
177	869	36	.42	85	845	41
195	1,447	53	.58	100	1,180	50
204	2,888	70	.17	14	2,580	72
207	1,859	57	.15	9	1,570	56
213	1,339	50	.57	99	1,200	51
219	4,769	81	.35	70	4,100	81
231	739	33	.23	34	630	34
243	2,681	68	.54	95	2,130	66
252	69	2	.19	20	47	2
279	6,388	89	.26	46	5,320	89
282	286	15	.89	112	241	15
285	5,737	87	.44	90	4,880	86
288	1,104	47	.56	98	809	38
294	726	32	.37	75	521	27
300	111	5	.17	15	90	4
315	675	28	.48	92	628	33
318	5,071	83	.23	35	4,640	84
319	360	16	.23	38	312	17
336	13,036	102	.29	49	11,600	104
339	3,590	75	.65	103	3,150	77
348	265	14	.33	63	209	14
354	15,836	106	.41	81	14,700	106
357	439	20	.11	3	338	18
360	560	26	.29	56	476	26
361	4,061	78	.51	94	3,000	75
363	2,567	61	.19	21	2,350	69
366	13,469	103	.35	71	10,700	103

Continued . . .

Appendix C, Table 3 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
369	4,050	77	.42	86	3,270	78
372	440	21	.21	27	392	22
375	6,919	90	.32	62	6,360	93
381	397	18	.22	31	357	19
389	10,891	100	.35	72	8,950	98
393	993	41	.34	66	579	30
402	12,032	101	.24	40	8,910	97
407	2,966	71	.33	64	2,140	67
411	225	10	.24	39	201	12
413	242	12	.34	67	190	11
414	699	31	.77	109	588	32
417	2,335	62	.34	68	1,940	60
423	4,265	80	.45	91	3,800	79
426	482	23	.18	16	426	25
447	801	34	.54	96	698	36
450	5,527	86	.41	82	4,190	83
457	4,129	79	.74	107	3,890	80
463	3,769	76	.22	32	3,110	76
464	9,484	96	.42	87	8,460	96
466	5,803	88	.81	110	5,190	88
468	19,464	109	.16	11	17,600	109
471	942	39	.06	1	860	42
479	1,056	44	.99	113	824	39
481	1,085	45	.73	105	888	43
485	47	1	.15	10	30	1
489	37,502	113	.28	47	31,400	113
492	19,290	108	.13	6	16,900	108

Continued . . .

Appendix C, Table 3 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
495	14,259	105	.74	108	10,600	102
496	4,852	82	.16	12	4,170	82
510	455	22	.20	23	407	23
513	629	27	.26	43	550	28
519	243	13	.35	73	171	10
522	2,300	60	.29	50	1,960	61
525	973	40	.65	102	892	44
546	8,270	94	.32	61	7,830	95
573	1,093	46	.22	29	921	45
579	17,294	107	.37	74	15,800	107
603	2,418	64	.21	28	2,030	62
612	803	35	.65	104	657	35
628	138	6	.22	33	116	6
633	361	17	.82	111	290	16
647	19,589	110	.54	97	17,700	110
657	1,148	48	.34	69	1,020	48
663	1,210	49	.31	59	1,170	49
676	8,649	95	.73	106	7,320	94
678	1,006	42	.29	51	966	47
687	101	3	.18	17	84	3
691	7,141	93	.41	83	6,350	92
702	1,465	54	.31	60	1,250	53
741	910	38	.39	78	767	37
753	2,168	58	.42	88	1,870	59
756	889	37	.29	52	834	40
777	421	19	.49	93	370	20
786	687	30	.22	30	573	29

Continued . . .

Appendix C, Table 3 - Continued

Stock	Standard Deviation (000's)		Coefficient of Variation		Mean-Absolute Deviation (000's)	
	Magnitude	Rank	Magnitude	Rank	Magnitude	Rank
789	2,467	65	.29	53	2,210	68
798	1,442	52	.23	36	1,280	54
804	521	24	.25	41	381	21
813	24,818	111	.38	76	21,700	111
831	108	4	.12	4	99	5
855	13,518	104	1.01	114	12,000	105
858	3,552	74	.29	54	2,970	74
909	7,109	92	.20	24	6,090	90
940	7,019	91	.38	77	6,110	91
949	1,631	55	.29	55	1,430	55

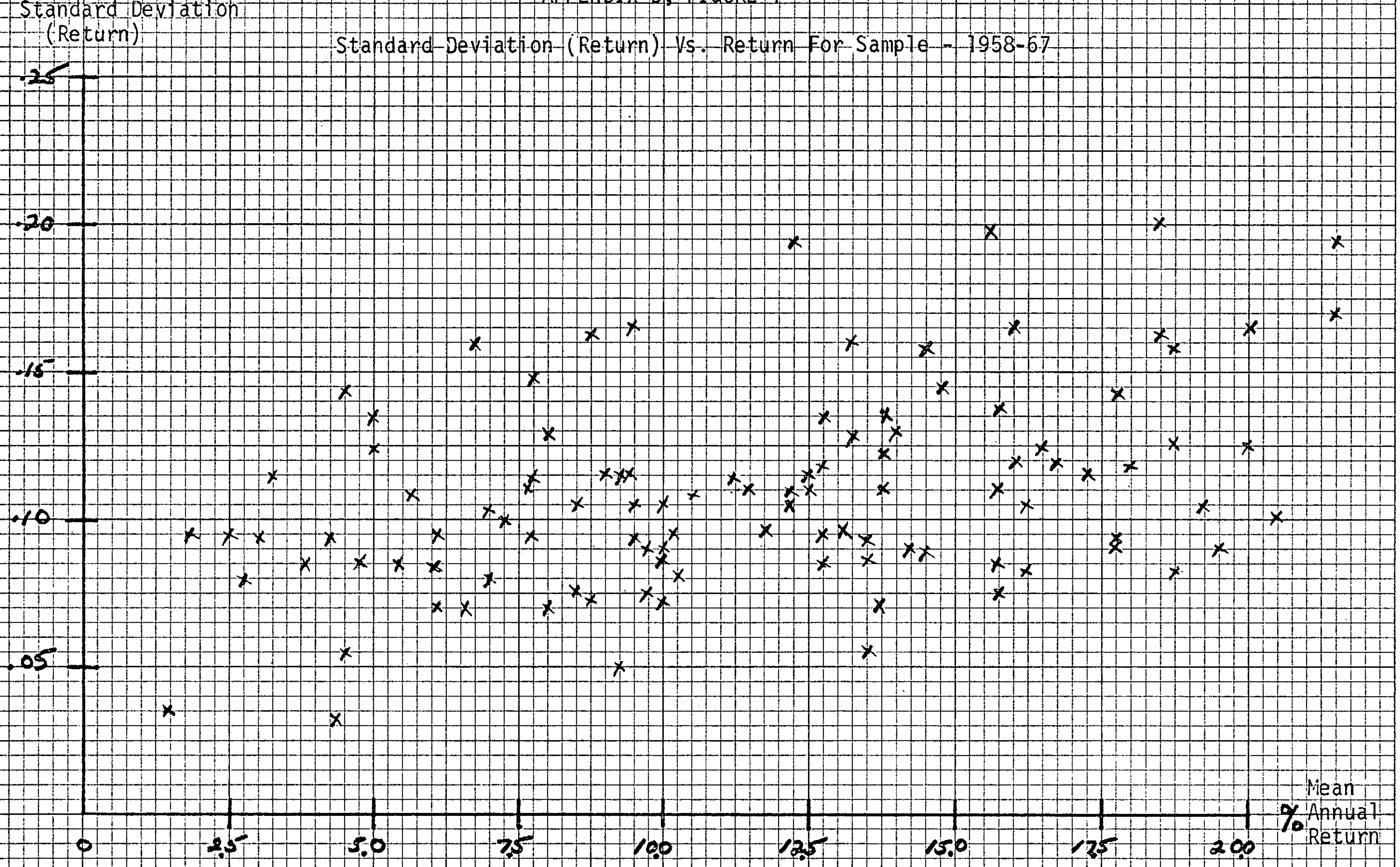
[1]For computation of measures, see Chapter II, Subsection B ii).

