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Investment Return and Risk

The authors analyze data for 16 classes of investments for periods of 5, 10, and 50 years and produce several tentative conclusions that conflict with traditional valuation and investment assumptions. The ideas that most investors are risk averse to a substantial degree and that the rate of return is commensurate with the risk associated with a particular investment are challenged.

An article in *Barron's* by Andy Zipser, "Considering the Alternatives: Comparing the Performance of 16 Different Investments,"[1] discusses research by Barton Biggs and Eugene Chung at Morgan Stanley that provided the mean rate of return and the "volatility" of different investment opportunities for three time periods: 50 years, 10 years, and 5 years. Biggs and Chung concluded that the rates of return for the various investment categories were commensurate with the risks associated with the investments. While their conclusion supports traditional investment ideas, it raises two often-asked questions. First, what are the appropriate risk rates of return for each of the investment categories? Second, given a specific willingness to accept risk on the part of a willing investor, how well do each of the categories perform? To investigate these questions, the authors assume that risk is proportional to the coefficient of variation in the rate of return.[2]

In the *Barron's* article, volatility

1. Andy Zipser, "Considering the Alternatives: Comparing the Performance of 16 Different Investments," *Barron's* (May 20, 1991): 1.
2. J. Fred Weston and Eugene F. Brigham, *Managerial Finance*, 7th ed. (Hinsdale, Ill.: The Dryden Press, 1981), 107–110.

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is defined as equal to the standard deviation of the rate of return. The coefficient of variation (i.e., the standard deviation as a percentage of the mean rate of return) is easily derived from the volatility values given in the article and provides a better measure of the variance in the rates of return because it is directly related to the magnitude of the return.

The authors are not able take an additional step and examine the possibility of a portfolio of investments because data were not provided on the covariance of the investments. The capital asset pricing model (CAPM) indicates that a portfolio of investments rather than a single investment tends to reduce risk to the investor—a possibility that is not examined here.

DEFINING TERMS

To answer questions about the relative risks of various categories of investments and how well each category performs relative to a specific investor's criteria for risk, a number of terms must first be defined.

First, for the purposes of this article a willing investor understands that some risk is always incurred in any investment and has decided that the following criteria must be met.

1. An investment must return at least the rate of inflation most of the time.
2. "Most of the time" means 84% of the time. That is, a willing investor can accept that an investment will return less than the rate of inflation 16% of the time.

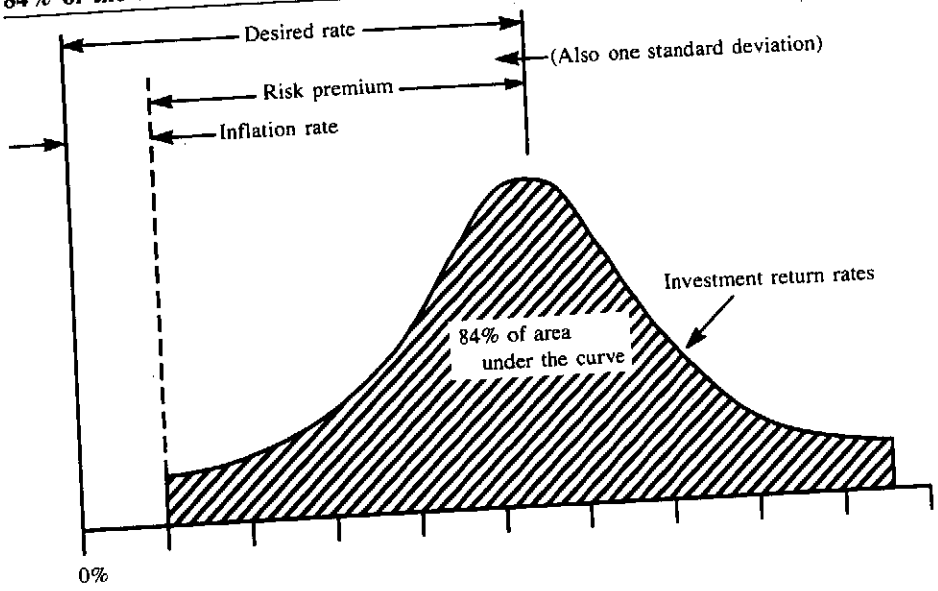
Because 16% is the area under the normal distribution curve lying to the left of the first standard deviation from the mean value of the distribution, using this figure in the definition of a willing investor greatly simplifies the calculations.

Given that it is known what our willing investor is prepared to accept in the way of risk, a risk premium and a desired rate of return can now be defined. The risk premium is the amount that must be paid to compensate the willing investor for the possibility that the volatility in the mean rate of return may result in an actual rate of return less than the rate of inflation. The desired rate of return is then the rate of inflation plus the risk premium. Figure 1 illustrates these definitions.

In Figure 1, the mean value of the normal distribution for the investment's rate of return has been shifted far enough to the right to place 84% of the area under the normal curve to the right of the rate of inflation. The amount of the right shift is equal to the risk premium and in this case is equal to the magnitude of the standard deviation in the rate of return. The desired rate of return is what is required of an investment that will provide a willing investor with a return at least equal to the rate of inflation 84% of the time. An investor will receive less than the rate of inflation 16% of the time on average.

Before proceeding, the issue of inflation must be considered. Specifically, the rate of inflation is not a constant and, although included in the rates of return for each investment category in the *Barron's* data, the rate of return for an investment traditionally lags behind changes in the rate of inflation. Inflation therefore has its own risks, which are qualitatively examined in the following analysis. Again, sufficient information is not available to examine the covariance between the rate of inflation and the investment rates of return and therefore it is assumed that infla-

FIGURE 1 Risk Premium and Mean Rate of Return Required to Cover Inflation 84% of the Time



tion is completely accounted for in the rate of return for a specific investment. Because average rates of return over relatively long periods of time are being used, this assumption should not prove particularly unrealistic.

