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How do institutional investors perceive risk?*

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"Beta" and "residual standard deviation" are much more than academic lingo: they accurately describe what goes on in the real world.

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Investors articulate the concept of *risk* in a wide variety of language. Professor Frank Knight characterized risk as "the subjective or felt uncertainty and one's cognitive feeling toward it."[1] In the last decade, the theory of finance has suggested specific measures of risk that are now used in many financial institutions. The seminal theoretical contribution is commonly known as the Sharpe-Lintner capital asset pricing model.[2] Total risk in this framework is defined as the standard deviation of return on a security or portfolio; its two components are systematic risk (beta) and non-market risk (the residual standard deviation).

Many professional analysts and portfolio managers have expressed sincere skepticism about beta and quantitative estimates of security risk in general. Empirical research on risk and return in the stock market, with results most academicians find decisively convincing, often leaves institutional investors unpersuaded.

Acting in the face of uncertainty is more difficult than talking about it, and the states of nature that the future might bring are so complex in the case of large corporations that the practitioner may consider it heroic to summarize "risk" in a single number. It is not unreasonable to ask how the many aspects of business risk and financial risk that may affect an investment can realistically be reflected in one parameter.

This note demonstrates that historical measures of risk are highly consistent with the risk of common stocks as perceived by 225 institutional portfolio managers and financial analysts who cooperated in this study. This behavioral evidence confirms the robustness of widely used estimates of beta and non-market risk as descriptors of perceived risk among institutional investors. The findings indicate that both historical beta and non-market risk are significantly related to perceived risk.

The interpretations of the results may be: (a) that both historical beta and non-market risk are important in predicting future (*ex ante*) beta,[3] just as perceived risk is an *ex ante* measure of future risk; and (b) that non-market risk as well as systematic risk are in fact germane to many institutional investors whose clients' portfolios are concentrated, rather than highly diversified, for a wide variety of reasons.[4] Our principal motivation in this study has been simply to demonstrate to portfolio managers the intuitive appeal of beta and non-market risk in light of the risk perceptions of practitioners in the professional investment community.

MEASURING RISK

We selected a sample of 25 common stocks from the population of Standard and Poor's 500 Stock Index plus 50 bank stocks and other major stocks traded over-the-counter. Our objective in the method of selection was to maximize our ability to discriminate between historical beta and non-market risk in relation to perceived risk by obtaining a sample of stocks for which estimates of beta and non-market risk were essentially uncorrelated over the previous sixty months.[5] Each month, Merrill Lynch estimates beta and non-market risk for several thousand common stocks by regressing the latest sixty months of data on each stock's returns (monthly dividend plus capital gain or loss, divided by beginning price) on a comparable series of monthly returns on "the market," as indicated by the S&P 500 Index. Their estimate of beta is the regression coefficient of the independent variable, the return on the market.

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1. Footnotes appear at the end of the article.

Using this sample of stocks, we sent a short letter to 400 financial analysts, portfolio managers, and other investment professionals in May, 1973. We asked each individual to assess the "risk" of each stock as he or she perceived it on a scale of 1 to 9, where the definition of risk was specifically left to the individual.[6] In addition, we asked for an indication of each respondent's "familiarity" with each company and its stock, also on a scale of 1 to 9. Our request that respondents assess their perceived risk and familiarity with the integers 1 through 9, rather than with a more finely calibrated scale, was consistent with the normal capacity of individuals to discriminate among categories in the transmission of information. Nine categories comprise a commonly used limit, and we used nine perceived risk classes in this inquiry.[7]

Fully completed questionnaires were returned by 225 respondents before the deadline of May 31, 1973, providing a common time frame for all participants during the two-week response period. A list of the stocks in the sample is given in Table 1. In order to provide the reader with the relative ranking of these stocks with respect to the principal variables in this study, we have provided the ordinal rank by the mean value of each variable; number 1 indicates the highest perceived risk or the highest beta in the sample.