APPENDIX D

GRAPHICAL ANALYSES OF RISK/RETURN RELATIONSHIPS

APPENDIX D, FIGURE 1

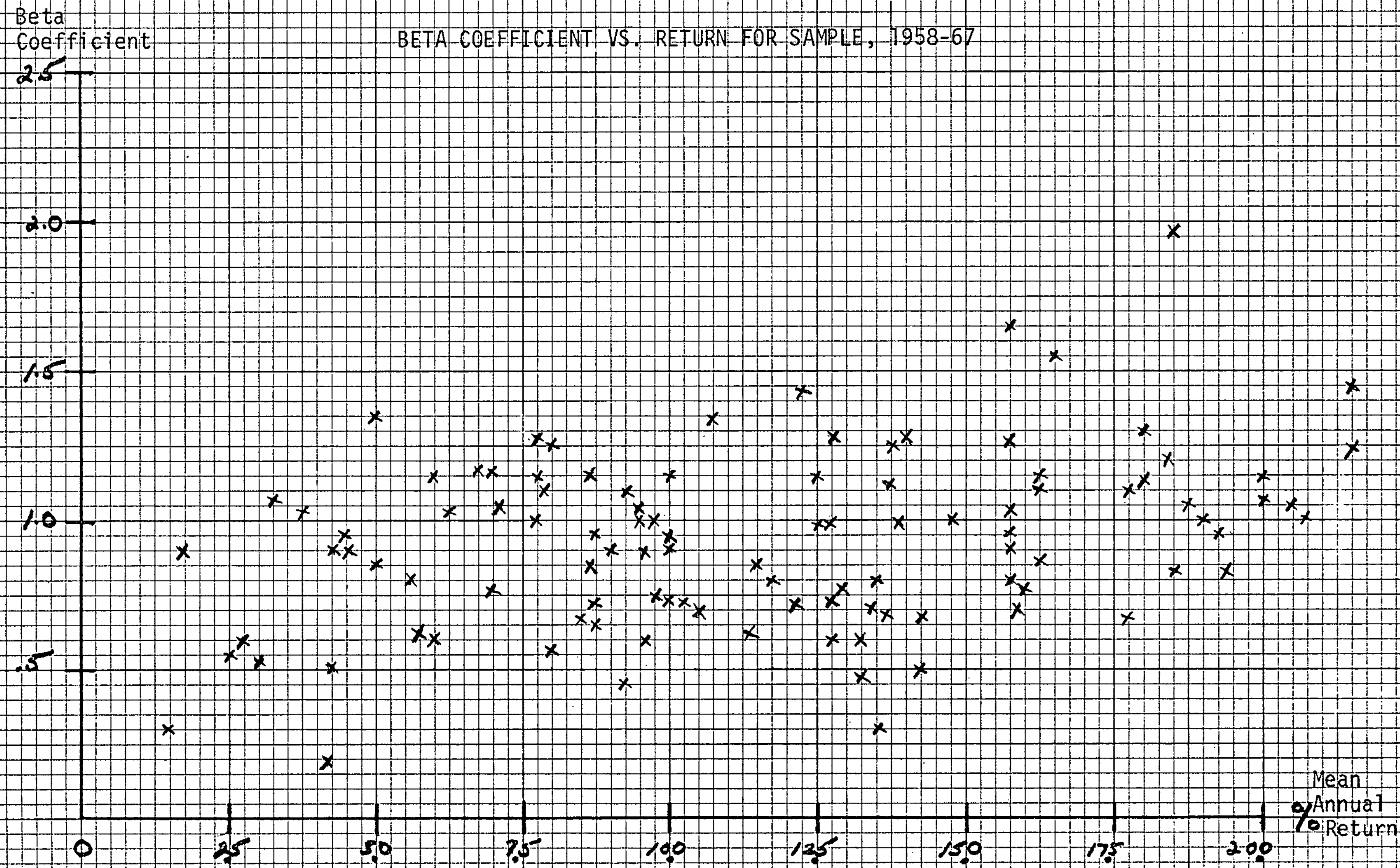
Standard Deviation (Return) Vs. Return For Sample - 1958-67



Source: Appendix B, Table 1.