Table 1 contains the *Barron's* data. It is important to note the standard deviation for each investment alternative. Standard deviations essentially measure the degree of dispersion between the mean value of a sample set and the ac-

TABLE 1 Mean Annual Rate of Return and Standard Deviations for the Marketplace

	50-Year Period		10-Year Period		5-Year Period	
	Annual Return (percentage)	Standard Deviation (percentage)	Annual Return (percentage)	Standard Deviation (percentage)	Annual Return (percentage)	Standard Deviation (percentage)
Inflation	4.60	3.90	4.50	1.90	4.10	1.60
Commercial paper	5.20	3.80	9.40	2.70	7.70	0.90
T-bills	4.40	3.40	8.50	2.50	6.80	1.10
Residential housing	7.70	4.00	4.40	6.00	4.80	1.50
Commercial real estate	7.50	4.90	8.80	4.30	5.20	2.10
U.S. farmland	9.80	7.50	2.80	5.70	7.40	4.00
Art	N/A	N/A	13.00	14.90	20.70	16.90
U.S. government bonds	4.50	9.40	13.70	13.40	10.80	9.40
S&P 500	11.60	16.10	13.90	12.60	13.20	11.90
Foreign bonds	N/A	N/A	11.80	16.10	15.40	16.30
Emerging growth stocks	14.10	28.80	8.30	13.40	7.90	11.10
EAFE*	N/A	N/A	15.10	25.10	17.50	28.50
Emerging market stocks	N/A	N/A	8.40	29.90	18.30	32.60
Venture capital	18.00	36.20	−2.40	17.90	−3.80	7.60
Japanese stocks	15.70	29.20	14.90	21.70	11.20	29.80
Gold	N/A	N/A	−1.90	15.20	3.70	14.70
Small stocks	15.60	28.70	9.30	18.00	0.60	15.50

*Europe, Australia, and Far East Index.

tual values of the sample points. For the purposes of this article, the standard deviation can be used to determine the probability that an investment will provide the indicated mean rate of return. The greater the dispersion, the less likely it is that the investment will achieve exactly the mean rate of return. Note that some of these dispersions (i.e., standard deviations) are rather large.

A common problem with rates of return on real estate investments that may also hold true for other investment categories is that published rates of return for real estate investments are often based on appraised values—particularly in the short run—rather than on actual sale prices. In a volatile market, this could result in an overstatement of the rate of return, reflected in the 5- and 10-year rate-of-return data. This problem is likely to have been mitigated to some extent in the 50-year data, because most of the properties would have been sold during that period.

THE RISK/RETURN ANALYSIS

Tables 2, 3, and 4 provide the coefficient of variation, the risk premium, the desired rate of return, the mean rate of return (from Table 1) and the rate differential for each of the 16 categories of investment plus inflation. The rate differential is defined as the mean rate of return for an investment minus the desired rate of return and expresses the amount by which the investment succeeds or fails to meet a willing investor's criteria. A failure to meet the investor's criteria is indicated by a negative rate differential. The tables are in the same investment opportunity order—from least volatile to most volatile for a 5-year investment as measured by their coefficient of variation.

The rate differential is designed to indicate the difference between the desired performance as represented by the desired rate and the actual performance of the invest-

TABLE 2 50-Year Investment Return Analysis

Investment	Coefficient of Variation	Risk Premium (one standard deviation)	Desired Rate (inflation + risk premium)	Mean Rate of Return (from Table 1)	Rate Differential (mean rate of return − desired rate of return)
Inflation	0.85	3.90	8.50	4.60	−3.90
Commercial paper	0.73	3.80	8.40	5.20	−3.20
T-bills	0.77	3.40	8.00	4.40	−3.60
Residential housing	0.52	4.00	8.60	7.70	−0.90
Commercial real estate	0.65	4.90	9.50	7.50	−2.00
U.S. farmland	0.77	7.50	12.10	9.80	−2.30
Art	N/A	N/A	N/A	N/A	N/A
U.S. government bonds	2.09	9.40	14.00	4.50	−9.50
S&P 500	1.39	16.10	20.70	11.60	−9.10
Foreign bonds	N/A	N/A	N/A	N/A	N/A
Emerging growth stocks	2.04	28.80	33.40	14.10	−19.30
EAFE	N/A	N/A	N/A	N/A	N/A
Emerging market stocks	N/A	N/A	N/A	N/A	N/A
Venture capital	2.01	36.20	40.80	18.00	−22.80
Japanese stocks	1.86	29.20	33.80	15.70	−18.10
Gold	N/A	N/A	N/A	N/A	N/A
Small stocks	1.84	28.70	33.30	15.60	−17.70

TABLE 3 10-Year Investment Return Analysis

Investment	Coefficient of Variation	Risk Premium (one standard deviation)	Desired Rate (inflation + risk premium)	Mean Rate of Return (from Table 1)	Rate Differential (mean rate of return − desired rate of return)
Inflation	0.42	1.90	6.40	4.50	−1.90
Commercial paper	0.29	2.70	7.20	9.40	2.20
T-bills	0.29	2.50	7.00	8.50	1.50
Residential housing	0.36	6.00	10.50	4.40	−6.10
Commercial real estate	0.49	4.30	8.80	8.80	0.00
U.S. farmland	2.04	5.70	10.20	2.80	−7.40
Art	1.15	14.90	19.40	13.00	−6.40
U.S. government bonds	0.98	13.40	17.90	13.70	−4.20
S&P 500	0.91	12.60	17.10	13.90	−3.20
Foreign bonds	1.36	16.10	20.60	11.80	−8.80
Emerging growth stocks	1.61	13.40	17.90	8.30	−9.60
EAFE	1.66	25.10	29.60	15.10	−14.50
Emerging market stocks	3.56	29.90	34.40	8.40	−26.00
Venture capital	7.46	17.90	22.40	−2.40	−24.80
Japanese stocks	1.46	21.70	26.20	14.90	−11.30
Gold	8.00	15.20	19.70	−1.90	−21.60
Small stocks	1.94	18.00	22.50	9.30	−13.20