PERCEIVED RISK, BETA, AND NON-MARKET RISK

Our hypothesis was that historical beta and non-market risk substantially "explain" perceived risk, as judged by portfolio managers and analysts. We evaluated the evidence in two ways. First, in terms of the *average* or mean value of perceived risk among the 225 respondents, how was mean perceived risk related to beta and non-market risk? The results are shown in Table 2. The degree of association between beta, non-market risk, and perceived risk is indicated by R-squared. If R-squared were equal to 1.00, beta and non-market risk would appear to explain all of the differences in mean perceived risk among stocks; if R-squared were equal to zero, beta and non-market risk would appear to explain none of the differences in perceived risk, i.e., to be totally unrelated to perceived risk.

We found that both beta and non-market risk were significantly related to perceived risk, and together they explained 83% (R-squared 0.83) of the var-

TABLE 1

COMPANY RANK BY MEAN VALUE OF VARIABLE

	Responses from Investors*		Public Data**			
	Perceived Risk	Familiarity	Beta	Non-Market Risk	Variability	Size: Market Value
American Express	15	13	14	14	15	19
American Motors	3	22	10	6	6	24
Avon Products	16	10	20	19	19	7
ATT	25	2	19	25	24	2
Bank of America	24	7	17	16	16	11
Braniff Airways	4	23	5	3	2	25
British Petroleum	9	24	23	2	5	3
Campbell Red Lake Mines	2	25	25	1	1	23
Celanese	12	21	12	10	14	21
Chrysler	7	15	4	12	8	16
Control Data	5	18	1	5	4	20
Delta Air Lines	10	14	3	13	12	18
Disney	13	9	16	8	9	12
Dupont	21	8	24	22	25	6
Eastman Kodak	19	5	21	20	23	3
Exxon	23	4	22	18	20	4
Ford	18	6	13	17	18	8
IBM	22	1	18	23	22	1
International Paper	17	16	9	21	17	15
ITT	11	11	6	15	13	10
McDonald	6	12	8	11	10	13
Pan Am	1	20	2	4	3	22
Sears Roebuck	20	3	15	24	21	5
Sperry Rand	8	19	7	7	7	17
Upjohn	14	17	11	9	11	14

* Rank number 1 indicates the highest ranking company in the averages of 225 responses.
** Rank number 1 indicates the highest beta, the largest non-market risk, total variability or size.

TABLE 2

PERCEIVED RISK AS EXPLAINED BY STATISTICAL RISK MEASURES
Dependent variable: Perceived risk of stock (mean of 225 responses)

	Sample	Constant	Beta	Non-Market Risk	Total Variability	R^{2*}
1. The Effect of Beta:	N = 25	3.61 (5.71)**	1.19 (2.27)			0.15
2. The Effect of Non-Market Risk:	N = 25	2.33 (6.07)		0.38 (7.32)		0.69
3. The Effect of Beta and Non-Market Risk:	N = 25	1.22 (3.25)	1.06 (4.55)	0.37 (9.67)		0.83
4. The Effect of Total Variability of Return (Standard Deviation):	N = 25	1.52 (4.35)			0.41 (10.34)	0.82
5. The Effect of Total Variability of Return (Variance):	N = 25	3.25 (13.91)			0.02 (8.67)	0.76

* All estimates of R^2 are adjusted for degrees of freedom.
** Numbers in parentheses are *t*-statistics.

iance in mean perceived risk among the 25 stocks. Beta alone explained 15% and non-market risk alone explained 69% of the variance in perceived risk. Total variability of return includes both beta (market) and non-market risk. As a measure of total variability of return, standard deviation was more highly associated with perceived risk than was variance of return (standard deviation squared). The relationship of perceived risk to total variability in the 25-stock sample is shown graphically in Figure 1.