APPENDIX D, FIGURE 2

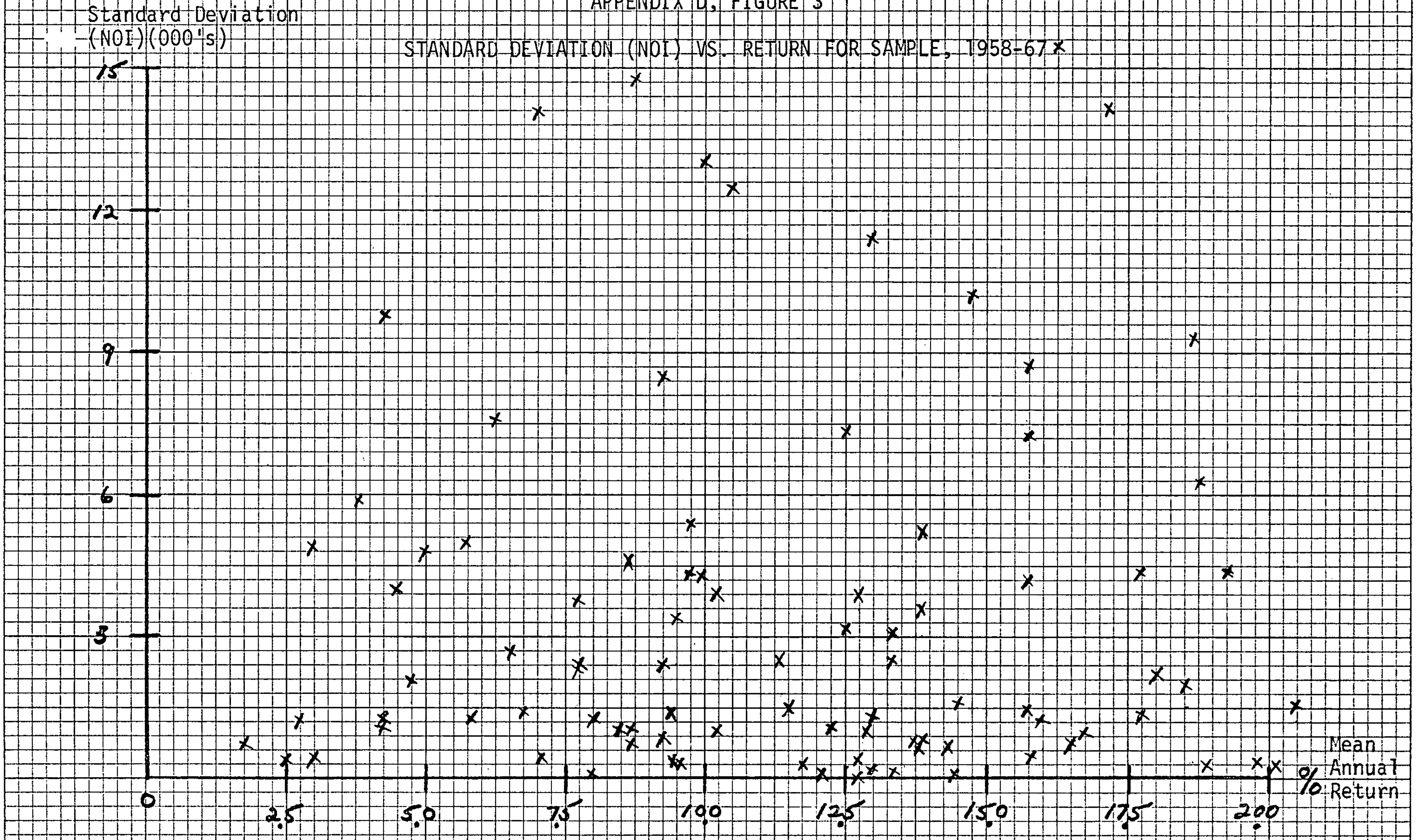
BETA COEFFICIENT VS. RETURN FOR SAMPLE, 1958-67



