REPORTS OF BETA'S DEATH HAVE BEEN GREATLY EXAGGERATED

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For decades the Capital Asset Pricing Model (CAPM) has been held as an article of faith among financial economists. The model, usually attributed to 1990 Nobel Laureate William Sharpe (1964), was also developed by Fischer Black (1972), John Lintner (1965), Jan Mossin (1966), and Jack Treyor (1965). CAPM attempted to quantify the relationship between risk and return. Both economists and financial practitioners have long believed that riskier assets must yield a higher expected rate of return to induce investors to hold them. The innovation of CAPM was to specify the particular risk measure that would be priced in the market.

Defining Risk

Risk is generally defined as the chance that investment outcomes will come out differently than expected. In particular, most investors think of risk as measuring the chance that returns will be lower than expected and, specifically, that the investment will produce a loss. This suggests a natural measure for risk, namely, the dispersion (or variance) of return outcomes around their average or expected values. To be sure, positive surprises (i.e., returns higher than anticipated) can hardly be considered to be unfavorable. Nevertheless, if return outcomes are reasonably symmetric, a dispersion measure will capture the magnitude or likelihood of downward or unfavorable surprises and, thus, should be a serviceable measure of risk.

The Capital Asset Pricing Model

Before CAPM, risk was typically estimated by measuring the variability of the past returns for each individual security. Securities that had low variance of past returns were considered quite safe, whereas those whose past returns displayed large dispersion were deemed risky. The critical insight of CAPM was to argue that only a portion of that past instability would be priced in the market as risk. Two types of factors tend to produce variability in returns. The first, called idiosyncratic risk, represents events that are specific to the individual company. Factors such as a new drug discovery, an oil find, a damaging product liability lawsuit, or the incapacity of a highly-respected chief executive officer all can affect the returns from individual securities.

The second factor, called systematic risk, represents the variability imparted to common stock returns by general movements in the broad market. During periods of market distress, such as October 1987, the broad market declined sharply and individual stocks followed suit. But not all stocks are equally sensitive to market swings. When the market drops by 10 percent, a relatively stable stock, such as AT&T, might drop by only 5 percent. On the other hand, a less stable stock, such as Digital Equipment, might decline by 20 percent. Beta is a measure of an individual stock's general sensitivity to market swings. The market as a whole (represented by a broad stock market index such as the Standard and Poor's 500 Stock Index) is accorded a beta of

one. Stocks with betas of 1/2 tend to swing half as much as the market while stocks with a beta of 2 tend to be twice as volatile. Beta is then a measure of relative volatility. It measures the systematic tendency of individual stocks to follow market movements.

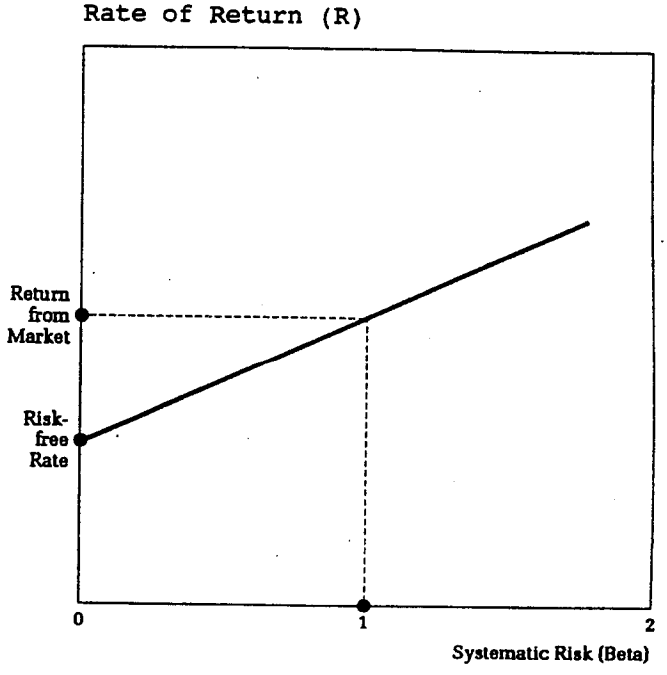
Thus, the dispersion in returns for any individual stock is influenced by two risk factors: idiosyncratic, or specific risk, and systematic, or market risk. The insight of CAPM was that only one of these risk factors was relevant for the pricing of individual issues. CAPM argued that idiosyncratic risk would not be priced in an efficient market and would not command a risk premium (i.e., an extra expected return to compensate for the extra risk). The reason was that idiosyncratic risk can essentially be eliminated by holding a diversified portfolio. The positive and negative events affecting individual companies are likely to cancel each other out. The new drug that makes one company's stock rise is likely to affect negatively the stock of another company which formerly had the most effective treatment. If specific risk can, thus, largely be cancelled out by diversification, it stands to reason that the market will not pay a premium for it.