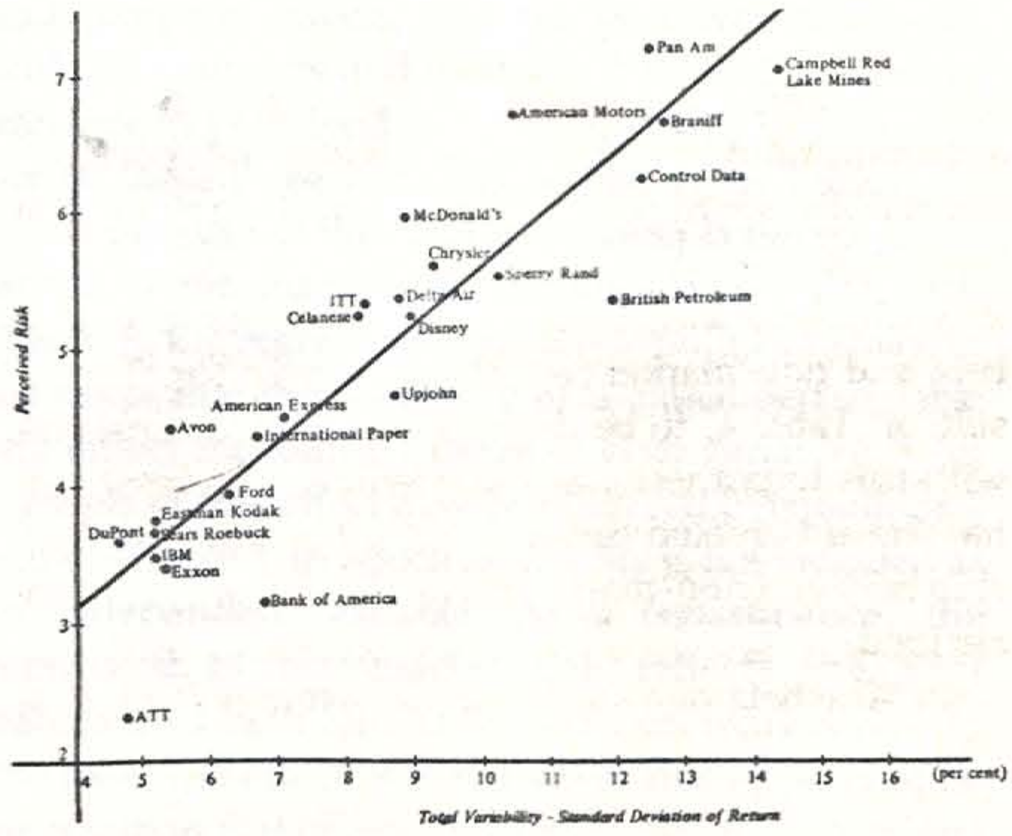
One gold mining stock in the sample, Campbell Red Lake Mines, had the highest non-market risk and total variability but the lowest beta in the sample. Gold mining shares are exceptional in that they are generally positively related to the price of gold but only weakly related to the stock market, so that they have high return variability and near-zero beta.[8] With Campbell Red Lake Mines deleted from the sample, the portion of variance in perceived risk explained by beta alone rose from 15 to 49%, but the effect of non-market risk was virtually unchanged.

In highly diversified institutional portfolios, beta or market risk comprises the major portion of total risk. However, in many institutional portfolios of forty to sixty stocks (often regarded as "well diversified"), *the remaining non-market risk is far from negligible,* and non-market risk is indeed germane in this context — whatever the motivation for selecting specific stocks, industries, or sectors.[9] It should be emphasized that we intentionally asked respondents to assess the risk of each stock without specifying a portfolio context, so that non-market risk was expected to be a more important factor than it might have been had we chosen to measure "perceived risk of each stock in a highly diversified portfolio."[10]

A second way of looking at the association between perceived risk, beta, and non-market risk is to examine the data for each respondent individually, rather than aggregating the data on stocks in averages across 225 individuals. We found that the results in an investor-by-investor analysis were consistent with the