Source: Appendix B, Table 1

APPENDIX D, FIGURE 3

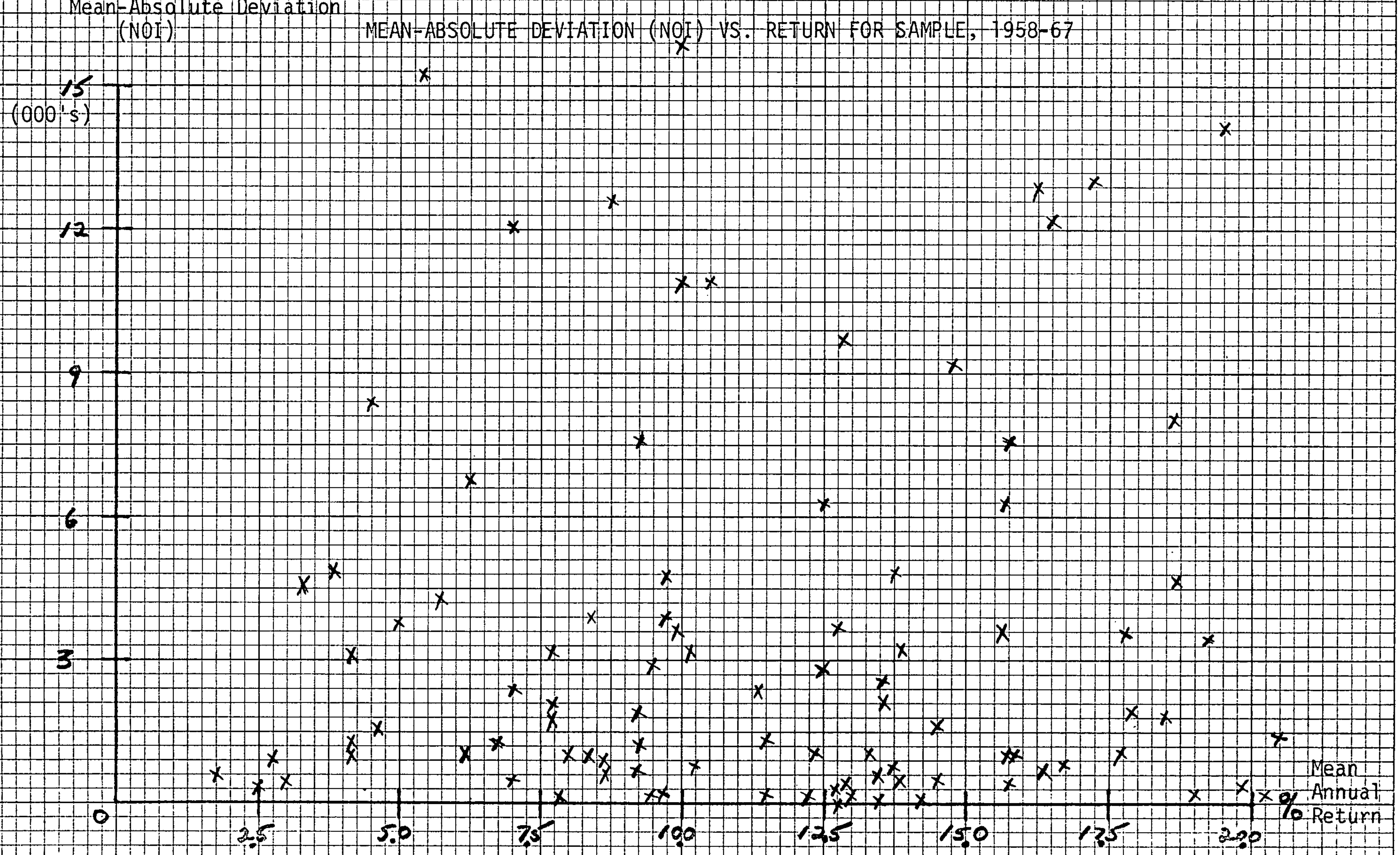
STANDARD DEVIATION (NOI) VS. RETURN FOR SAMPLE, 1958-67



Source: Appendix C, Table 1

APPENDIX D, FIGURE 4

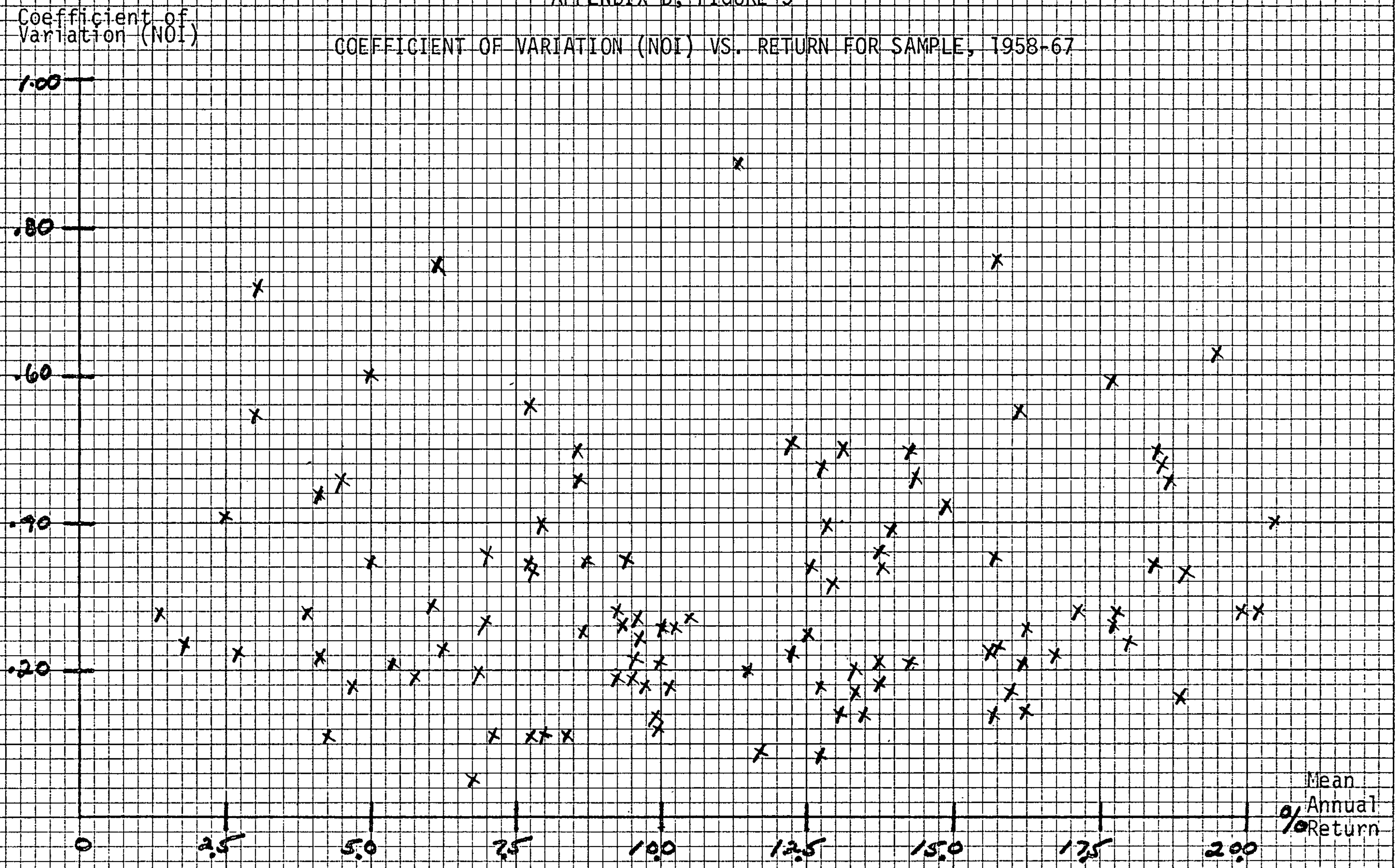
