Risk, Investment Strategy and the Long-Run Rates of REturn

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Working Paper No. 18-72a

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I. Introduction

Are long-run expected rates of return for investors who take greater risks higher than for those who don't? Are investors who hold diversified portfolios of greater risk necessarily better off in the long run? What effect do different investment strategies have upon expected returns? How do objective and subjective measures of risk compare in their ability to distinguish the underlying risks of different stocks? These and other neglected questions are the subject of this paper.

This study begins by pointing out the need for an empirical study of the relationship of long-run expected rates of return to risk despite the existence of numerous studies of short-run expected rates.[1] In response to this need, the succeeding sections examine long-run rates of return and reach the following conclusions:

1. Expected five-year rates of return are likely to be an increasing function of risk, where risk is estimated by standard *a priori* measures. Nonetheless, these expected returns do not appear to increase as fast as they should with risk if the capital asset pricing model held exactly in the short run.
2. Quality ratings have an edge over betas as normally computed in measuring risk for NYSE stocks of smaller market values, while the reverse to a lesser extent occurs for the larger issues.
3. Although over a long period, average five-year rates of returns realized by rebalancing tended to be only moderately higher than those for buy-and-hold strategies, the differences in any five-year period, while possibly not statistically significant at the five percent level, are frequently of sufficient size to be of major importance to an investor.
4. Similarly, although over a long period, average five-year returns

of small issues tend to be only moderately higher than those for large issues of the same risk; the differences in any five-year period may be substantial.

5. There is no necessary euphoria in investing in high-risk stocks over the long run even though they may have higher expected rates of return. From 1928 through 1968, high-risk stocks for the market as a whole tended to yield less than low-risk stocks. In other words, there is no guarantee that high-risk stocks will yield bigger returns in any single period -- no matter how long -- even though their expected returns may be greater.

Under certain conditions, the results of the numerous studies of expected short-run rates of return can be used to infer the long-run relationship. The next section points out that these conditions are not met precisely, so that there is need for a direct examination of long-run rates of return. This examination begins with Section III.

II. The Implications of Short-Run Studies for the Long Run

Studies of the relationship of expected short-run rates of returns on common stock to risk have generally concluded that over long periods of time this relationship is positive. In booming markets, such as 1965-68, the relationship between the average monthly rate of return and risk is strongly positive.[2] In only moderately strong markets, the relationship may be negligible (1955-59) or even negative (1960-64). In weak markets, the relationship is often negative (1940-41, 1946-47, and 1952-53). Virtually all these recent studies measured risk by the beta coefficient (β).

Besides these general conclusions concerning monotonicity, two studies[3] have concluded that the relationship, at least as a first approximation, can be assumed linear for common stocks.[4] Finally, the short-run returns implied by common stocks for extremely low-risk assets appear inconsistent with the returns for similarly low-risk bonds or risk-free governments, sometimes being higher and sometimes lower but on the average higher over the last forty or so years. At the present time, there is no tested theory which explains these differences.

Under certain conditions, these empirical findings about the short run can be generalized to the long run. For example, if successive monthly returns were stochastically independent of each other and transaction costs zero, the short-run relationship of expected return to risk, as measured by β, would determine the long-run relationship. More precisely, if E(R) is the expected short-run return, measured as one plus the rate of gain, the assumed independence would imply that the expected long-run rate of return, composed of n short-run intervals, will be $[E\ (R)]^n$.

Now if empirical tests have established with probability, say 0.95, that E (R) is a non-negative function of β, $[E\ (R)]^n$ will also a non-negative function of β with the same probability. If $E\ (R) = f\ (\beta)$, such a short-run empirical finding would take the form $P\ [f' > 0\ ] > 0.95$. This probability statement that the sign of the first derivative of the short-run relationship is positive implies that the first derivative of the long-run relationship is also positive with the same probability. On the assumption that E (R) is positive, the inequality within this probability statement can be rewritten as $P\ [n\ (f)^{n-1} f' > 0] > .95$. The reader will recognize $n\ (f)^{n-1} f'$ as the derivative of $(f)^n$ which is equal to $[E\ (R)]^n$, the expected long-run rate of return.

Again assuming independence, the empirical finding that short-run expected rates of return are not only a non-negative function of beta but also a linear function, say with probability 0.95, would imply that long-run expected rates of return would be a strictly convex function of beta with the same probability. In other words, long-run expected rates of return should increase at a faster rate than beta increases if returns increase with risk and the linearity assumption of the capital asset pricing model holds for short-run returns.[5]

Under the assumptions of independence and no transaction costs, it would be possible to infer the relationship between expected long-run returns and risk from the short-run relationship with the same probability that the short-run relationship is held. Yet these assumptions do not describe the market place exactly, so that there is no guarantee that any inference about long-run relationships from short-run empirical results would be valid.