Figure 1

MEAN PERCEIVED RISK AND TOTAL VARIABILITY



findings reported in Table 2. In 197 out of 225 cases, the estimated coefficients of beta were positive (significantly so in 104 cases). For 220 out of 225 individuals, non-market risk was positively related to perceived risk (significantly so in 188 cases). The point is that individuals' rankings of their perceived risk of common stocks generally were positively related to beta and non-market risk. This is not to suggest that most individuals explicitly used historical data on beta and non-market risk in the assessment of perceived risk, but rather that the underlying elements of companies' fundamental business and financial risk were reflected both in investor perceptions and in statistical risk measures.

PERCEIVED RISK AND FAMILIARITY

Irving Fisher suggested that two major ways by which risk may be reduced are increased *diversification* (sometimes called consolidation by Fisher and Knight) and increased *knowledge* (called specialization by Knight).[11] Risk reduction through diversification is relatively well appreciated by practitioners and academicians alike. Whether or not perceived risk is reduced by knowledge is an empirical question, and we hardly need stress that the familiarity which we have measured is only a proxy for the kind of deep knowledge to which Fisher alluded in the context of risk reduction.[12]

TABLE 3

TOTAL MARKET VALUE, BETA AND NON-MARKET RISK
Dependent variable: Size, measured by total market value of stock ($ Billions)

Sample	Constant	Absolute value of (Beta-1)	Non-Market Risk	R^2
N = 25	25.80	−2.18	−1.71	0.40
	(5.45)*	(−2.23)	(−3.12)	

* Numbers in parentheses are t-statistics.

Generally, the better an analyst feels he knows a company and its stock, the less risk he will perceive. Specifically, we hypothesize that perceived risk will be lower as an investor's own assessment of his familiarity with a company and its stock increases, provided beta and non-market risk are accounted for. The results in Table 4, to be discussed later, are consistent with this hypothesis, as the coefficient of familiarity has the anticipated negative sign. First, the relationship between non-market risk and familiarity must be clarified.

The beta of a stock and the average familiarity with the stock are essentially unrelated variables, but familiarity and non-market risk are strongly negatively related, as indicated by a correlation coefficient of -0.89. In part, the explanation for the latter relationship relates to firm *size* measured in terms of the total market value of outstanding common stock. Larger companies tend to have smaller non-market risk in common stock returns, as the firms themselves are effectively diversified as operating "portfolios" of divisions or subsidiaries.[13] A parallel argument can be made with respect to beta. Larger companies tend to have betas nearer to 1.0. As the firm's market value becomes a larger part of the aggregate market value in the economy, beta tends to move in the direction of 1.0; this suggests, in other words, that the absolute value of Beta-1 is negatively associated with size. The results shown in Table 3 support the hypothesis that larger companies tend to have: (a) betas nearer 1.0, and (b) relatively lower non-market risk.

The amounts of information available in the press on larger companies may foster the impression of familiarity among analysts and investors, and analysts and investors in financial institutions may have a general proclivity toward familiarity with companies in which substantial market positions may be taken owing to the large value of shares outstanding.

In sum, we suggest that the perceived risk of common stocks is well explained by three variables: historical beta or systematic risk with respect to the market; historical non-market risk or specific industry and company effects; and the perceived familiarity with the company and its stock. A total of 85% of the variance in perceived risk among stocks is accounted for by these three variables, as shown in Table 4.