Systematic risk, on the other hand, can not be reduced by diversification. Indeed, even if an investor was perfectly diversified by holding all the individual stocks in the market, her portfolio would still be risky in the sense that it was subject to the ups and downs of the market as a whole. Thus,

only systematic, or nondiversifiable risk (measured by beta) will deserve some risk compensation in the market. And the higher the risk of a stock or a portfolio (as measured by the portfolio's average beta value), the higher the return should be. The following diagram depicts the relationship between risk and return.

Here the risk-free rate (R_F) is taken to be the short-term Treasury Bill rate (a security whose nominal rate of return over some short holding period is perfectly certain). The return for the market (R_M) is taken to be the return from a broad stock market index.

Risk and Return According to the Capital-Asset Pricing Model*



$R=R_F + B(R_M - R_F)$

Alternately, the equation can be written as an expression for the risk premium, that is, the rate of return on the portfolio or stock over and above the risk-free rate of interest:

$R - R_F = B(R_M - R_F)$.

Figure 1

Tests of the CAPM

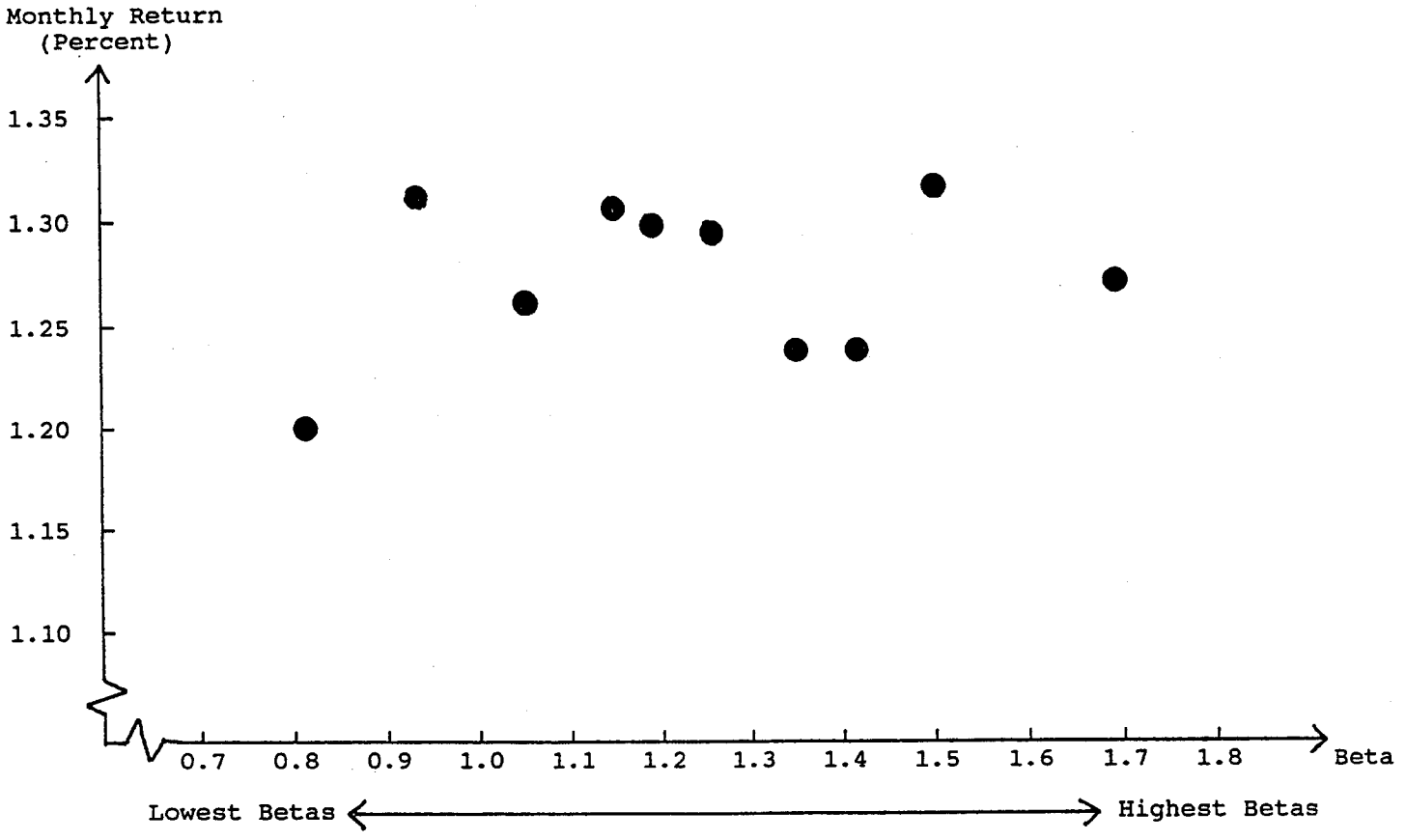
At first, the tests of the Capital Asset Pricing Model seemed encouraging. Data from the 1960s and 1970s for individual stocks and for mutual funds appeared to indicate that security returns were, in fact, directly related to beta as the theory asserts. Stocks and mutual funds with higher betas did seem to produce somewhat higher rates of return. It turned out, however, that even during the period when the theory appeared to work, the actual risk-return relationship was somewhat flatter than that predicted by CAPM. Low-risk stocks appeared to earn higher rates of return and high-risk stocks lower rates of return than the theory predicted. Moreover, some troubling aspects of the model came to light. Richard Roll pointed out that it is impossible to observe the market's return since the market includes <u>all</u> stocks, a variety of other financial instruments, and even nonmarketable assets, such as an individual's investment in education. The S&P 500 Index (or any other index used to represent the market) is a very imperfect market proxy at best. Roll showed that by changing the market index against which betas are measured, one can obtain quite different measures of the risk level of individual stocks or portfolios. As a consequence, one would make very different predictions about expected returns.