First of all, the independence assumption, while theoretically appealing, appears valid only as an approximation. A number of earlier studies have found some dependence among successive rates of return, although generally not of sufficient size to use for profit after taking account of transactions costs.[6] An analysis of serial correlation coefficients of individual securities conducted as part of this paper again confirms the existence of a statistically significant amount of dependence.[7] Even these small amounts of dependence could invalidate the preceeding statistical arguments used in inferring the relationships between expected long-run returns and risk from the short-run relationships.

Second, the more comprehensive studies of the relationship between commission expenses and taxes. As a result of such costs, the short-run and long-run relationships between risk and return may differ widely depending on the investment strategy followed. Previous studies have typically based their analyses of the short-run relationships on monthly (and sometimes even weekly) data and have implicitly assumed monthly (or weekly) rebalancing of portfolios to maintain the initial weights within each group of securities of homogenous risk. This rebalancing policy would normally require some selling of stocks with the highest rates of return over the month and some buying of those with the lowest returns. Such an investment policy would obviously incur appreciably higher commissions and probably higher tax costs than, for instance, a buy-and-hold policy. In short, the expected rates of return used in almost all short-run studies might not be obtainable.[8]

A third difficulty in generalizing short-run relationships to the long run arises if we are interested in quantifying the long-run tradeoff. Even assuming the independence of short-run returns from period to period, it would be difficult to infer the actual long-run tradeoff without a better understanding of the short-run tradeoffs than current studies have provided. Although as a first approximation short-run expected returns may increase linearly with risk (at least for stocks listed on exchanges), the degree of increase tends to fluctuate in an erratic fashion from period to period and sometimes the tradeoff for common stocks appears inconsistent with returns on low-risk non-equity instruments. Since there is no satisfactory theory as yet to explain these phenomena, the short-run relationships probably have limited value in inferring the explicit form of the long-run relationship.

Finally, the two customary procedures for obtaining empirical estimates of long-run returns from short-run returns--the cumulation of sample arithmetic or geometric mean returns--may yield strongly biased estimates of the expected increase in value. These biases would occur even if it is assumed that the observed short-run returns are independent drawings from any stationary population for which variances are defined.[9] Multiplying the sample arithmetic mean of short-run returns by itself the appropriate number of times yields an upward biased estimate of the expected period return, while the cumulation of the geometric mean of returns yields a downward biased estimate for the usual cases of empirical interest.

III. Five-Year Rates of Return

Covering the period from February 1926 through January 1971 and in more detail the subperiod from July 1928 through June 1968, this section presents the average returns for non-overlapping five-year periods for three different portfolio strategies. For each strategy, returns are reported for up to ten different portfolios spanning the full spectrum of risk. Risk is measured by Fitch ratings[10] and also by beta coefficients. In all cases, the risk measures used were available prior to the implementation of a strategy, so that an investor could have realized the returns reported in this paper.[11]

The various five-year returns calculated for the period from July 1928 through June 1933 illustrate the different strategies used in constructing the averages in Tables 1-3. Using beta as a measure of risk, all New York Stock Exchange common stocks in existence on July 1928 and having such risk measures were assigned to ten portfolios. The lowest risk portfolio was made up of the stocks with the smallest beta coefficients and contained ten percent of the total number of stocks. The highest risk portfolio contained the highest beta stocks and likewise

Table 1

Percentage Increases in Portfolio Value for 60-Month Holding Periods Estimated Over 40 or More Years