TABLE 4

PERCEIVED RISK AND FAMILIARITY
Dependent variable: Perceived risk of stock (mean of 225 responses)

Sample	Constant	Familiarity	Beta	Non-Market Risk	R^2
N = 25	4.10	−0.37	1.10	0.23	0.85
	(2.68)*	(−1.93)	(4.96)	(2.95)	

* Numbers in parentheses are t-statistics

Because of the high correlation between familiarity and non-market risk, the omission of either variable from the regression equation introduces a bias, in the sense that the coefficient of the included variable will reflect the joint influence of both variables.[14] An example of this effect may be observed in equations 2 and 4 of Table 2, in which familiarity is not included as an independent variable. As a consequence, the coefficient of non-market risk reflects the joint influence of both familiarity and non-market risk; in this case, the effect of non-market risk appears to be greater than that of beta, as a determinant of perceived

risk. When familiarity is included, however, the coefficient and the t-statistic of beta is *higher* than that of non-market risk, as anticipated on theoretical grounds. The results summarized in Table 4 may therefore provide the best picture of the relative influences of the "independent variables" in this study — beta, non-market risk, and familiarity.

RISK "EX ANTE" AND "EX POST"

Risk suggests "exposure to surprise." The future may be different from the past in many respects that are relevant to security values. Historical beta and variability of return are *ex post* measures, often based on the most recent sixty months of return data. Perceived risk is an *ex ante* measure which may be based on past returns, fundamental analysis, present hunches, and all other information that portfolio managers and analysts believe to be germane.

At the time the perceived risk assessments in this study were made in May, 1973, the stock market was near the peak of the "two-tier market" phenomenon — as we now all know with the wisdom of hindsight.[15] In the subsequent year from mid-1973 to mid-1974, a number of first-tier stocks (including IBM and Avon, for example) had dramatic declines in market price. IBM and Avon had relatively low *ex post* variability of return prior to 1973 and relatively low *ex ante* perceived risk as of 1973. It goes without saying that investors' average perceived risk is reflected in the price of each stock. While *ex post* beta and variability of past returns provided limited information as to "exposure to surprise" from events such as those of 1973-74, when these so-called "low risk" stocks dropped dramatically in market price, so did average *ex ante* perceptions of risk of institutional investors fail to reflect the impending changes until the "surprises" had in fact occurred. New information was rapidly reflected in stock prices. All of this simply suggests that investors and analysts "learn" over time in such a way that *ex ante* perceptions are based on and tend to reflect what has occurred up to the current moment.

Individuals, of course, may have personal perceptions of risk that differ greatly from the current measure of historical beta. It bears emphasizing that estimates of beta for any one stock are subject to substantial measurement error; each statistical estimate of historical beta is in reality a distribution or range within which "true beta" is believed to lie. Given the problems of measurement error[16] inherent in historical betas of individual stocks, it is striking to find the significant relationship between the average values of perceived risk and these measures of historical beta for individual stocks. Criticism of beta and standard deviation as "pale statistical reflections" of the complex reality of investment risk should not be unduly harsh, in view of the strong association between these measures and current perceptions of risk among members of the professional investment community.

To the extent that this behavioral evidence on historical beta and perceived risk is valid for individual stocks, the association between beta and perceived risk is even stronger for institutional portfolios. It is well-known that problems of measurement error in individual stock betas tend to diminish in importance as the diversification of portfolios in which these securities are held increases. Simply put, measurement errors in beta tend to "average out" in large portfolios, so that one can have more confidence in estimates of portfolio betas than of stock betas. While beta and non-market risk obviously do not "say it all" in terms of individuals' perceptions of risk, the findings demonstrate the behavioral meaning of risk measures used in modern capital theory, in terms of the subjective assessments of perceived risk made by financial analysts and institutional portfolio managers.

[1] Frank H. Knight, *Risk, Uncertainty and Profit* (New York: Houghton Mifflin Co., 1921), p. 242.

[2] William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance*, 19 (September, 1964), pp. 425-442; and John Lintner, "The Valuation of Risk Assets and the Selection of Risky Projects in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics*, 47 (February, 1965), pp. 13-37.

[3] Empirical evidence on the use of historical data in the prediction of future betas is presented by Barr Rosenberg and James Guy, "The Prediction of Systematic Risk," Working Paper No. 33, Institute of Business and Economic Research, University of California, Berkeley, February, 1975.