MEAN-ABSOLUTE DEVIATION (NOI) VS. RETURN FOR SAMPLE, 1958-67



Source: Appendix C, Table 1

APPENDIX D, FIGURE 5

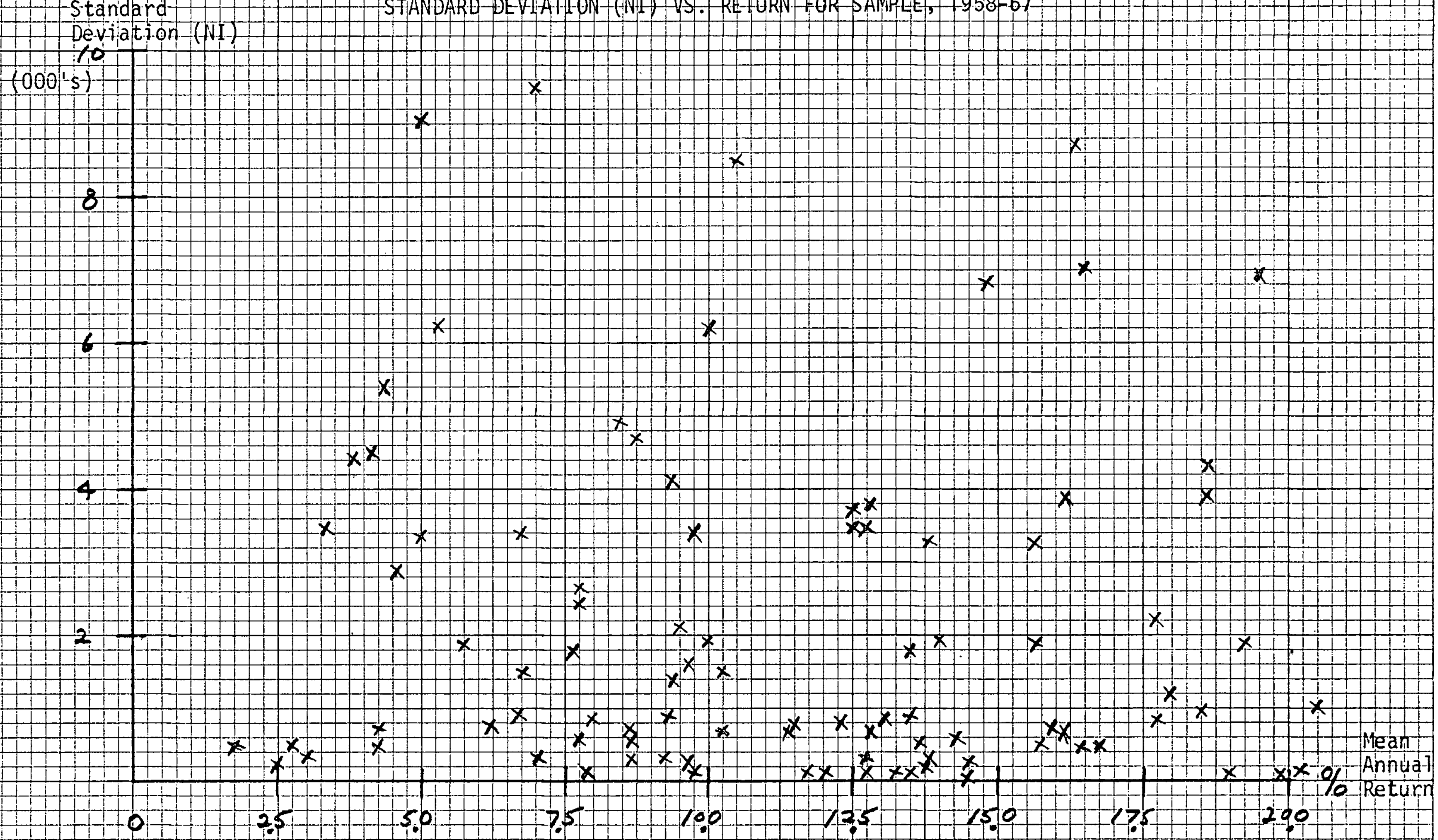
COEFFICIENT OF VARIATION (NOI) VS. RETURN FOR SAMPLE, 1958-67



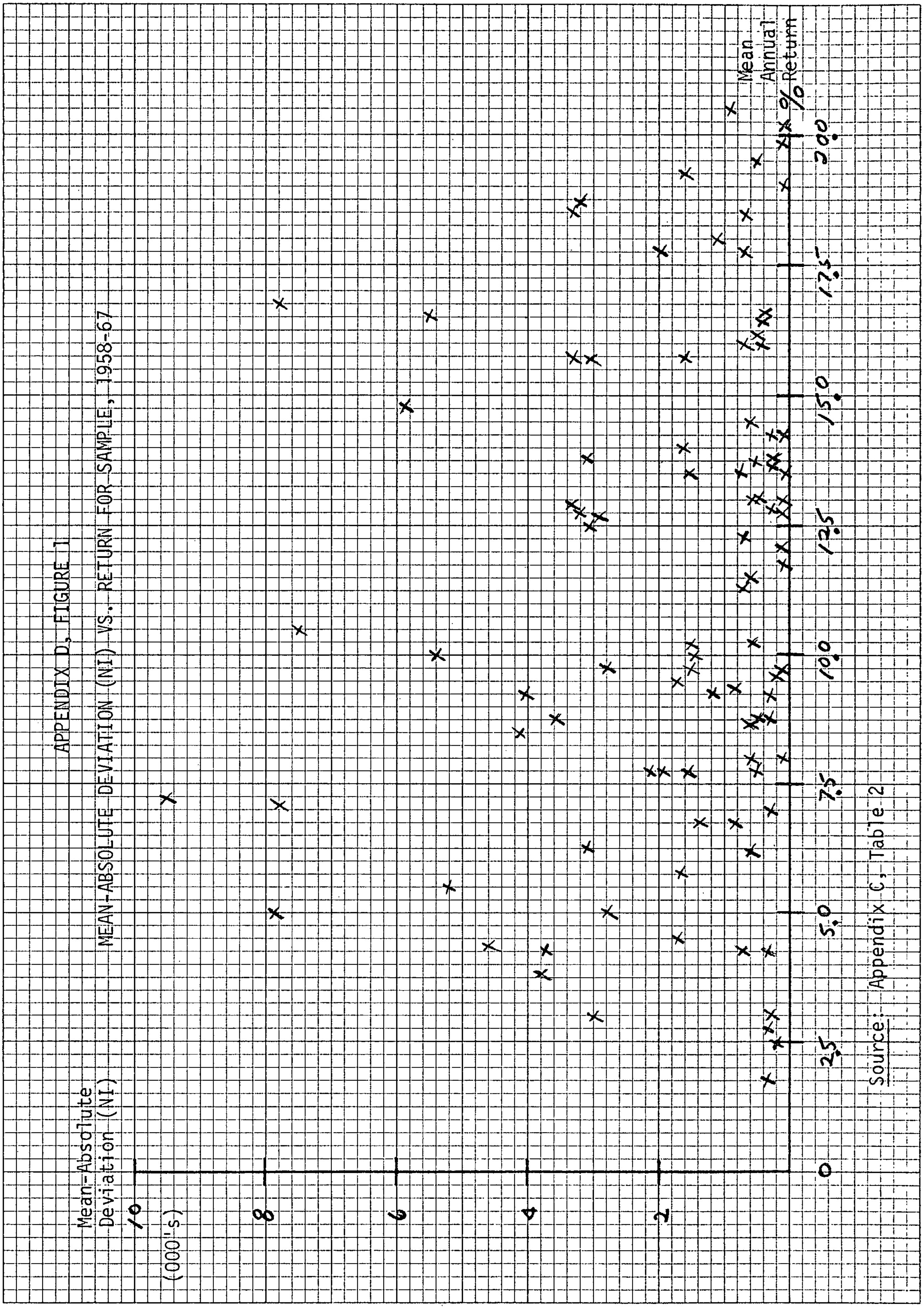
Source: Appendix C, Table 1.