Date	Risk Measure: and Weighting Type	Risk Class	Rebalanced Portfolios: Arith. Av. to 60th Power	Rebalanced Portfolios: Geom. Av. to 60th. Power	Rebalanced Portfolios: Arith. Av. of Nonoverlapping 60 Month Period Return			Buy-and-Hold Portfolios: Arith. Av. of Nonoverlapping 60 Month Period Returns		
					Unadj.	Adj. for Commissions	Adj. for Comm. & Taxes	Unadj.	Adj. for Commissions	Adj. for Comm & Taxes
/26-1/71	FITCH:	low	77.2	55.0	59.4	55.7	32.1	55.6	54.7	31.2
	Stocks	2	93.5	65.0	75.1	68.1	38.9	64.6	63.3	34.2
	Equally	3	110.8	74.7	93.9	83.2	50.3	80.7	78.7	44.7
	Weighted	4	133.5	77.7	107.7	92.2	60.5	89.4	86.9	53.1
		5	177.8	96.8	142.9	114.5	83.7	101.9	98.3	66.4
		high	196.1	103.4	244.8	181.5	159.3	115.4	110.3	90.5
/28-6/68	FITCH:	low	74.4	53.0	56.9	53.6	27.7	52.7	51.7	27.4
	Stocks	high	222.3	115.5	137.5	103.4	83.2	80.2	76.3	61.8
	Equally									
	Weighted									
/28-6/68	BETA:	low	86.2	70.3	72.9	66.1	34.1	64.7	63.0	32.9
	Stocks	2	101.1	77.5	82.0	75.5	40.9	76.3	74.4	41.7
	Equally	3	112.6	82.2	86.8	78.4	43.7	74.4	72.3	39.6
	Weighted	4	113.4	79.0	83.3	75.6	40.8	75.8	73.7	41.1
		5	122.7	83.4	89.1	80.5	45.2	77.8	75.7	43.8
		6	126.4	80.6	91.3	80.7	47.0	79.5	77.1	45.7
		7	152.9	92.5	106.0	91.5	55.8	86.2	83.4	51.7
		8	146.3	86.5	97.2	84.3	51.4	77.3	74.7	45.1
		9	191.2	100.2	114.3	96.5	63.6	90.0	87.0	57.4
		high	208.9	102.3	116.9	90.2	67.1	73.3	70.0	52.5
/28-6/68	BETA:	low						58.9	58.1	30.2
	Stocks	2						61.7	60.5	33.2
	Proportionally	3						73.8	72.3	43.6
	Weighted	4						83.3	82.1	52.8
		5						71.6	70.3	41.5
		6						69.3	67.7	38.5
		7						69.5	67.9	38.9
		8						71.7	70.0	43.5
		9						86.2	83.9	52.2
		high						72.5	69.7	47.3

Table 2

Percentage Increases in Portfolio Value for 60-Month Holding Periods Estimated Over 20-Year Periods

...sure: ...hting	Risk Class	1928 - 1948 Rebalanced Portfolios Unadj.	1928 - 1948 Rebalanced Portfolios Adj. for Commissions & Taxes	1928 - 1948 Buy-and-Hold Portfolios Unadj.	1928 - 1948 Buy-and-Hold Portfolios Adj. for Commissions & Taxes	1938 - 1958 Rebalanced Portfolios Unadj.	1938 - 1958 Rebalanced Portfolios Adj. for Commissions & Taxes	1938 - 1958 Buy-and-Hold Portfolios Unadj.	1938 - 1958 Buy-and-Hold Portfolios Adj. for Commissions & Taxes	1948 - 1968 Rebalanced Portfolios Unadj.	1948 - 1968 Rebalanced Portfolios Adj. for Commissions & Taxes	1948 - 1968 Buy-and-Hold Portfolios Unadj.	1948 - 1968 Buy-and-Hold Portfolios Adj. for Commissions & Taxes
	low	35.1	10.5	26.5	5.8	67.6	32.2	66.6	33.7	78.8	44.8	78.9	49.0
	high	140.3	77.1	36.7	21.5	136.3	82.0	75.5	53.3	134.6	89.3	123.7	102.2
	low	54.7	19.8	35.6	9.4	77.6	34.2	73.5	33.7	91.0	48.4	93.8	56.5
	2	64.9	28.2	54.2	23.8	101.0	50.6	95.9	50.5	99.1	53.6	98.4	59.5
	3	71.1	31.4	45.8	15.6	112.1	56.3	99.0	51.4	102.5	56.0	102.9	63.6
	4	67.4	29.1	51.9	21.9	100.2	48.0	95.3	49.3	99.1	52.6	99.7	60.3
	5	72.4	32.1	48.7	20.4	100.5	48.0	92.3	47.0	105.8	58.3	107.0	67.1
	6	77.3	35.9	55.5	27.0	124.2	65.6	110.7	62.8	105.4	58.1	103.4	64.4
	7	87.8	39.4	49.5	20.7	131.9	67.7	105.6	56.8	124.2	72.2	122.9	82.7
	8	74.0	33.4	42.6	17.3	119.4	62.6	99.5	54.8	120.3	69.5	112.0	73.0
	9	96.0	48.4	52.3	28.5	140.8	78.2	115.0	69.1	132.6	78.8	127.8	86.4
	high	123.8	64.2	39.6	24.0	140.1	78.2	86.4	56.6	110.1	69.9	107.0	81.1
	low			34.3	10.4			59.4	26.1			83.5	50.0
	2			21.9	1.5			82.9	46.8			101.5	64.9
...onally	3			40.5	14.4			100.5	59.5			107.1	72.7
	4			36.0	11.9			137.0	91.7			130.6	93.6
	5			35.0	10.5			99.6	55.8			108.2	72.4
	6			44.6	17.4			93.4	49.3			94.0	59.6
	7			37.7	13.1			100.5	55.6			101.4	64.7
	8			31.8	9.1			86.4	47.3			111.6	77.9
	9			37.6	13.1			135.1	83.5			134.8	91.2
	high			22.3	6.6			109.5	69.2			122.7	88.0