[4] For example, among 123 mutual funds, 60% of the variance in monthly fund returns was associated with the market return and 40% of the variance was associated with non-market (residual) factors. Quite aside from the question of how diversified the institutional portfolios *should* be, many are in fact not well diversified. See J. G. McDonald, "Objectives and Performance of Mutual Funds, 1960-1969," *Journal of Financial and Quantitative Analysis*, (June, 1974), p. 313.

[5] The sample of 25 stocks was chosen as follows from the 550-stock population. An initial sample of 25 stocks was chosen at random and the correlation coefficient between beta and non-market standard deviation was calculated. This correlation is normally positive. A stock was then successively chosen from the population and another dropped from the sample until a target correlation coefficient of 0.05 was reached by trial and error, and the desired (orthogonality or independence) condition was satisfied.

[6] The following instructions were sent to each portfolio manager or analyst, together with the list of stocks given in Table 1:
"*RISK*: What is your estimate of the 'risk' of each stock on the following list? The definition of risk is intentionally not specified, so that you can use your own concept of the essential qualities of risk. If you feel that the time horizon is relevant, please consider each stock's risk over the next twelve months. Please assign a number from 1 to 9, where 9 is extremely risky and 1 means virtually no risk. Naturally, everyone is more familiar with some situations than with others. If you do not follow the stock closely, please attempt to make an estimate or 'educated guess' of its riskiness.
FAMILIARITY: How familiar are you with the company and its stock? Please indicate your familiarity on a 1 to 9 scale, where 9 is extremely familiar with the situation and 1 is unfamiliar."

[7] See, for example, George A. Miller, "The Magical Number 7, Plus or Minus 2: Some Limits on Our Capacity for Processing Information," *Psychological Review* 63 (March, 1956), pp. 81-96.

[8] See, for example, J. G. McDonald and B. H. Solnik, "Gold Mines, Gold and the Stock Market," *Analyse Financière* 18 (September, 1974).

[9] See, for example, J. G. McDonald, "Investment Objectives: Risk, Diversification and Exposure to Surprise," *Financial Analysts Journal* 30 (March-April, 1975), pp. 42-50.

[10] For previous empirical findings that returns on New York Stock Exchange common stocks appear "on the average and on the whole" to be consistent with a return-generating process whose principal argument is market risk, see Eugene F. Fama and James D. MacBeth, "Risk, Return and Equilibrium: Empirical Tests," *Journal of Political Economy* 81 (May-June, 1973), pp. 607-636.

[11] Irving Fisher, *The Nature of Capital and Income* (New York: The MacMillan Company, 1906): pp. 288-291; and Frank H. Knight, pp. 238-240.

[12] Familiarity also relates to the kind of inference discussed by Robert L. Winkler, "Bayesian Models for Forecasting Future Security Prices," *Journal of Financial and Quantitative Analysis* 8 (June, 1973), pp. 387-405.

[13] The negative relationship between size (measured by total balance sheet assets) and non-market risk was demonstrated by Barr Rosenberg and Walt McKibben, "The Prediction of Systematic and Specific Risk in Common Shares," *Journal of Financial and Quantitative Analysis* 8 (March, 1975), pp. 317-333.

[14] When both of the highly correlated variables are included, one is limited in ascertaining the relative influence of each variable on perceived risk, in terms of the value of the estimated coefficient of each variable.

[15] Valuation in this so-called two-tier market was examined by Ezra Solomon and J. G. McDonald, "A Note on the Two-Tier Market, 1970-1974," *Wall Street in Transition* (New York: New York University Press, 1974), pp. 145-183.

[16] Merrill Lynch and some other risk measurement services also produce "adjusted betas," in which they adjust (toward 1.0) their estimates of historical beta in recognition of measurement error. Barr Rosenberg & Associates produces estimates of beta with "Bayesian adjustments," utilizing fundamental analysis of balance sheet and income statement information as well as historical security returns.