The most damaging blow to CAPM, however, came in 1992 with the publication of a study by Eugene Fama and Kenneth French, which seemed to shatter any support for beta in the academic and professional community. Their empirical evidence was clear; beta

and long-run average return were simply not correlated, as is shown in the figure below. Beta appeared to be of no use to investors. With the release of the Fama and French study, investment professionals almost universally condemned beta. Articles with titles such as "Bye-bye to Beta" and "Is Beta Dead Again?" were representative of the period.[1] A comment typical

AVERAGE MONTHLY RETURN VS. BETA: 1963-1990

Fama and French Divide All Stocks into Deciles According to Their Betas and Find the Relationship between Beta and Return Is Flat



Source: Fama and French (1992).

Figure 2

of the investment community was put forth by a prominent manager: "I have always thought this academic wisdom [the CAPM and beta] was way off base, and now there's new evidence to prove I was right."[2]

Should We Confine Beta to the Scrap Heap?

Are we, therefore, ready to confine beta to the scrap heap of discarded economic ideas? We think not. Reports of beta's death are greatly exaggerated. Below we review an important insight offered by Fischer Black about the usefulness of beta as a tool for portfolio managers. Then we present an empirical study covering a 25-year period showing that beta is indeed a quite serviceable and dependable indicator of risk.

In an article in The Journal of Portfolio Management, Fischer Black proposed that even if Fama and French are correct in their conclusions, and high-beta stocks generate returns that are the same as low-beta stocks, the CAPM might still be useful.[3] Indeed, Black argued that beta might be more useful than ever for portfolio managers. If one is not rewarded for bearing the increased risk of a high-beta portfolio, this would suggest that investors should shift to low-beta portfolios. In addition, low-beta stocks might serve the function of an alternative asset to bonds or cash in an investor's portfolio, possessing similar risk but earning higher average returns. If investors are rational and risk averse, preferring higher return and lower risk *ceteris paribus*, then this new relationship, or

lack thereof, suggests unique opportunities to invest in low-beta stocks without suffering the punishment of lower returns. Moreover, those investors willing to accept a market level of risk could buy low-beta portfolios on margin (borrowing at or near the risk-free rate) and leverage up the portfolio's risk to the beta of the market. By employing leverage, the investor would achieve a higher-than-market return with a risk level not exceeding that of the market as a whole. Black's conclusions have significant implications for investors and corporations:

> Just like an investor who is free to borrow, a rational corporation will emphasize low-beta assets and use lots of leverage. Even if the line is flat for both investors and corporations, beta is an essential tool for making investment decisions. Indeed, beta is more useful if the line is flat than if it is as steep as the CAPM predicts.[4]

Beta as a Serviceable Measure of Risk

We shall also show that beta is, in fact, a quite serviceable measure of risk. Recalling our earlier discussion, most investors think that a useful risk measure will indicate the chance of disappointment in investment returns -- especially the possibility of losing money in a declining market. The question we pose is whether the beta measure of systematic risk does fulfill that function. Investors who are risk averse will find a risk measure important in the investment process, regardless of the long-run risk and return relationship. Specifically, the risk they wish to minimize is that on the downside. What is needed is a risk measure that sufficiently reflects exposure to

significant drops in the market as a whole.

Does beta accurately measure an investment's risk exposure when the market declines? Traditional CAPM theory asserts that high-beta stocks tend to experience greater losses than low-beta stocks in a declining market. The empirical study described here will show that, for the 25-year period from 1968 to 1992, beta has served as an accurate *ex ante* indicator of downside risk exposure in significantly declining markets.

An Empirical Study of Risk in Declining Markets

The results of the empirical study analyzed below support the claim that beta is indeed useful in measuring the downside exposure of a portfolio in declining market conditions. Whether the market proxy used is the S&P 500 or an equal-weighted market index, our results are the same: High-beta stocks suffer significantly greater losses than low-beta stocks in declining markets, with the market return falling approximately in the middle. In addition, the length of time used to measure beta, within the range of 24 months to 60 months, seems to matter little to the ultimate conclusion.

The first step in the study involved the determination of appropriate declining market periods for examination. In an effort to replicate the Fama and French techniques, we focused the study on the years 1968 to 1992. This similar time frame will enable us to say that although Fama and French found no overall beta and return relationship over the period, there <u>is</u> a

clear relationship if we simply focus on declining markets during this period. Unlike previous CAPM analyses which limited their focus to defined periods of time (months or years usually), we allowed for flexibility in the duration of declining markets. Declining market periods (bear markets) were determined by a graphical observation of weekly market returns for the S&P 500.

We selected two value-weighted indices of market activity, the S&P 500 and a value-weighted market index, and defined a declining market as one where both indices fell at least 10 percent from peak to trough. This definition focused the study on periods where there were losses in the broader market as well as in the larger issues heavily weighted in the S&P 500. According to this definition, we identified 13 periods between 1968 and 1992 that qualify as declining or bear markets. Table 1 summarizes these market periods.[5]

Table 1 - Percentage Returns on Indices for Declining Market Periods Studied

Declining Market Period	Dates	Number of Days in Period	S&P 500	Value Weighted Market	Equal Weighted Market
1	05/14/69 - 07/29/69	52	-15.06	-16.45	-23.47
2	11/10/69 - 01/30/70	57	-13.47	-13.19	-15.78
3	04/01/70 - 05/26/70	40	-22.69	-24.62	-32.63
4	12/08/72 - 10/03/74	458	-47.49	-46.20	-45.31
5	06/30/75 - 09/16/75	55	-13.42	-13.00	-9.58
6	09/12/78 - 11/14/78	46	-13.54	-14.42	-21.57
7	02/13/80 - 03/27/80	31	-16.69	-17.98	-23.22
8	04/01/81 - 09/25/81	124	-17.08	-15.55	-14.29
9	12/04/81 - 03/08/82	64	-14.21	-13.77	-11.22
10	05/07/82 - 08/12/82	68	-13.70	-12.23	-11.41
11	01/06/84 - 06/15/84	113	-11.72	-10.16	-10.04
12	10/05/87 - 12/04/87	44	-31.75	-31.05	-32.54
13	07/16/90 - 10/11/90	63	-19.56	-18.53	-21.47

In testing whether beta was a serviceable measure of risk in declining markets, we used every stock listed on the New York Stock Exchange and American Stock Exchange during these declining market periods as available on the monthly CRSP security price tapes. For each stock, we calculated four different measures of beta to determine if technique would affect the ultimate outcome. We employed the traditional CAPM equation, $r_i - r_f = (r_m - r_f)\beta$, where r_i, r_f, and r_m stand for the return from the i^{th} stock, the risk free return, and the market return respectively. We regressed the monthly excess return of each security above the risk-free rate on the monthly excess return of a market proxy above the risk-free rate to determine beta. The monthly three-

month rate on United States Treasury Bills was used as a proxy for the risk-free rate. Four measures of beta were calculated using different market proxies and lengths of time for the regressions. Two of the betas were calculated using the S&P 500 as a market proxy and two using an equal-weighted market index as the market proxy. Within those two groups, betas were calculated using a 60-month window preceding the declining market and a shorter 24-month window.