Table 3

Percentage Increases in Portfolio Value for 60-Month Holding Periods Estimated Over 10-Year Periods*
(Buy-and-Hold Portfolios)

Beta Class	1938-48				1948-58				1958-68			
	Stocks Equally Weighted		Stocks Proportionally Weighted		Stocks Equally Weighted		Stocks Proportionally Weighted		Stocks Equally Weighted		Stocks Proportionally Weighted	
	Unadj.	Adj. for Comm. & Taxes	Unadj.	Adj. for Comm. & Taxes	Unadj.	Adj. for Comm. & Taxes	Unadj.	Adj. for Comm. & Taxes	Unadj.	Adj. for Comm. & Taxes	Unadj.	Adj. for Comm. & Taxes
low	61.9%	25.0%	44.0%	15.1%	85.1%	42.4%	74.9%	37.1%	102.5%	70.6%	92.1%	63.0%
2	95.6	50.7	53.5	24.8	96.3	50.4	112.4	68.9	100.5	68.6	90.6	61.0
3	92.6	45.6	71.1	33.9	105.4	57.2	130.0	85.1	100.5	70.1	84.2	60.2
4	93.1	48.2	69.3	33.3	97.4	50.4	204.8	150.1	101.2	70.3	56.4	37.1
5	94.4	50.1	73.1	35.5	90.3	43.9	126.1	76.2	123.6	90.4	90.3	68.6
6	118.8	71.6	86.3	42.1	102.7	53.9	100.5	56.5	104.1	74.8	87.5	62.7
7	107.7	59.2	76.4	37.1	103.5	54.4	124.7	74.1	142.2	111.0	78.2	55.3
8	104.7	61.7	66.0	31.0	94.2	48.0	106.8	63.7	129.7	98.0	116.3	92.2
9	127.9	86.6	108.6	64.8	102.2	51.7	161.7	102.3	153.4	121.1	108.0	80.2
high	95.9	68.8	74.2	45.2	76.9	44.4	144.7	93.3	137.1	117.8	100.7	82.7

ten percent. The other eight portfolios were similarly stratified by beta values. The portfolios stratified by Fitch ratings do not contain equal numbers of securities. The low risk portfolio consists of stocks rated AAA, AA, A, and BBB, while the high risk portfolio consists of stocks rated C and below. The remaining portfolios each correspond to a single rating class.

Three investment strategies were applied to each portfolio. The first strategy assumed an equal amount invested in each security on July 1928 and that these stocks were held with no rebalancing for the five-year period. Cash dividends were reinvested in the company which paid them. Any stock delisted was assumed sold at the last available price and the proceeds reinvested in the remaining stocks according to their then existing proportions. The second strategy is one in which the investment in each security is rebalanced so as to maintain equal weights at the beginning of each month.

The third strategy is a buy-and-hold strategy like the first but with the exception that the amount initially invested in each security is proportional to the market value of the stock outstanding. The returns from this strategy are particularly important because they approximate the returns from buying a segment of the market portfolio made up of stocks of similar risks. This return can be interpreted as the return realized by all investors from this class of risky stocks, whereas the equally weighted portfolios cannot be so interpreted. These interpretations are only approximate because the strategy only adjusted for the small value of new shares issued or old shares retired in excess of those required for splits or stock dividends every five years and included only stocks with risk measures available at the beginning of each five-year period.

For each strategy and for each portfolio, returns were calculated in three ways: first, with no allowance for commissions or taxes; second, with an adjustment for commissions; and third, with an adjustment for both commissions and taxes. The adjustment for commissions used the actual round-lot commission rate applicable at the time of any required transaction.[12] The adjustment for taxes assumed the highest marginal tax rate for dividends and the corresponding capital gain taxes appropriate to the date,[13] but of course most investors are in a much lower bracket and many institutional investors pay no income tax at all. Such returns were calculated for sequential non-overlapping five-year periods using both beta and Fitch measures of risk.[14] Tables 1-3 present the averages of these five-year returns for various time periods.

