

(1950-1965) each industry's annual rate of return and dispersion. In this way our measures should not have been unduly influenced by abnormal years.⁵

(It will be readily noted by economists that in measuring risk as the average intercompany dispersion (or variance) we are, at the same time, staying with and breaking with standard economic tradition. The word risk is generally used by economists to represent certain aspects of the utility functions persons are presumed to maximize in their decision making processes. Specifically, the second moment of the expected utility function is considered the risk element⁶ which one usually tries to minimize, while trying to maximize the first moment of the utility function. It is, therefore, natural to measure risk as some type of variance (i.e., mathematical second moment); in so doing we are in keeping with tradition. However, the expected utility function concerns itself with *ex ante* risk. There is no strong reason to believe that temporal variance is a good measure of this quantity. In fact, when dealing with autocorrelated time series (as economic series almost always seem to be) we reject the usual reliance on individual company temporal variance.)

The inter-company dispersion of returns measures one aspect of industry riskiness. We call it the *interspatial*⁷ component and view it as somewhat analogous with the uncertainty of any one company's market share in a nonregulated industry. There also exists an *intertemporal* component to industry riskiness. This component is analogous with the *non-predictable* element of year to year changes in individual company or industry profitability. So defined it is very difficult to measure because most economic time series are highly autocorrelated. We have developed some more general intertemporal dispersion measures and have used them, as far as possible, in our analyses.

Our statistical tests on interspatial dispersion turned out to be significant and are discussed in full below. There are, however, a number of theoretical problems which warrant discussion at this point. A few are easily disposed of. One is the problem of industry definition. The theory depends *critically* upon the idea of similarity between the companies assigned to an industry group. The industry groupings we chose are as homogeneous as the SIC based Compustat tape would allow. One may choose the precise industry composition in differing ways and thus, because the number value of our basic measure of risk is so *critically dependent* on the industry grouping, we believe that it was essential to test the sensitivity of our measure to different industry groupings. It is reassuring to report that the results were essentially unchanged when we employed a small number of quite narrow and homogeneous industries.⁸

A similar problem arises because of the widely different sizes of the firms that are rightfully grouped in any industry and the fact that the firms used in our analyses (because of the selectivity of the Compustat tapes) tended to be the larger and more successful firms in each category. We, at this point, do not have sufficient data to investigate the effect that this may have on our results but have sufficient reason to believe that the inclusion of smaller firms would strengthen the relationship we have found.

IV. DEFINITIONS OF RETURN

In studying the relation between risk and return it is, of course, necessary to construct quantitative measures of both variables. The measure of risk has been defined in the previous section as the average interspatial deviation of company rates of return about the industry's rate of return. As can be seen from the mathematical deviation presented in Appendix A, the general definition of our risk measure does not depend at all on the specific definition of the rate of return. However, care must be taken in defining return, for the logic upon which the measure of risk is based maintains its economic validity if, and only if, the return calculated is a true, overall economic rate of return.

Rates of return can be measured either at "book value" or at "market value." Book value returns relate the yearly income flow as reported on the company P&L statement to stock Balance Sheet items, such as total assets. Although book value figures are subject to many imperfections, in the long run they are the best indicator of real⁹ economic return to invested resources. For a company

⁵ Appendix A presents a detailed mathematical derivation of our measure of risk and contrasts it with other measures that have been proposed.

⁶ C. J. H. Markowitz, *Portfolio Selection*, New York: Wiley, 1959.

⁷ May also be called cross-sectional or intercompany.

⁸ Throughout this paper "real" is used in its economic sense, meaning tangible or physical rather than intangible.