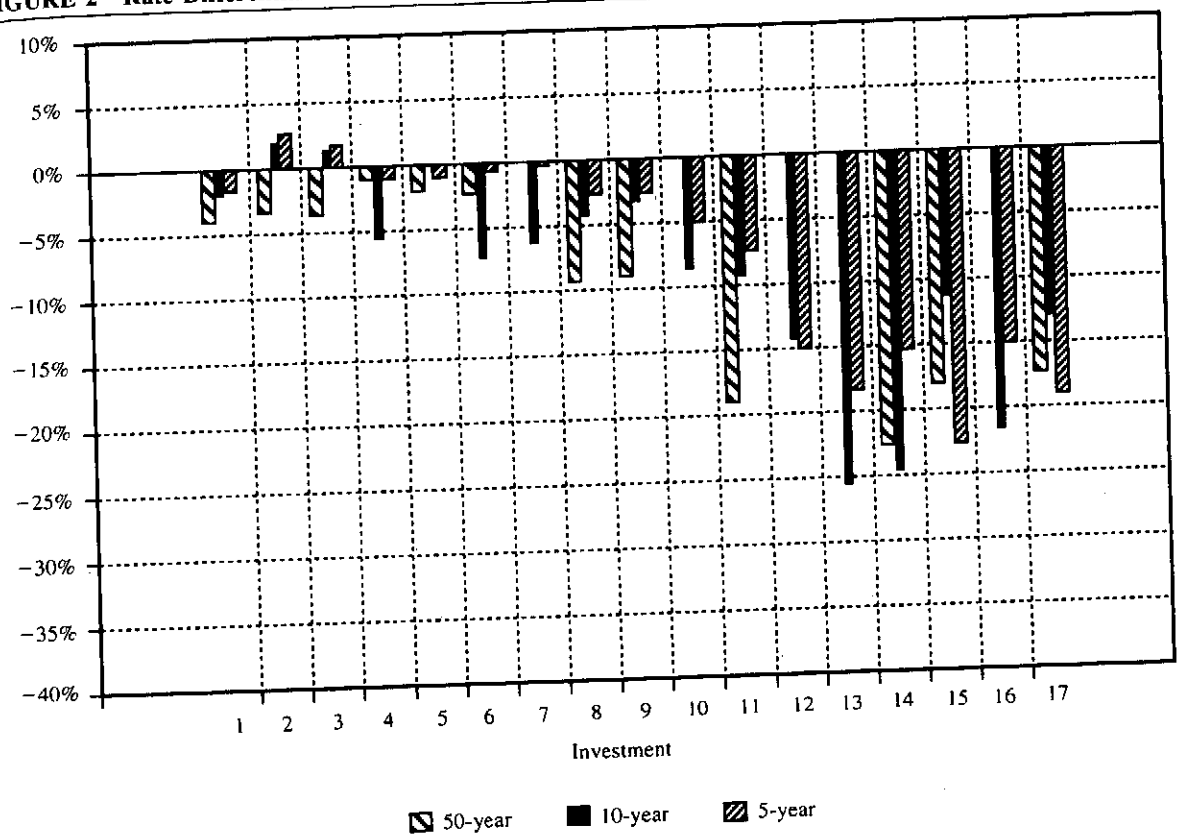
ment as indicated by the mean rate of return. For example, if the mean rate of return is 10% and the desired rate is 9%, the rate differential is 1% (i.e., 10% minus 9%) indicating that on average, the investment returns 1% more than the rate of inflation 84% of the time.

Some of the investments originally had a negative mean rate of return for a given time period, resulting in a strongly negative rate

TABLE 4 5-Year Investment Return Analysis

Investment	Coefficient of Variation	Risk Premium (one standard deviation)	Desired Rate (inflation + risk premium)	Mean Rate of Return (from Table 1)	Rate Differential (mean rate of return − desired rate of return)
Inflation	0.39	1.60	5.70	4.10	−1.60
Commercial paper	0.12	0.90	5.00	7.70	2.70
T-bills	0.16	1.10	5.20	6.80	1.60
Residential housing	0.31	1.50	5.60	4.80	−0.80
Commercial real estate	0.40	2.10	6.20	5.20	−1.00
U.S. farmland	0.54	4.00	8.10	7.40	−0.70
Art	0.82	16.90	21.00	20.70	−0.30
U.S. government bonds	0.87	9.40	13.50	10.80	−2.70
S&P 500	0.90	11.90	16.00	13.20	−2.80
Foreign bonds	1.06	16.30	20.40	15.40	−5.00
Emerging growth stocks	1.41	11.10	15.20	7.90	−7.30
EAFE	1.63	28.50	32.60	17.50	−15.10
Emerging market stocks	1.78	32.60	36.70	18.30	−18.40
Venture capital	2.00	7.60	11.70	−3.80	−15.50
Japanese stocks	2.54	29.80	33.90	11.20	−22.70
Gold	3.97	14.70	18.80	3.70	−15.10
Small stocks	25.83	15.50	19.60	0.60	−19.00