APPENDIX D, FIGURE 6

STANDARD DEVIATION (NI) VS. RETURN FOR SAMPLE, 1958-67

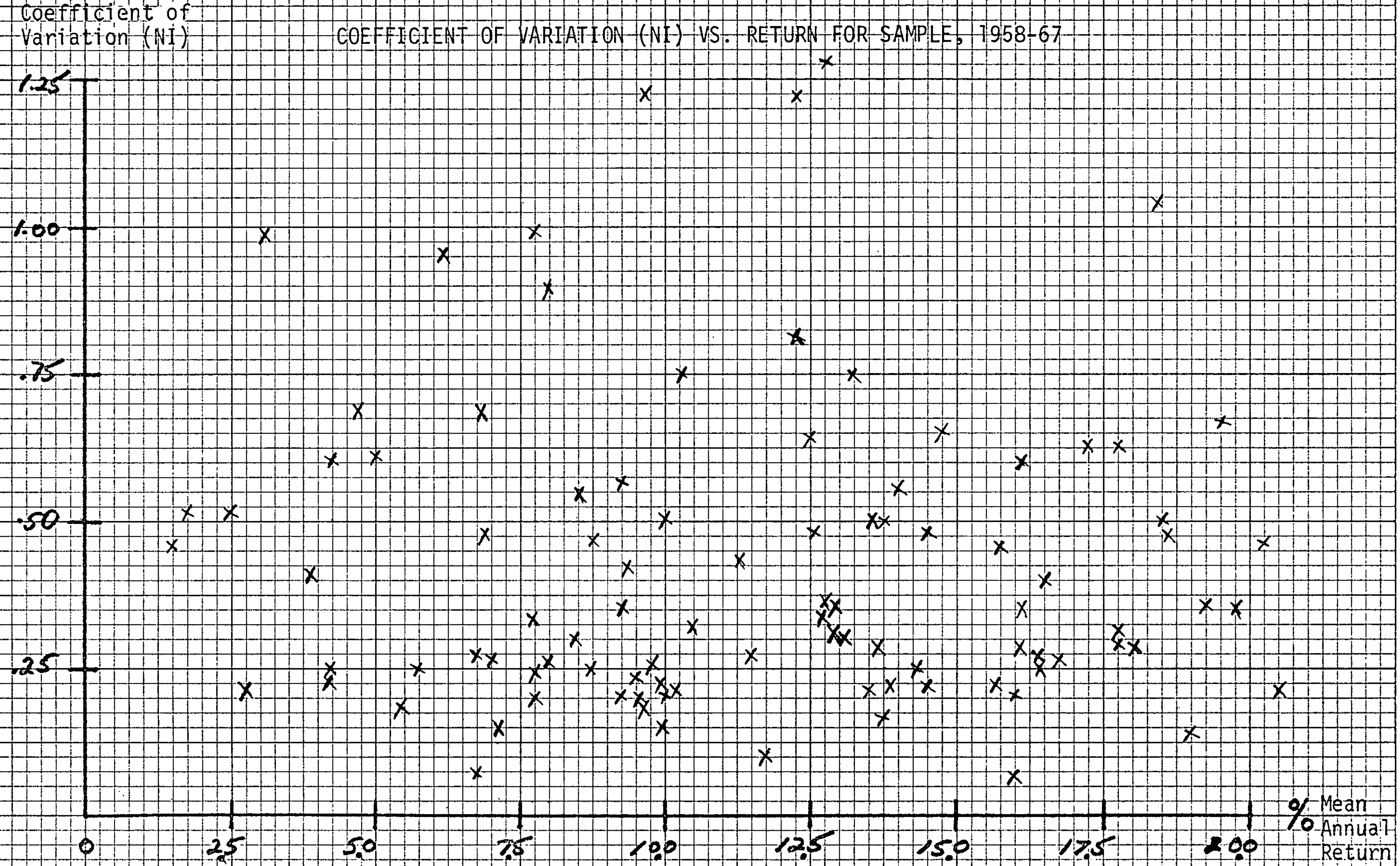


Source: Appendix C, Table 2.


APPENDIX D, FIGURE 1
MEAN-ABSOLUTE DEVIATION (NI) VS. RETURN FOR SAMPLE, 1958-67
Mean-Absolute Deviation (NI)
(000's)
10
8
6
4
2
0
25
50
75
100
125
150
175
200
Mean Annual Return %
Source: Appendix C, Table 2