Monotonic Relation of Return to Risk. The average five-year rates of return calculated over the longest periods analyzed in this study--eight or nine five-year non-overlapping periods--indicate that it is likely that long-run expected rates of return are positively related to risk (Table 1).

For the equally weighted Fitch portfolios from February 1926 through January 1971, the average returns from both buy-and-hold and rebalanced portfolios increase as a strictly monotonic function of risk. Over the shorter eight five-year periods from 1928 through 1968, the averages do tend to increase with risk for each of the three strategies using beta as a measure of risk. Only for the rebalanced equally weighted portfolios is this tendency strongly pronounced. The rank order correlation between risk and any measure of return for this strategy is greater than 0.90, which is significantly different from zero. For both equally weighted and proportionally weighted buy-and-hold strategies, the rank order correlations are positive but with one exception not significant. The exception is the returns adjusted for commissions and taxes for the equally weighted buy-and-hold strategy, possibly reflecting the relative importance of capital gains in the returns from high risk stocks. In view of the potentially large sampling errors in estimating expected five-year returns from only eight or nine observations and the consistently positive correlations between risk and returns, it seems safe to conclude that long-run expected rates of return are likely to increase with risk.

No Evidence of Convexity. Though the results do suggest the monotonicity of expected returns to risk, the realized returns give no evidence of a convex relationship between expected long-run returns and monthly betas. The previous section showed that the assumptions of the market line theory and independence of successive short-run rates of return would imply such a convex relationship.

For each of the eight five-year periods from July 1928 to June 1968, the unadjusted holding-period returns for the equally weighted portfolios were regressed on β and β^2--one regression for the rebalanced and another for the buy-and-hold strategy.[15] Thirteen out of these sixteen quadratic regressions had negative signs on β^2 when theory would point to a positive sign. Three of these thirteen β^2 coefficients were in fact significantly negative, while only one of the three positive coefficients was significant. This analysis indeed provides more evidence for concavity than for convexity. Similar regressions, using instead holding period returns adjusted for commissions and taxes, give almost identical results: eleven out of the sixteen coefficients on β^2 were negative. As a result, while expected long-run rates of return apparently do tend to increase with beta, they do not increase as fast as theory would suggest if short-run expected rates of return are linearly related to risk as measured by beta.

Quality Rating vs. Beta. Quality rating, at least as given by Fitch historical data for portfolios with equal weights, while the reverse seems true but to a lesser extent for portfolios with proportional weights.[16] The criterion used in measuring "better" was the relative abilities of the risk measures to discriminate among securities according to subsequent returns. To apply this criterion, stocks having both measures of risk were classified into six groups with the same number of stocks in each for each five-year period using first, Fitch ratings, and second, beta coefficients. For equally weighted buy-and-hold portfolios over the 1928-68 period, the rank order correlation between risk and average unadjusted five-year rates of return was 0.43 using beta as the measure of risk and 0.83 using Fitch ratings. For proportionally weighted buy-and-hold portfolios, the rank order correlation was 0.94 using beta and 0.77 using Fitch. Thus Fitch ratings tend to work better than betas for stocks of smaller market values and somewhat less well for stocks of larger market values. The same conclusion follows from other measures of discriminatory power.[17]

Rebalancing vs. Buy-and-Hold Strategies. Of the two equally weighted investment strategies, the five-year returns from rebalancing beat the returns from buy-and-hold on average over the 1926-71 period (Table 1). This result obtains even after adjusting for transactions costs and taxes.

The reader should keep in mind two important qualifications in interpreting these numbers. First the differences in performance between the equally weighted rebalanced and buy-and-hold portfolios are substantial only for portfolios with above-average risks. Second and more important, of the three overlapping periods shown in Table 2, the superiority of rebalancing is most marked in the 1928-48 period, is considerably smaller in 1938-58, and disappears in 1948-68. Indeed, in this last period the buy-and-hold policy may have been preferable after allowances for transactions costs and taxes. A breakdown of these periods into smaller time intervals indicates that the largest gap in returns between the rebalanced and buy-and-hold portfolios occurred in the 1928-33 period and the second largest in the 1938-43 period. The advantage of rebalancing over buy-and-hold vanished after World War II. The 1948-58 and 1958-68 periods saw a slight advantage for the buy-and-hold policy.[18]