FIGURE 2 Rate Differential



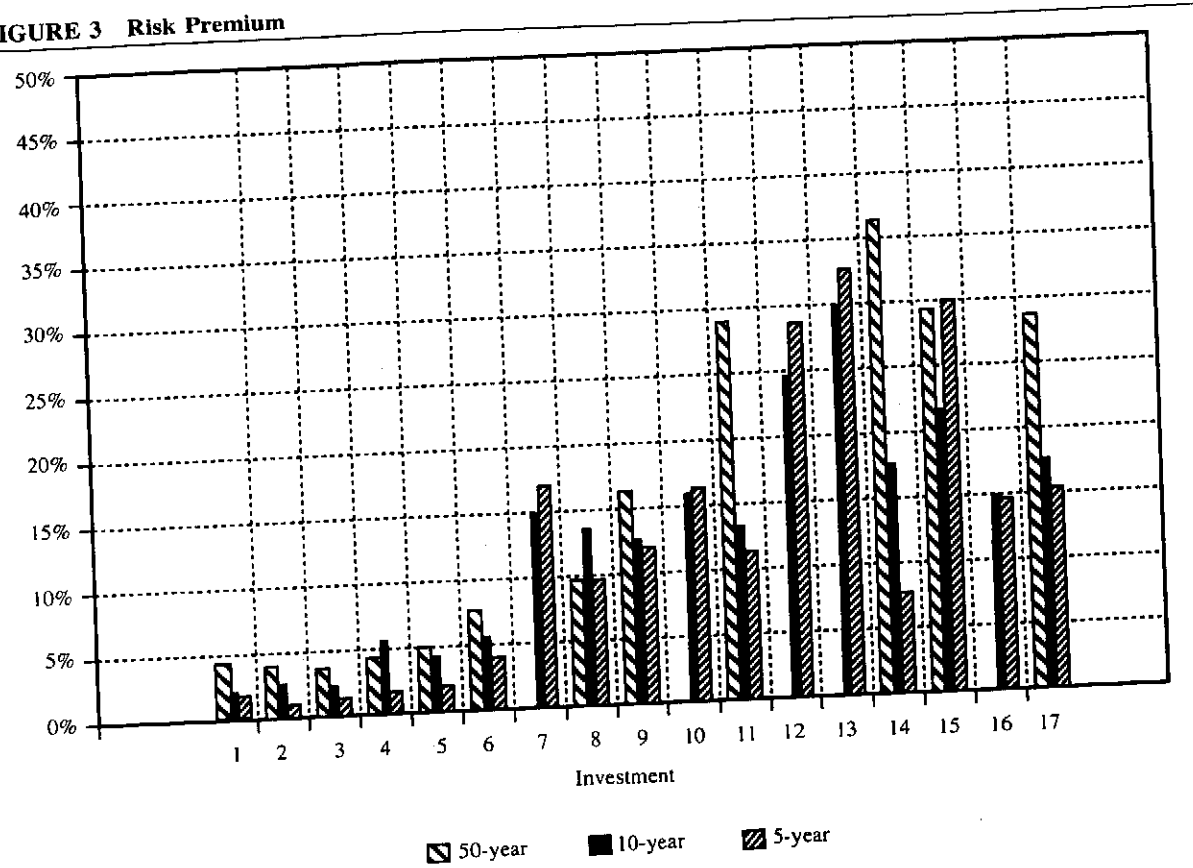
Legend (X-axis)

1 = Inflation
2 = Commercial paper
3 = T-bills
4 = Residential housing
5 = Commercial real estate
6 = U.S. farmland
7 = Art
8 = U.S. government bonds
9 = S&P 500
10 = Foreign bonds
11 = Emerging growth stocks
12 = EAFE
13 = Emerging market stocks
14 = Venture capital
15 = Japanese stocks
16 = Gold
17 = Small stocks

differential. For example, the venture capital mean rate of return for a 5-year investment was −3.80% and the desired rate was 11.70%, resulting in a −15.50% rate differential. Thus, an investment in the average venture capital category for the 5-year period not only did not return the rate of inflation 84% of the time, but fell 15.50% below the rate of return required to achieve that goal.

Figures 2 and 3 provide in graphic form the results of Tables 2, 3, and 4 for the risk premium and the rate differential. These figures seem to indicate fairly bleak investment results, with even T-bills and U.S. Government bonds faring poorly. To some extent, however, such a conclusion may not be warranted. First, the willing investor hypothesized for this article is a conservative investor—one who expects to achieve a return greater than the rate of inflation most of the time (i.e., 84%)—and sometimes a rate much greater than the

FIGURE 3 Risk Premium



Legend (X-axis)

1 = Inflation	2 = Commercial paper
3 = T-bills	4 = Residential housing
5 = Commercial real estate	6 = U.S. farmland
7 = Art	8 = U.S. government bonds
9 = S&P 500	10 = Foreign bonds
11 = Emerging growth stocks	12 = EAFE
13 = Emerging market stocks	14 = Venture capital
15 = Japanese stocks	16 = Gold
17 = Small stocks	

rate of inflation. Second, category-wide mean rates of return are being used here, and individual investments may fare much better (or worse) than the category mean. Third, it has been implicitly assumed that the investment is held for the total time period and—except for notably long-term investments such as real estate—this assumption probably does not hold on average. Nevertheless, some interesting insights can be drawn from the information presented here.

INFLATION PLUS REAL GNP PER CAPITA—A BENCHMARK RETURN

For the 50-year period covered in these analyses (1940–1990) the real (i.e., deflated) Gross National Product (GNP) per capita was 2.11%. Adding the 50-year mean inflation rate of 3.90% gives a "basic" or "average" return for this period of 6.01%. Because this 6.01% return is the total of *all* returns, it seems reasonable to suggest that the only way any partic-

ular investment could earn *more* than 6.01% over a 50-year period is for some other investment to earn less. For the 10-year period (1980–1990) the real GNP per capita averaged 1.69%. Adding the inflation rate of 4.50% gives an average total return of 6.19%. For the 5-year period (1985–1990) the average total return is 5.98% (i.e., 1.88% for GNP per capita plus 4.10% for inflation).

Interestingly, when these two fundamental return components, GNP per capita and inflation, are combined, they hover closely around 6% for all three time periods. This rate may well be the criterion rate of return that fits the concept of the "mean toward which all variable returns tend to regress" because, for the economy as a whole, this is all the return there is. In terms of game theory, the total investment market appears to be not a "zero sum game," but quite possibly a 6% game.

Tables 1, 2, 3, and 4 and Figures 1, 2, and 3 provide a number of interesting insights into the risk potential for investments in the categories examined. Figure 2, for example, illustrates that, in general, longer term investments require a higher risk premium than shorter term investments—a conclusion generally supported by the market differential between short- and long-term bond rates. A surprising result was the relative ranking of some of the individual risk premiums. For example, investments in commercial paper, T-bills, residential housing, commercial real estate, and U.S. farmland carry the lowest risk premiums while U.S. Government bonds carry a surprisingly high 9% to 13% risk premium.

While it is not a great surprise that emerging growth stocks, venture capital, emerging market stocks, and small stocks carry high risk premiums, the actual level of risk premiums in excess of 20% for 50-year investments is much greater than the risk rates of return in the marketplace. For these same categories it is clear that risks—as indicated by the required risk premiums—are significantly less for shorter term investments than for longer term investments.