APPENDIX D, FIGURE 8

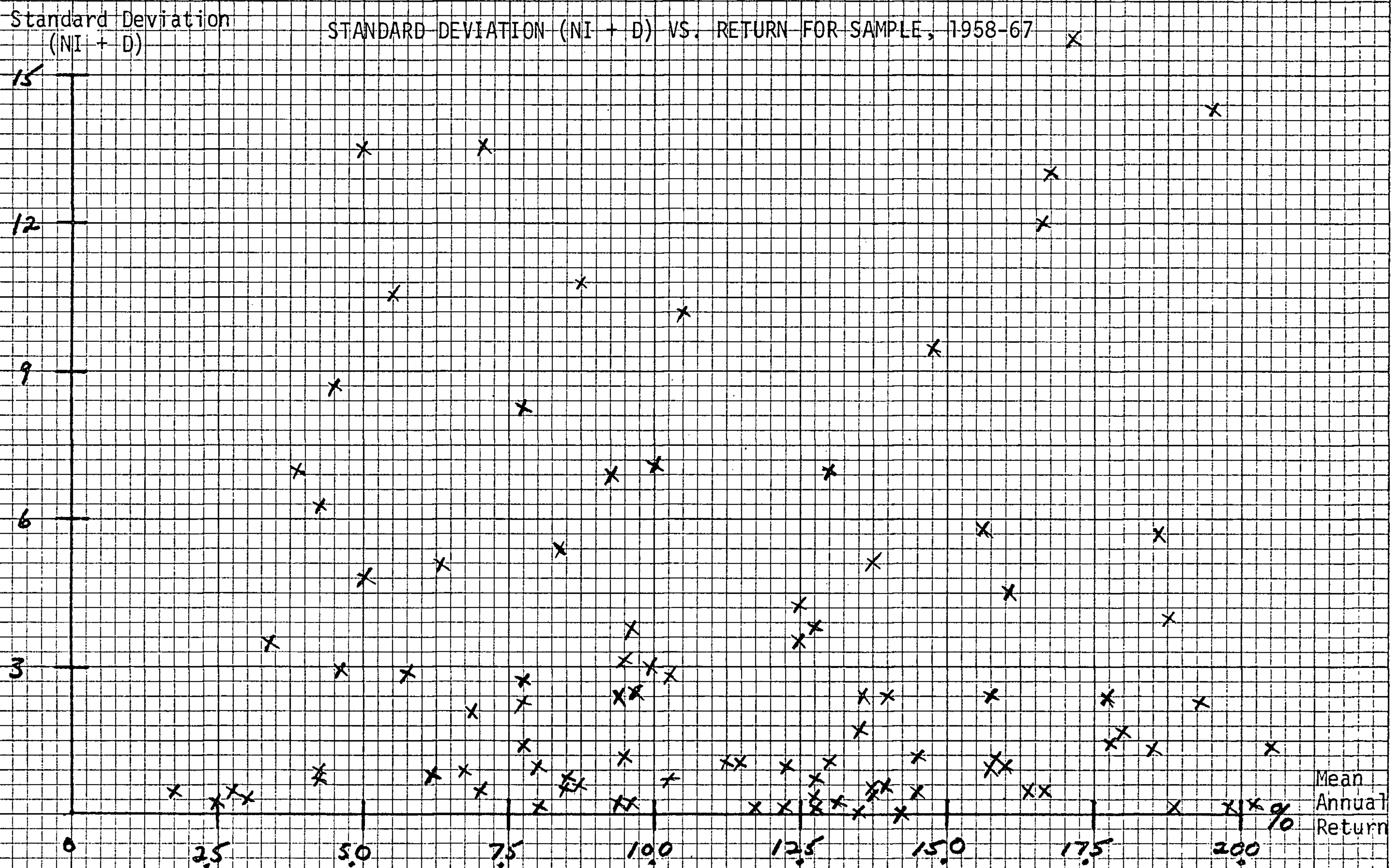
COEFFICIENT OF VARIATION (NI) VS. RETURN FOR SAMPLE, 1958-67



Source: Appendix C, Table 2

APPENDIX D, FIGURE 9

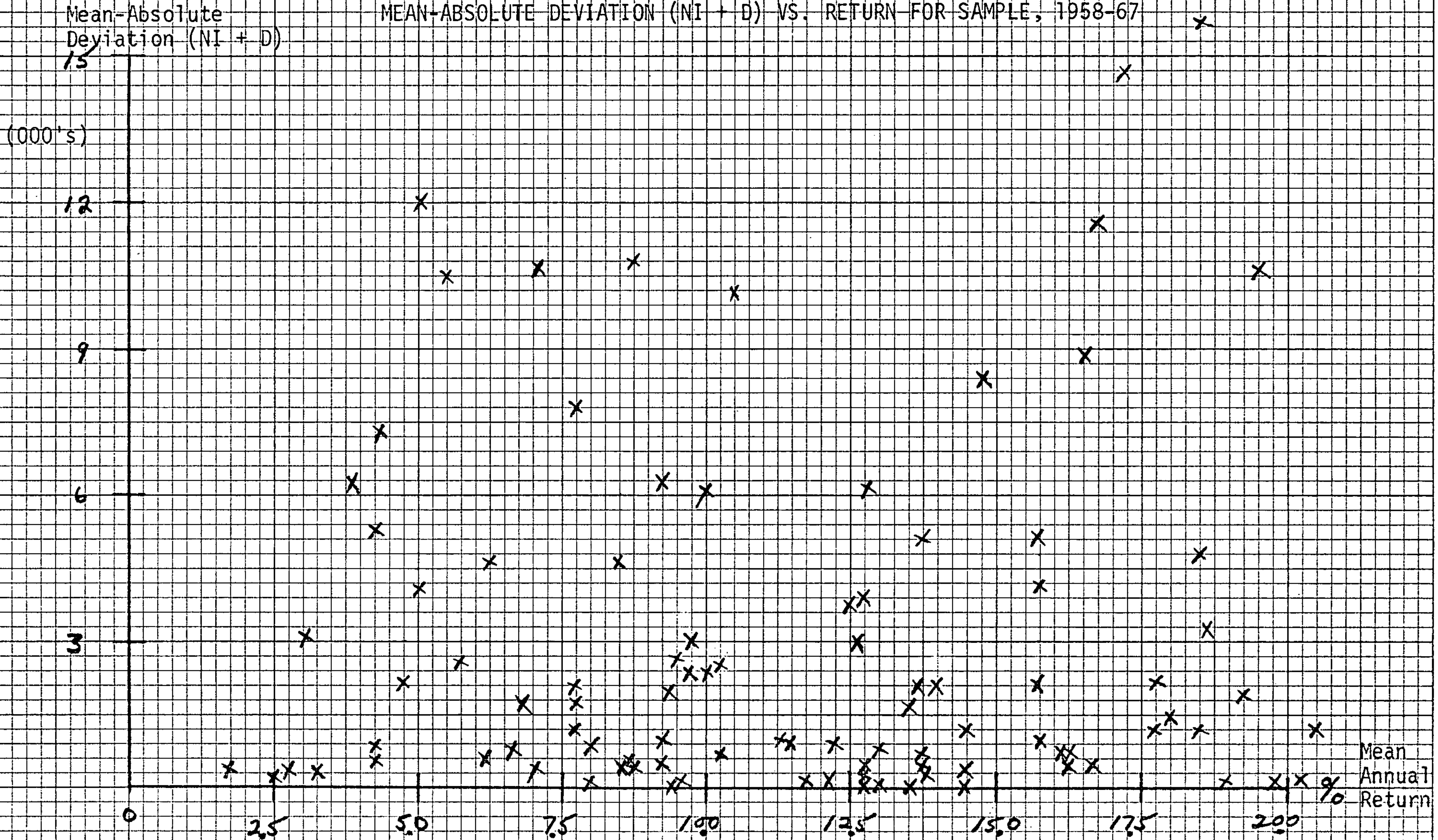
STANDARD DEVIATION (NI + D) VS. RETURN FOR SAMPLE, 1958-67



Source: Appendix C, Table 3

APPENDIX D, FIGURE 10

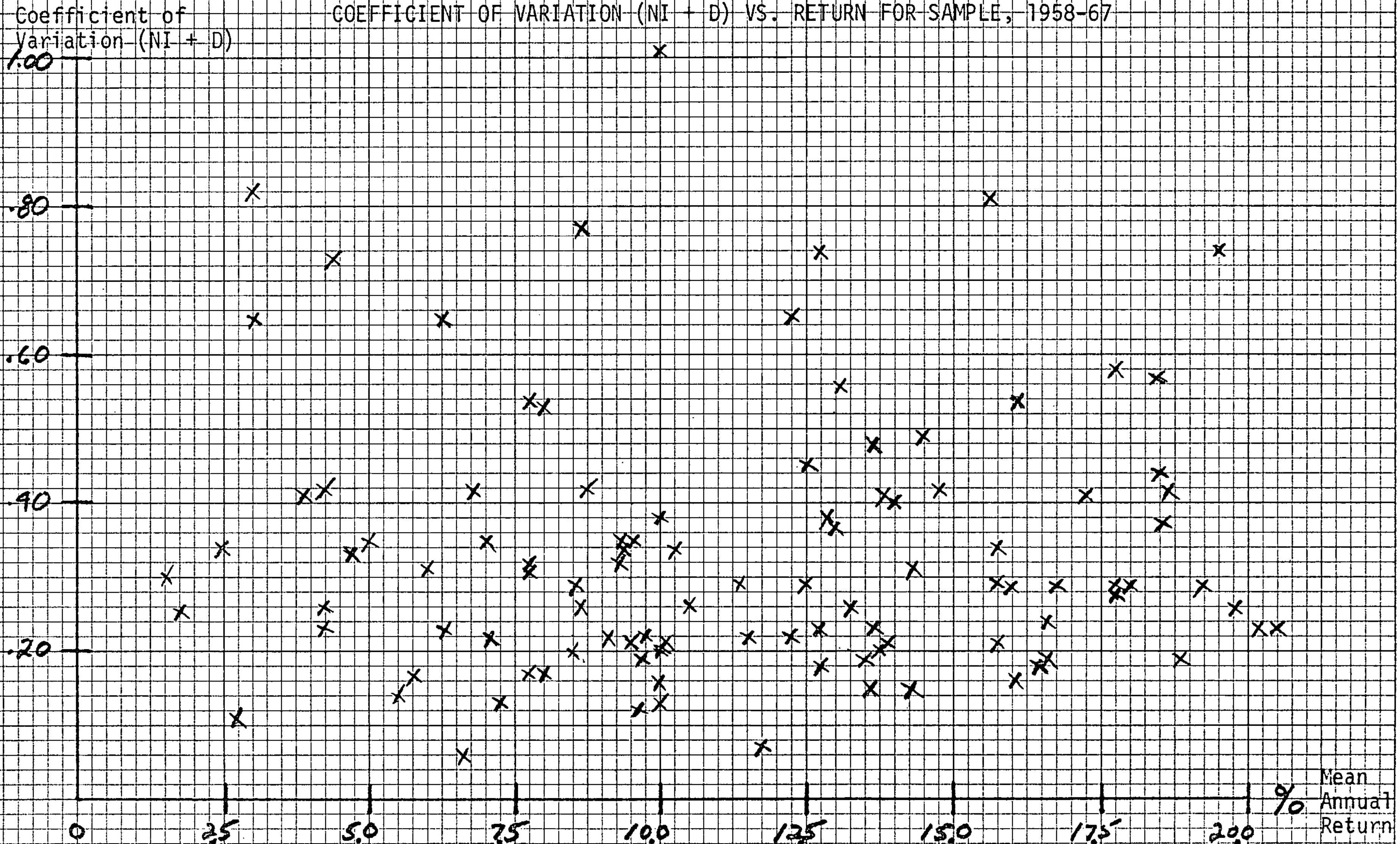
MEAN-ABSOLUTE DEVIATION (NI + D) VS. RETURN FOR SAMPLE, 1958-67



Source: Appendix C, Table 3.

APPENDIX D, FIGURE 11

COEFFICIENT OF VARIATION (NI + D) VS. RETURN FOR SAMPLE, 1958-67



Source: Appendix C, Table 3

APPENDIX E

LIST OF FIRMS IN SAMPLE

APPENDIX E, TABLE 1

LIST OF FIRMS CONTAINED IN SAMPLE BY CODE, 1958-67

1 Abitibi Paper
18 Algoma Central Railway
21 Algoma Steel Corp.
30 Alcan Aluminium
33 Anglo-Canadian P. & P.
37 Anthes Imperial
51 Atlantic Sugar
54 Auto Electric

78 Beaver Lumber
87 Bell Canada
102 Bright T. G.
104 B. A. Bank Note
105 B. A. Oil
108 B. C. Forest Products
111 B. C. Packers
117 B. C. Telephone

135 Calgary Power
141 Can. Cement
144 Can C. & Cut Stone
150 Canron
156 Can. Malting
159 Can. Packers
165 Can. Steamship Lines
171 Cdn. Breweries
177 Cdn. Canners
195 Cdn. Hydrocarbons
204 Cdn. Industries
207 Cdn. Int. Power
213 Cdn. Marconi
219 Cdn. Petrofina
231 Cdn. Utilities
243 Cdn. Westinghouse
252 Chateau-Gai Wines
279 Consolidated-Bathurst
282 Consolidated Textile
285 Consumers' Gas
288 Consumers Glass
294 H. Corby
300 Cosmos Imperial
315 Crown Cork & Seal