There are at least three possible ways of explaining the superior performance of rebalancing to buy-and-hold in the first two decades of the 1928-68 period and the disappearance of this phenomenon in the last two decades. One explanation would be an increase in market efficiency from the first to the second halves of this period, perhaps because of securities legislation (resulting in increased disclosure and curbs on manipulation) or because of other changes in the institutional environment. A second explanation might lie in the unique character of the stock market decline starting in 1929 and, to a lesser extent, in 1937. A third explanation might attribute the impressive differences between the returns from rebalancing and buy-and-hold strategies to chance, reflecting the very large dispersion of the underlying distribution of investment returns. The tests reported in footnote 18 are consistent with this last interpretation.

<u>Return and Size of Issue</u>. An earlier analysis[19] found that for the 1964-68 period, portfolios of New York Stock Exchange stock with equal amounts invested in each issue performed much better than portfolios with amounts invested proportional to the market value of the shares. The implication is that in this period at least, the smaller issues far out-performed the larger issues. However, the differences were not as pronounced for the much longer period covered in this paper.

Over the entire 1928-68 period equally weighted portfolios outperformed the proportionally weighted ones, as measured by the average five-year returns at least for investors with a buy-and-hold strategy (Table 1). However, a breakdown of the 1928-68 period into three overlapping twenty-year intervals showed no systematic difference in performance between the equally and proportionally weighted portfolios (Table 2). In the first twenty years, equally weighted portfolios consistently and by large amounts outperformed proportionally weighted portfolios. In the other two intervals, there was no consistent tendency. The gap in performance between the equally and the proportionally weighted portfolios is more pronounced over shorter periods of time. Thus in each of the two decades 1938-48 and 1958-68, the equally weighted portfolios in every beta class substantially out-performed proportionally weighted portfolios (Table 3). The reverse situation characterized the years 1948-58.[20] The differences in performance associated with the two different weighting schemes are even more pronounced if the ten-year periods are further broken down into five-year intervals. The magnitude of these differences in returns for a particular risk, even if they prove not statistically significant, should give pause to an investor in interpreting current measures of investment performance which are typically based on a single arbitrary weighting scheme.

These substantial period-dependent differences in performance between equally weighted and proportionally weighted portfolios, or equivalently between large and small stock issues, may indicate that there is another (or more than one) important factor affecting returns which is not allowed for in current return generating functions. In other words, a return generating function which assumes the existence of only one common factor may be inadequate to explain the differences between actual and expected returns. The gap in performance between equally weighted and proportionally weighted portfolios appears too great to be explained by the greater liquidity risks attached to equal weighting but of the wrong sign (in two out of three instances) if greater unique risks are attached to proportional weighting. Additional testing will be required to confirm whether a size-related factor is necessary in explaining the returns of individual securities.

IV. Concluding Remarks

Lest the reader conclude that an investor with a long-term horizon, such as some eleemosynary institutions, would be well advised to assume the greater risks associated with larger expected returns, this last section will serve to dispel such a conclusion. It is true that if expected five-year returns are positively related to risk, if there are no transaction costs and if five-year returns are stochastically independent,[21] expected returns for horizons greater than five years would be positively related to risk.

Nonetheless, the investment results for any particular long period of time represent only a single drawing from a probability distribution and there is no guarantee that this drawing would be anywhere near the expected result. This is true even if investors have correctly assessed the distribution generating future returns. Indeed, aggregate returns which were realized by all investors over the 1928 to 1968 period illustrate that there is no necessary reward for bearing additional risk over any particular long period of time. As pointed out earlier, the returns from a value-weighted buy-and-hold strategy do correspond to what all investors would realize from their investments in all stocks covered by the strategy. It is impossible for all investors to realize the returns which would result from equally-weighted strategies.

For value-weighted buy-and-hold strategies, the returns realized over the forty-year period from July 1928 through June 1968 were, if anything, negatively related to risk. For example, one dollar invested in stocks of the lowest risk would have increased to $32.74 before adjustment for commissions or taxes, (Table 4), while the same dollar in stocks of the highest risk would have increased to only $26.65. More generally, the unadjusted increases in value for all risk classes are not positively correl-

Table 4

The Value of One Dollar in 40 Years

Under A Value-Weighted Buy-and-Hold Strategy

July, 1928 - June, 1968

Risk Class	Dollar Value		
	Unadj.	Adj. for Commissions	Adj. for Comm. and Taxes
low	$ 32.74	$ 31.07	$ 4.84
2	27.24	25.19	3.67
3	51.66	46.89	8.61
4	55.88	51.40	9.69
5	43.74	39.66	7.09
6	43.76	38.86	7.49
7	42.63	37.53	7.38
8	46.50	41.17	7.72
9	42.27	36.83	5.53
high	26.65	22.68	3.43

ated with risk. The rank order correlation is in fact negative (-.14), though not significant. The same conclusions follow after adjusting for commissions or both commissions and all taxes.[22] This does not mean that in some other forty-year period it would not have been preferable in retrospect to be in high-risk securities.