Based upon these initial calculations, each individual stock was assigned a beta. As previous studies have shown, however, portfolio betas are more reliable than individual security betas which are prone to significant measurement error. We, therefore, ranked the securities according to their preceding betas and formed portfolio deciles, the lowest-beta stocks falling in the first decile and the highest-beta stocks falling in the tenth decile. Portfolio betas were then calculated as the mean betas of their composite securities, with an equal weighting assigned to each security in the portfolio. Thus, only information available to investors was used to form the portfolios.

Declining Market Returns and Beta

Using the CRSP tapes, period returns were calculated for the securities listed during the declining market periods. The returns included dividends and were compounded daily. Stocks that were not listed for the entire declining market period were dropped.[6] These period returns were then matched with their

corresponding securities in the portfolio deciles. Portfolio returns were determined by calculating the mean return of all securities in a given decile, with an equal weight assigned to each security in the portfolio.

Aggregate results were determined by grouping all first deciles from each of the 13 periods together and then recalculating a mean decile beta and mean decile return. The process was repeated for subsequent deciles. In the end, there were four pairs of portfolio betas and returns corresponding to the four calculation groups for each decile. Table 2 summarizes these aggregate results.

Table 2 - Summary of Aggregate Results for 13 Declining Market Periods (1968-1992)

24 Month Preceding Betas										
Mean Decile Betas With Equal-weighted Market Proxy	0.18	0.46	0.63	0.76	0.89	1.02	1.15	1.31	1.53	2.02
Mean Decile Betas With S&P 500 Market Proxy	0.14	0.48	0.67	0.83	0.98	1.12	1.29	1.47	1.73	2.27
Mean Decile Returns Using Equal-weighted Proxy Betas (%)	-11.70	-14.06	-16.83	-17.98	-19.52	-21.11	-22.70	-24.03	-26.12	-29.65
Mean Decile Returns Using S&P 500 Proxy Betas (%)	-12.82	-14.91	-16.78	-17.75	-19.06	-20.33	-22.54	-24.51	-25.34	-29.58
60 Month Preceding Betas										
Mean Decile Betas With Equal-weighted Market Proxy	0.33	0.53	0.67	0.79	0.89	0.99	1.09	1.22	1.40	1.79
Mean Decile Betas With S&P 500 Market Proxy	0.38	0.64	0.80	0.94	1.05	1.16	1.28	1.42	1.61	2.01
Mean Decile Returns Using Equal-weighted Proxy Betas (%)	-8.68	-13.63	-16.49	-18.06	-19.57	-20.91	-22.68	-23.28	-26.37	-29.77
Mean Decile Returns Using S&P 500 Proxy Betas (%)	-9.25	-13.25	-16.06	-18.49	-20.28	-20.41	-22.23	-23.91	-25.58	-29.80

The data show a clear relationship between beta and downside risk in declining markets. The high-beta portfolios consistently perform most poorly during periods when the S&P 500 and value-weighted indices drop at least 10 percent. The result holds

regardless of the market proxy or the length of time used to calculate the betas.

Figures 3 and 4 plot the results. The usefulness of beta as a measure of downside risk appears compelling. The relationship between beta and return in declining markets is strictly negative and monotonic.[7] As one increases the portfolio beta from the lowest deciles, the portfolios perform progressively worse in declining markets, regardless of the market proxy used.[8]

Individual Period Results

As striking as the aggregate results are, it is also important to break down the analysis by period. If an investor plans to use beta as her risk measure in choosing a portfolio, she will be concerned not only with the aggregate performance of beta in forecasting downside exposure but also its consistency in each market period. Analyzing data for each of the 13 market periods studied, we find that the relationship holds in every period. While the relationship is not always strictly monotonic, the general tendency for high-beta portfolios to suffer more in bear markets is always upheld.