318 Crown Zellerbach
319 Crows Nest Industries

336 Distillers-Seagram
339 Dom. Bridge
348 Electrohome
354 Dom. Foundaries & Steel
357 Dom Glass
360 Domco Industries
361 Dom. Steel
363 Dom. Stores
366 Domtar
369 Dom. Textile
372 Donohue Bros.
375 Du Pont of Canada

381 Eddy Match

389 Falconbridge Nickel
393 Federal Grain
402 Ford Canada
407 Fraser Companies

411 General Bakeries
413 General Products
414 General Steel Wares
417 Goodyear Tire
423 Great Lakes Paper
426 Great Lakes Power

447 Harding Carpet
450 Hawker Siddeley
457 Home Oil
463 Hudson Bay Mining
464 H. B. Oil & Gas
466 Husky Oil

Appendix E, Table 1 - Continued

468 Imperial Oil
471 Imperial Tobacco
479 Inglis
481 Inland Natural Gas
485 Interior Breweries
489 International Nickel
492 International Paper
495 International Utilities
496 Interprov. Pipelines

510 Jockey Club

513 Kelly, Douglas
519 Kelvinator
522 Labatt, John
525 Lafarge cement
546 Loblaw Cos.

573 Maple Leaf Mills
579 Massey-Ferguson
603 Molson Breweries
612 MLW Worthington

628 Nabors Drilling
647 Noranda

657 Ocean Cement
663 Ogilvie Flour

676 Pacific Petroleum
678 Pembina Pipe
687 Photo Engravers
691 Price Co.

702 Quebec Telephone

741 Rolland Paper

753 St. Lawrence Cement
756 Salada Foods
777 Shop & Save
786 Silverwood Dairies
789 Simpsons
798 Southam Press
804 Standard Paving
813 Steel Co. of Canada

831 Tamblyn
855 Trans-Canada Pipelines
858 Trans-Mt. Oil Pipe Line

909 Walker-G. & W.
904 Weston, Geo.
949 Woodward Stores