These increases in value were calculated in a similar way as the returns for the five-year periods except for two major differences: First, both old and new stocks were reassigned every five years to portfolios according to the latest available assessments of beta. The returns, where indicated, were properly adjusted for the commissions and taxes which would have been incurred in such restructuring.[23] Second, each of the portfolios was converted to cash at the end of the forty-year period, which of course would have incurred commissions and possibly some taxes. The increases in value adjusted for commissions would therefore represent the cash-to-cash forty-year experience of any organization not paying taxes. Since the tax adjustment was based upon the maximum personal tax liability, an individual not subject to the maximum would have experienced a return between the two adjusted figures.

According to the New York Times,[24] a recent report to the Ford Foundation[25] was widely interpreted as a criticism of universities for not concentrating on "maximum long-term return." Such returns, as that report recognizes, are often associated with higher short-run volatility, i.e. higher betas. It might be argued that a forty-year horizon examined here is too short for a university but this argument is irrelevant. For any long horizon the realized change in wealth will be one drawing from a probability distribution with an extremely large dispersion. There is thus no guarantee that a high-risk investment strategy will produce greater wealth in any fixed period of time than a low-risk strategy--even if expected long-run returns are positively related to risk.

The forty-year results in Table 4 indicate that higher risk strategies do not dominate lower risk strategies for investors in aggregate. Except for the most bizarre dependencies among forty-year returns, one would not expect to find such dominance for longer horizons. The results in this paper, utilizing the longest period of time for which data are available, thus give no clear guideline about the appropriate level of risk to be assumed by eleemosynary institutions or any other investors in managing their funds.

Footnotes

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1. Three such studies include: Black, Jensen and Scholes (1972); Blume and Friend (1973) and Fama and MacBeth (1973).

2. Blume and Friend (1973).

3. Black, Jensen and Scholes (1972) and Blume and Friend (1973).

4. Fama and MacBeth (1973) have found some statistically significant but unpredictable non-linearities in the cross-sectional relationship of one-month returns to beta. Since the non-linearities are unpredictable from month to month, their finding is not inconsistent with a linear relationship between average monthly returns and beta.

5. The short-run finding mathematically takes the form $P[E(R)=a+b\beta]>0.95$, where $b>0$. Raising each side of the equality to the n^{th} power yields $P\{[E(R)]^n = [a+b\beta]^n\}>0.95$. Upon taking the derivative twice, the probability inequality becomes $P\{d^2E(R)^n/d\beta^2 = n(n-1) \quad [E(R)]^{n-2}b^2\}>0.95$. Since $E(R)$ is greater than zero, the second derivative is non-negative for n greater than 1.0, which establishes the proposition in the text.

6. A typical study would be Fama and Blume (1966).

7. Two tests of significance were carried out and gave similar results. One converted the serial correlation coefficients (ρ) into

   $Z = \frac{1}{2} \ln \left(\frac{1+\rho}{1-\rho}\right)$ statistics for each of the stocks included in a five year period (ranging from 496 issues in 1928-1933 to 944 issues in 1963-68) and then obtained t-values to measure the significance of the deviation of the average Z from zero. (The t-values ranged from a high of -25.4 in 1933-38 to a low of -4.6 in 1958-63.) A second test found that the number of positive or negative serial correlations in each of the periods differed significantly under the null hypothesis that a positive or negative number was equally likely.

8. Cheng and Deets (1971).

9. Blume (1972).

10. The beta coefficients for any month were calculated by regressing the immediately prior returns upon the Fisher Combination link relative index. These calculations typically used sixty prior months, but if the data did not permit this, the calculations were still performed using the maximum available data providing there were at least twenty-

nine prior monthly returns. The Fitch ratings were collected for 1926, 1928, and every fifth year thereafter through 1958. By 1963, Fitch had stopped rating common stocks.

11. At the beginning of each five-year period, it was assumed that the investor purchased the portfolio with cash; but at the end, the portfolio was not liquidated.