The rate differential chart in Figure 2 illustrates these observations and is clearly at odds with the idea that the rates of return historically provided by the marketplace compensate for the risks. For long-term investments, no category adequately covers the risks as required for the defined willing investor, and only the commercial paper and T-bill categories provide rates of return in excess of that required by the willing investor's criteria in the shorter term. Residential housing appears to provide a better return when held either for an extremely short period (assuming that appraised values accurately reflect actual sale prices in the short term) or for an extremely long period, but is not particularly productive in the medium term. U.S. Government bonds do not do very well in any time period, but virtually all the other investment categories are extremely poor performers for the defined willing investor.

It is possible that investors are not as risk averse as previously thought, and that investors in one risk class of investments (e.g., real estate and T-bills) may not be interested in investing in another risk class (e.g., venture capital, small stocks, and emerging market stocks). Some investors are, in fact, willing to make investments at less than our willing investor criterion; that is, at some probability of achieving a greater than inflation rate of return less than 84% of the time. At a 50% probability of re-

In terms of game theory, the total investment market appears to be not a "zero sum game," but quite possibly a 6% game.

turn, for example, the risk premium equals zero and an investor thus is willing to accept an equal chance of receiving or not receiving a specific rate of return.

The idea that investors in one class of return rates may not be willing to invest in a different class is supported by the apparent existence of three rate-of-return classes, as follows.

1. A low-risk class consisting of commercial paper, T-bills, residential housing, commercial real estate, U.S. farmland, and possibly art; although for art, foreign bonds, Europe, Australia, and Far East index (EAFE), emerging market stocks, and gold, the historic perspective of the 50-year returns is not yet available. The rate differentials for these categories range from 2% to −7%.

2. The moderate-risk class consisting of U.S. Government bonds, the S&P 500, and foreign bonds, although for the latter, again, 50-year data are not available. The rate differentials for these categories are in the range of −2% to −9%.

3. The relatively high-risk class consisting of emerging growth stocks, EAFE, emerging market stocks, venture capital, Japanese stocks, gold, and small stocks. The rate differentials for these categories range from −7% to −26%. Interestingly, the Japanese stocks do not indicate a significantly better performance in any investment horizon than small stocks.

In light of the differences in performance between these classes, a willing investor in the low-risk class would probably not be willing to invest in the high-risk class. Thus, for certain types of highly speculative real estate investments, the marketplace for investors would be found not among traditional real estate investors, but rather among those investors traditionally interested in the high-risk class. A traditional high-risk investor, however, may be willing to counterbalance a high-risk investment with a low-risk investment as a portfolio strategy.

PROBABILITY OF ACHIEVING THE DESIRED RATE

A relevant issue is to determine the probability of achieving the desired rate of return for each category of investment. Because there appears to be little justification for assuming the criterion of earning at least the rate of inflation plus one standard deviation can be achieved, the actual return histories may be examined to reveal the *real* chances the willing investor had of achieving the desired rate of return. Tables 5, 6, and 7 are probability analyses for each of the investment time horizons. Figure 4 summarizes the probability of achieving the desired rate.

Examination of the commercial real estate rate of return provides some interesting information. Over a 50-year period, an investor's actual chance of obtaining the desired rate as defined earlier, given the actual mean return, was 34%. For the 10-year period, the probability increases to 50%, and for the 5-year period, the probability drops back to 32%. Based on these figures, it is possible that the randomly chosen but almost universally used 10-year projection period for commercial real estate valuation reflects a "subconscious" optimization. Whether this is so is a possible area for further research.

TABLE 5 50-Year Investment: Probability Analysis

Investment	Mean Rate of Return	Desired Rate of Return	Standard Deviation	z-Value	Probability of Receipt of Desired Rate
Commercial paper	5.20	8.40	3.80	0.84	0.20
T-bills	4.40	8.00	3.40	1.06	0.14
Residential housing	7.70	8.60	4.00	0.23	0.41
Commercial real estate	7.50	9.50	4.90	0.41	0.34
U.S. farmland	9.80	12.10	7.50	0.31	0.38
Art	N/A	N/A	N/A	N/A	N/A
U.S. government bonds	4.50	14.00	9.40	1.01	0.16
S&P 500	11.60	20.70	16.10	0.57	0.28
Foreign bonds	N/A	N/A	N/A	N/A	N/A
Emerging growth stocks	14.10	33.40	28.80	0.67	0.25
EAFE	N/A	N/A	N/A	N/A	N/A
Emerging market stocks	N/A	N/A	N/A	N/A	N/A
Venture capital	18.00	40.80	36.20	0.63	0.26
Japanese stocks	15.70	33.80	29.20	0.62	0.27
Gold	N/A	N/A	N/A	N/A	N/A
Small stocks	15.60	33.30	28.70	0.62	0.27
Mean	0.27				
Coefficient of variation	0.31				
Median	0.27				

The data in Figure 4 indicate that shorter investment horizons generally result in a higher probability of achieving the desired rate. The mean probability of achieving the desired rate of return for a 50-year period is 0.27 (27%) over all investments; for the 10-year period it is 0.32 (32%); and for the 5-year period it is 0.37 (37%). Some in-

TABLE 6 10-Year Investment: Probability Analysis

Investment	Mean Rate of Return	Desired Rate of Return	Standard Deviation	z-Value	Probability of Receipt of Desired Rate
Commercial paper	9.40	7.20	2.70	0.81	0.79
T-bills	8.50	7.00	2.50	0.60	0.73
Residential housing	4.40	10.50	6.00	1.02	0.15
Commercial real estate	8.80	8.80	4.30	0.00	0.50
U.S. farmland	2.80	10.20	5.70	1.30	0.10
Art	13.00	19.40	14.90	0.43	0.33
U.S. government bonds	13.70	17.90	13.40	0.31	0.38
S&P 500	13.90	17.10	12.60	0.25	0.40
Foreign bonds	11.80	20.60	16.10	0.55	0.29
Emerging growth stocks	8.30	17.90	13.40	0.72	0.24
EAFE	15.10	29.60	25.10	0.58	0.28
Emerging market stocks	8.40	34.40	29.90	0.87	0.19
Venture capital	−2.40	22.40	17.90	1.39	0.08
Japanese stocks	14.90	26.20	21.70	0.52	0.30
Gold	−1.90	19.70	15.20	1.42	0.08
Small stocks	9.30	22.50	18.00	0.73	0.23
Mean	0.32				
Coefficient of variation	0.66				
Median	0.29				

TABLE 7 5-Year Investment: Probability Analysis

Investment	Mean Rate of Return	Desired Rate of Return	Standard Deviation	z-Value	Probability of Receipt of Desired Rate
Commercial paper	7.70	5.00	0.90	3.00	0.99
T-bills	6.80	5.20	1.10	1.45	0.93
Residential housing	4.80	5.60	1.50	0.53	0.30
Commercial real estate	5.20	6.20	2.10	0.48	0.32
U.S. farmland	7.40	8.10	4.00	0.18	0.43
Art	20.70	21.00	16.90	0.02	0.49
U.S. government bonds	10.80	13.50	9.40	0.29	0.39
S&P 500	13.20	16.00	11.90	0.24	0.41
Foreign bonds	15.40	20.40	16.30	0.31	0.38
Emerging growth stocks	7.90	15.20	11.10	0.66	0.25
EAFE	17.50	32.60	28.50	0.53	0.30
Emerging market stocks	18.30	36.70	32.60	0.56	0.29
Venture capital	−3.80	11.70	7.60	2.04	0.02
Japanese stocks	11.20	33.90	29.80	0.76	0.22
Gold	3.70	18.80	14.70	1.03	0.15
Small stocks	0.60	19.60	15.50	1.23	0.11
Mean	0.37				
Coefficient of variation	0.69				
Median	0.31				

vestment categories show a different behavior, however, calling into question the general applicability of this conclusion.

Of the investments for which data were available for all three investment periods, four categories—commercial paper, T-bills, U.S. Government bonds, and the S&P 500—showed an increasing probability of achieving the desired rate with a decreasing investment horizon, and six categories showed a decrease. On the whole, however, the mean return for all investments averaged a 5-point increase in the probability of achieving the desired rate for the 10-year period as compared with the 50-year period, and another 5-point increase for the 5-year period.

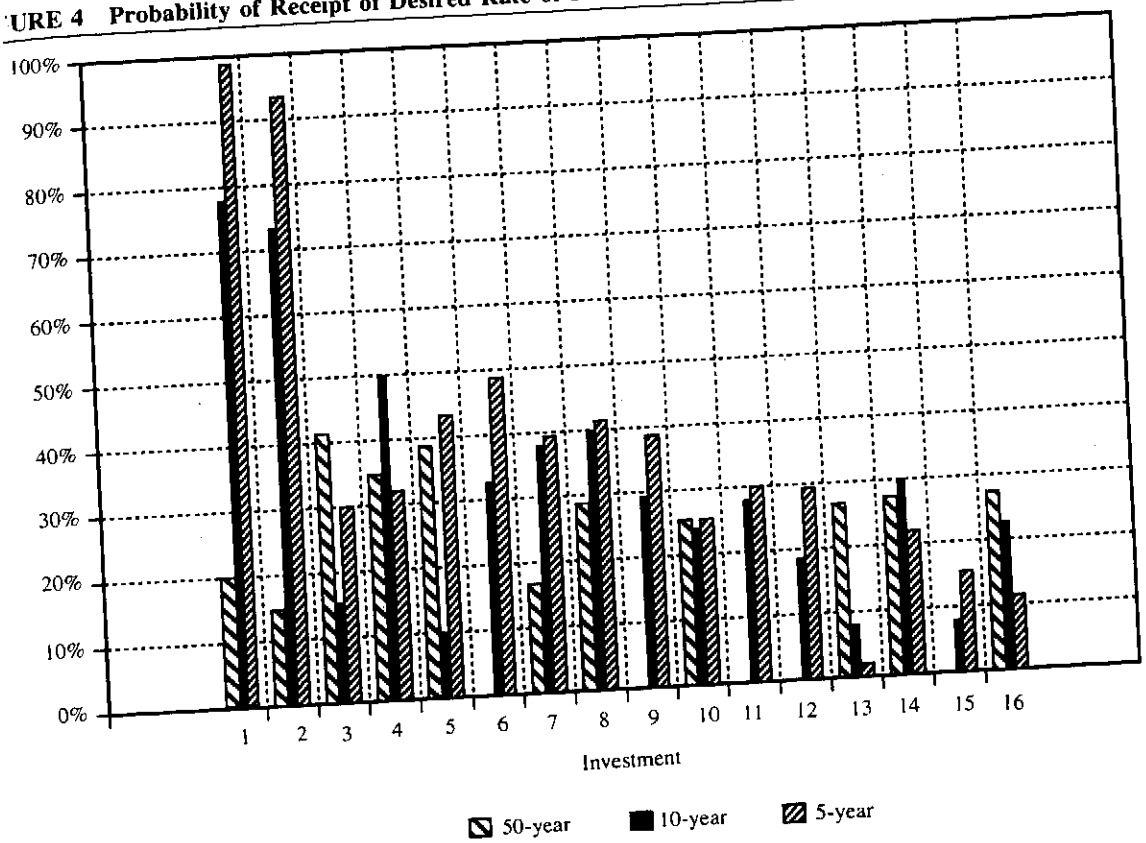
INVESTMENT RETURN VERSUS INVESTMENT RISK

As noted earlier, the *Barron's* article mentions that the rate of return and the associated risks are well correlated over a long period of time. If this is correct, the rates of return should be reasonably predictable from their associated risks. Table 8 shows the result of a simple regression of the rate of return on the volatility coefficient for the 50-year investment data from Table 2. The resulting adjusted coefficient of determination (R^2), intended to reflect the percentage of variation in the dependent rate of return variable that is explained by the regression equation, is an extremely modest 32% with a standard error of 4.0588. This reflects a coefficient of variation of 39%.