12. Capital gain taxes were calculated on the assumption that the most recent purchase in the lowest tax category was sold first. Thus, long-term gains or losses were realized before shorter-term gains or losses. Under the particular rebalancing policy in this paper, this rule for selling securities would tend to minimize taxes if the market were steady or rising. As with the portfolios adjusted only for commissions, the portfolios were assumed not to have been liquidated at the end of five years, so that unrealized gains or losses were untaxed.

13. For the Fitch ratings, the portfolios formed in the sixties were based upon 1958 ratings. Except for the big gap, the Fitch ratings were never dated more than three years before the formation of the portfolios. The β coefficients were always updated to the month at which the portfolios were formed.

14. The beta coefficients used in these regressions were not derived from the beta coefficients used in forming the portfolios but were estimated anew from the subsequent sixty monthly returns realized under the portfolio strategy. This technique will minimize order biases.

15. Ofer (1973) suggests that another subjective measure, Standard & Poor's ratings, are poorer measures of risk than the Fitch stock ratings over the postwar period for which they were both available.

16. For the unweighted portfolios, using Fitch ratings over the 1928-68 period, the difference between the average five-year rate of return from the highest risk portfolio to the lowest risk portfolio was 0.26 compared to the 0.02 for the beta unweighted portfolios. The standard deviation of the six five-year average returns was 0.16 for Fitch and 0.11 for beta. For the weighted portfolios, the difference between high and low risk portfolios was 0.15 for Fitch and 0.30 for beta, and the standard deviations were 0.106 and 0.114 respectively.

17. That rebalancing beats buy-and-hold strategies in the pre-World War II period might suggest that, contrary to the usual assumption of independence of rates of returns from one time interval to another, returns over this period were characterized by substantial negative serial dependence. As reported in Section II, the average serial correlation between successive monthly rates of return for individual stocks over each of the five-year periods from 1928 to 68 was generally negative and statistically significant. Yet, there was no apparent relationship between the sign and magnitude of the correlation and the relative performance of rebalancing and buy-and-hold strategies in the different periods. Indeed, in the 1928-33 period when rebalancing outperformed buy-and-hold by a substantial margin, the average 60-month serial

correlation coefficient for individual stocks was positive and highly significant.

When instead of the customary time-series serial correlations for individual stocks, cross-sectional correlations were computed for each successive pair of months within the 1928-33 period, the average serial correlation for each month is negative not only for every five-year period, including 1928-33, but also for every beta class within each period. These average cross-sectional correlations, which are significant in each period, bear a somewhat closer relationship to the relative performance of rebalancing and buy-and-hold stragegies than do the time-series correlations, but the relationship is still not perfect.

A more satisfactory explanation of the difference in results between rebalancing and buy-and-hold strategies follows from recognizing that mathematically buy-and-hold would be expected to outperform rebalancing if on the average the returns on stocks on month t (R_{ti} where i represents any stock) are positively correlated with the cumulative returns on the same stocks ($\prod_{\tau=1}^{t-1} R_{\tau i}$) from the beginning to the month immediately preceding t. The sign of such cross-sectional correlations, which were computed for each month in the periods 1928-33 and 1933-38 for each of ten stock portfolios classified by beta, explains the observed difference in performance between buy-and-hold and rebalancing strategies over these five-year periods quite well. However, while the observed differences in average returns for given beta between buy-and-hold and rebalancing strategies are extremely large for 1928-33 the averages of the 59 monthly correlations between R_{ti} and $\prod_{\tau=1}^{t-1} R_{\tau i}$ are not significantly different from zero either for 1928-33 or 1933-38 for any of the ten beta stock portfolios using either a t-test or a Binomial test of signs.

18. Friend, Blume and Crockett (1970).

19. It should be noted that though only arithmetic averages of non-overlapping 60 month period returns are presented for these shorter periods, the monthly arithmetic averages raised to the 60^{th} power provided similar results.

20. This assumption seems more plausible for five-year returns than for daily, weekly, or monthly returns since a primary reason for short-run dependencies is transaction costs which make it unprofitable for investors to profit from short-run disequilibria of small magnitude. In the long run, such transaction costs are probably less critical.

21. A similar result for buy-and-hold strategies was obtained in Friend and Taubman (1966).

22. In calculating realized gains or losses, it was assumed that each share of a security held over five years had as its cost basis the average cost of all shares of that security currently in the portfolio and purchased more than five years before.

23. The New York Times (September 24, 1973).

24. Managing Educational Endowments (1972).

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