When the commercial real estate return is predicted from its coefficient of volatility, the predicted return is 7.14%, but with a standard error of forecast of 4.50% (or a coefficient of variation of 62%). Accepting even the most liberal confidence interval of 80% results in a prediction of return somewhere between 1% and 13%, an unacceptably wide range.

In Table 9, which shows a similar regression for the 10-year pe-

URE 4 Probability of Receipt of Desired Rate of Return



Legend (X-axis) (NOTE: The numbering is different from figures 2 and 3.)

1 = Commercial paper	2 = T-bills
3 = Residential housing	4 = Commercial real estate
5 = U.S. farmland	6 = Art
7 = U.S. government bonds	8 = S&P 500
9 = Foreign bonds	10 = Emerging growth stocks
11 = EAFE	12 = Emerging market stocks
13 = Venture capital	14 = Japanese stocks
15 = Gold	16 = Small stocks

riod, the R^2 is 50%, just slightly better than the 50-year data. The standard error of estimate is 45% of the mean return, and when the return for commercial real estate is predicted, the standard error of forecast is 36% of the predicted return of 11.35%. Again, the 80% confidence interval is unacceptably broad: in this case 6% to 17%.

Table 10 shows the results for the 5-year period. The R^2 is 6% and the standard error is 70% of the mean value. When commercial real estate return is predicted, the result is a 10% return (compared with the actual rate of 5.2%), and the 80% confidence interval is an uninformative range of 1% to 19%. Converting the data to a nonlinear basis did not improve the results.

The assumption of a correlation between risk and return does not appear to be justified, and the absence of such a correlation is evident from a simple inspection of the data. For example, in the 50-year data (Table 2), both T-bills and U.S. farmland have a coefficient of volatility (*COV*) of 77%, yet they

TABLE 8 50-Year Investment: Risk/Return

Step 1, Variable 1

Standard error of estimate							4.0588
Coefficient of variation							0.3913
Adjusted coefficient of determination (R^2)							0.3191
Tolerable coefficient of determination							0.1058
Coefficient of association (A statistic)							0.1748
Degrees of freedom							9
F-Ratio							5.6855
Probability of F by chance							0.0087
Constant term							4.0706
Variable	Coefficient	Std. error	t Value	Prob.	Beta	MEV*	Elast.
1 IndVo**	4.7255	1.9818	2.3844	0.0394	0.6222	0.0862	0.6076
Critical t-value @ .01 level of significance							3.2504
Critical t-value @ .05 level of significance							2.2628
Critical t-value @ .10 level of significance							1.8336
For subject		Constant		4.0706			
variable 1		IndVo		0.6500 × 4.7255 = 3.0716			7.1422
Predicted return							4.450472
Standard error of forecast							0.6231
Coefficient of variation							
		95% Confidence interval		−2.9282	to	17.2125	
		90% Confidence interval		−1.0181	to	15.3025	
		80% Confidence interval		0.9861	to	13.2982	

*Marginal Explanatory Value = what percentage of standard error is reduced by inserting this variable.
**Index of Volatility.

reflect a return of 4.40% and 9.80%, respectively. U.S. Government bonds have a *COV* of 209%, and the venture capital shows a similar risk with a *COV* of 201%, yet the former has a return of 9.40% and the latter 18%. In the 10-year analysis (Table 3), commercial paper shows a return of 9.40% and small stocks 9.30%, yet commercial paper has a *COV* of only 29% and small stocks a *COV* of 194%. Comparisons between investments throughout Tables 2, 3, and 4 indicate a similar lack of correlation between risk and return.

Clearly, these analyses show an insignificant correlation between the rates of return and their associated risk factors. Because this result directly contradicts one of the most fundamental "givens" in valuation and investment analysis—that rate of return is commensurate with risk—analysts should, at the least, reexamine this assumption with more empirical studies rather than continue to accept this concept as an underlying, self-evident premise. Meanwhile, a more accurate formulation of the common risk/return principle might be that the *expected* rate of return is commensurate with risk.

It is possible that further analysis including a mean and standard deviation of numerous specific investments in a specified category might reflect a better correlation between return and risk for a particular class of investments.

CONCLUSION

The analyses in this article indicate that investors are not as risk averse as traditionally supposed. The rate

TABLE 9 10-Year Investment: Risk/Return

Step 1, Variable 1

Standard error of estimate	3.8819
Coefficient of variation	0.4501
Adjusted coefficient of determination (R^2)	0.4971
Tolerable coefficient of determination	0.3938
Coefficient of association (A statistic)	0.2908
Degrees of freedom	14
F-Ratio	15.8272
Probability of F by chance	0
Constant term	12.1841

Variable	Coefficient	Std. error	t Value	Prob.	Beta	MEV*	Elast.
1 IndVo**	−1.6968	0.4265	−3.9783	0.0017	−0.7284	0.1096	−0.4126
Critical t-value @ .01 level of significance							2.9774
Critical t-value @ .05 level of significance							2.1453
Critical t-value @ .10 level of significance							1.7617
For subject		Constant		12.1841			
variable 1		IndVo		0.49000 × 1.6968 = −0.8314			
Predicted return							11.3526
Standard error of forecast							4.059686
Coefficient of variation							0.3576
		95% Confidence interval		2.6433	to	20.0620	
		90% Confidence interval		4.2006	to	18.5047	
		80% Confidence interval		5.8914	to	16.8138	

*Marginal Explanatory Value = what percentage of standard error is reduced by inserting this variable.
**Index of Volatility.

differentials indicate that investors historically have been willing to place funds in investments that do not have a rate of return sufficient to equal or exceed inflation 84% of the time. In addition, rates of return do not increase proportionately with risk, according to the criterion used in this article. In addition, some traditionally "safe" investments may only be safe in the short term. For example, U.S. Government bonds do not perform well on a long-term basis, falling well below the rate differentials for real estate. The highly liquid and traditionally safe T-bills do well in the short term, but not as well as commercial paper—traditionally perceived as a more risky investment—and do not perform well over the extremely long term.

There appears to be little correspondence between rate of return and risk, at least as measured by the *COV* associated with the return. The difference appears to lie in investor willingness to accept varying levels of risk, implying that different categories of investment attract different investors. That is, investment alternatives are probably not directly substitutable. An investor with funds available for an investment in commercial real estate is probably not willing to make those funds available for investment in small stocks or venture capital. If direct substitution were the case, the rate differentials and probabilities of achieving the desired rate of return would have been similar between the investments, and they clearly were not.

An individual investor probably does have a specific and constant risk criterion, even if the marketplace as a whole does not. This is

TABLE 10 5-Year Investment: Risk/Return

Step 1, Variable 1

Standard error of estimate	6.4506
Coefficient of variation	0.7002
Adjusted coefficient of determination (R^2)	0.0635
Tolerable coefficient of determination	*
Coefficient of association (A statistic)	0.0323
Degrees of freedom	14
F-Ratio	2.0169
Probability of F by chance	0.1009
Constant term	10.2646

Variable	Coefficient	Std. error	t Value	Prob.	Beta	MEV*	Elast.
1 IndVo**	−0.3796	0.2673	−1.4202	0.1749	−0.3549	0.0464	−0.1142
Critical t-value @ .01 level of significance							2.9774
Critical t-value @ .05 level of significance							2.1453
Critical t-value @ .10 level of significance							1.7617
For subject		Constant		10.2646			
variable 1		IndVo		0.4000 × −0.3796 = −0.1519			
						Predicted return	10.1127
						Standard error of forecast	6.679224
						Coefficient of variation	0.6605
95% Confidence interval				−4.2164	to	24.4418	
90% Confidence interval				−1.6543	to	21.8797	
80% Confidence interval				1.1276	to	19.0978	

*Marginal Explanatory Value = what percentage of standard error is reduced by inserting this variable.
**Index of Volatility.

not a new or startling conclusion, but the data available suggest that the degree of difference in risk may be measured between investor communities. The degree of difference between risk acceptance levels may be stated in terms of what level of risk is acceptable for each type of investment. For example, the 84% criterion seems to work reasonably well for commercial paper and T-bills. However, a higher risk standard must apply to all of the other investment opportunities. Applying the risk criterion to venture capital, for example, indicates that these investors accept the chance that they will earn a rate of return at least equal to inflation only 26% of the time. This compares poorly with our criterion of 84% of the time. Note that venture capital tends to perform better in the long term than in the short term—one of the exceptions to the general rule that higher risk investments perform better in the short term than in the long term.

This information could be useful in a real estate situation involving environmental risks. It would seem reasonable that the rate of return required by an investor in an environmentally risky commercial real estate property would more closely resemble the small stocks (22.50%) or venture capital (22.40%) rates. Once the desired rate of return has been selected, it can easily be changed into a capitalization rate or used in a discounted cash flow analysis for valuation purposes. The data and our earlier conclusions suggest that the marketplace for the environmentally risky commercial real estate will also be different. The likely buyer will be inherently willing to accept greater risks than

a traditional commercial real estate investor and will probably already be a participant in one of the higher risk markets.

An additional application for the risk premium data is in the valuation of small corporate stocks, particularly those with a small market or closely held stocks. The problem in these cases has been the comparison of the price-to-earnings (*P*:*E*) ratios and other criteria with those of publicly traded organizations to establish a value opinion. The risk premium differential between that for small stocks (the smallest 20% of companies listed on the New York Stock Exchange in terms of equity) and the S&P 500 may provide the needed adjustment factor. Note that the large differentials between these two categories hold true for all three time periods.

Further, Figure 3 shows that over a 5-year period, only commercial paper and T-bills meet the desired rate. Over a 10-year period, only commercial paper, T-bills, and commercial real estate achieve this return. Finally, over a 50-year period, *none* of the investments meets the criterion of an 84% probability of earning an amount at least equivalent to the inflation rate.

Such results seem to indicate that in the long run, the average return for all investments (as a totality) cannot be sustained at a level in excess of inflation plus the deflated per capita growth in the GNP. In support of this concept, note that from 1950 to 1986—a period of 36 years—deflated GNP per capita grew at a 1.9% rate. From 1970 to 1980—10 years—the rate was 1.7%. From 1980 to 1985, the rate was 2%. Therefore, if the long-term inflation rate of 4.6% and the real GNP growth per capita of 1.9% are added the result indicates that the average return on investments as a whole amounts to around 6.5%. At the 1991 Appraisal Institute Symposium,[3] Dr. Halbert C. Smith forecasted a real GNP growth for the near future of 2.5% to 3% and inflation of 3.6% to 3.9%. Combining the two indicators results in a composite basic rate of 6.1% to 6.9%, which is consistent with the historical composite basic rate.

If such a rate is only roughly correct, the great majority of anticipated yields, as projected by investors, lenders, appraisers, and others, are overly optimistic. It is worth noting that in Table 2, the 50-year mean rate of return has been in the range of 4.4% to 7.7% for commercial paper, T-bills, residential housing, and commercial real estate, a fact that supports the hypothesis that the combined real GNP per capita growth rate plus inflation provide a stable basic or criterion rate of return.

A major difference between the inferences drawn from this set of data as compared with those drawn in the *Barron's* article is that, based on the given data no significant relationship appears to exist between achieved return and risk. Moreover, most of the investment categories are much more volatile, and therefore riskier, than investors obviously assume. It is also apparent that the investors in the various categories generally do a poor job of estimating their future risk and return, possibly because they are usually overly optimistic and pay little attention to the past histories of the pertinent investor categories. This may well be a function of the old "gambler's fallacy," which holds that if you have

If such a rate is only roughly correct, the great majority of anticipated yields, as projected by investors, lenders, appraisers, and others, are overly optimistic.

3. Dr. Halbert C. Smith, speaking at the October 4, 1991, Appraisal Institute Symposium in Philadelphia, Pennsylvania.

lost ten times in a row, your probability of winning on the eleventh try is higher than if you had only lost half of the time.

An unintended but not inconsiderable byproduct of the calculations in this article is that it has been demonstrated that an analyst can start with one page of data, such as that in Table 1, and by seeking out the underlying relationships hidden in the data, can enhance both the number and the pertinence of inferences to be drawn.