Another interesting result of this study is the predictive strength shown by beta in the periods after 1980. Many economists hypothesized after the Fama and French study that the long-run beta and return relationship had ceased to exist after

1980. Whether or not this conclusion is accurate, these data suggest that the short-run relationship between return and beta in declining markets following 1980 did not significantly weaken.[9]

Concluding Comment

The focus of this study has been the practical use of beta as a serviceable measure of risk. The rational risk-averse investor needs to identify a risk measure that will highlight the downside potential of her portfolio. The empirical study presented here indicates that beta, however measured, remains a useful tool in forecasting short-term risk in declining markets.

Figure 3 - Mean Decile Returns during Declining Market Periods (1968-1992): Deciles Formed Using 24-Month Preceding Betas

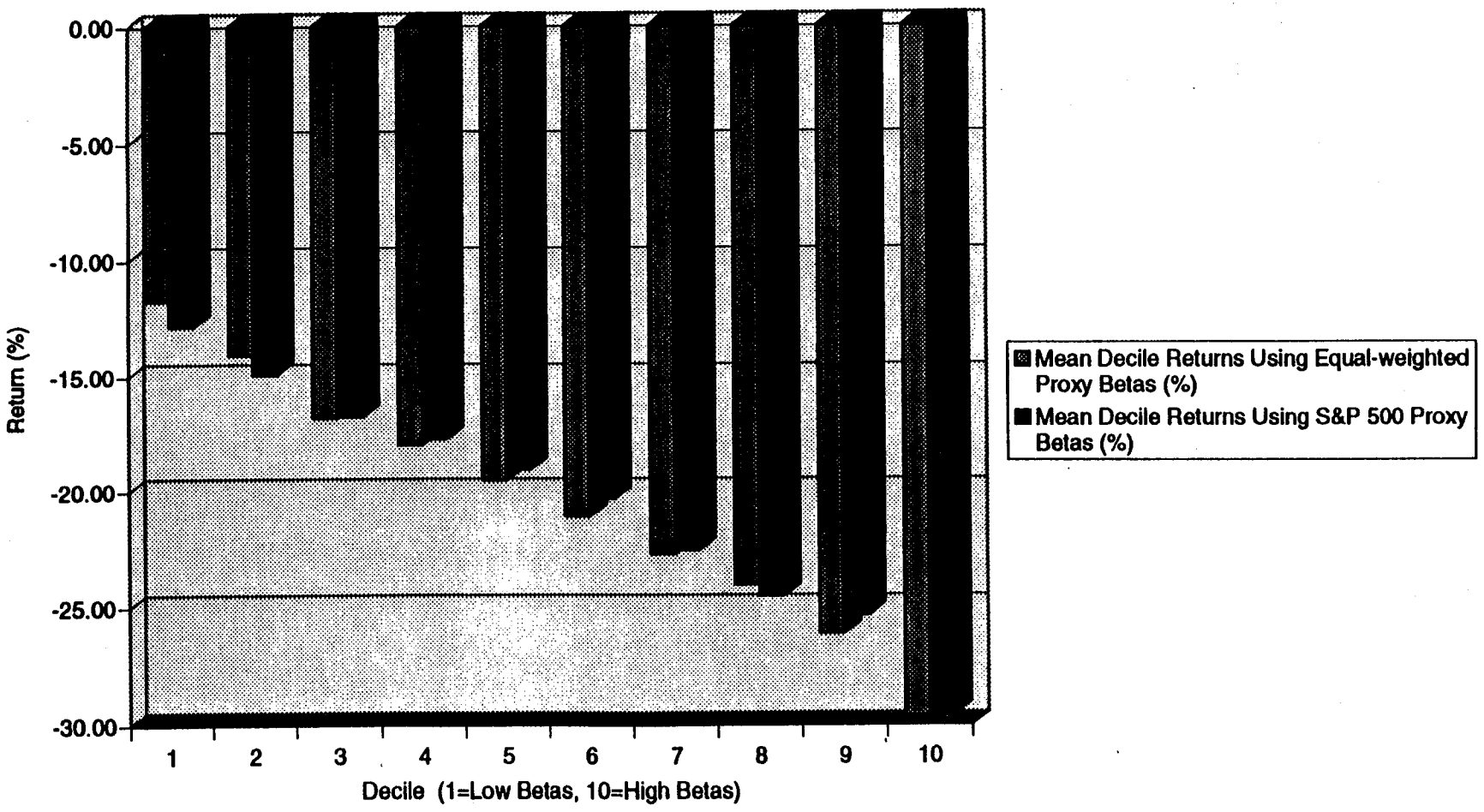
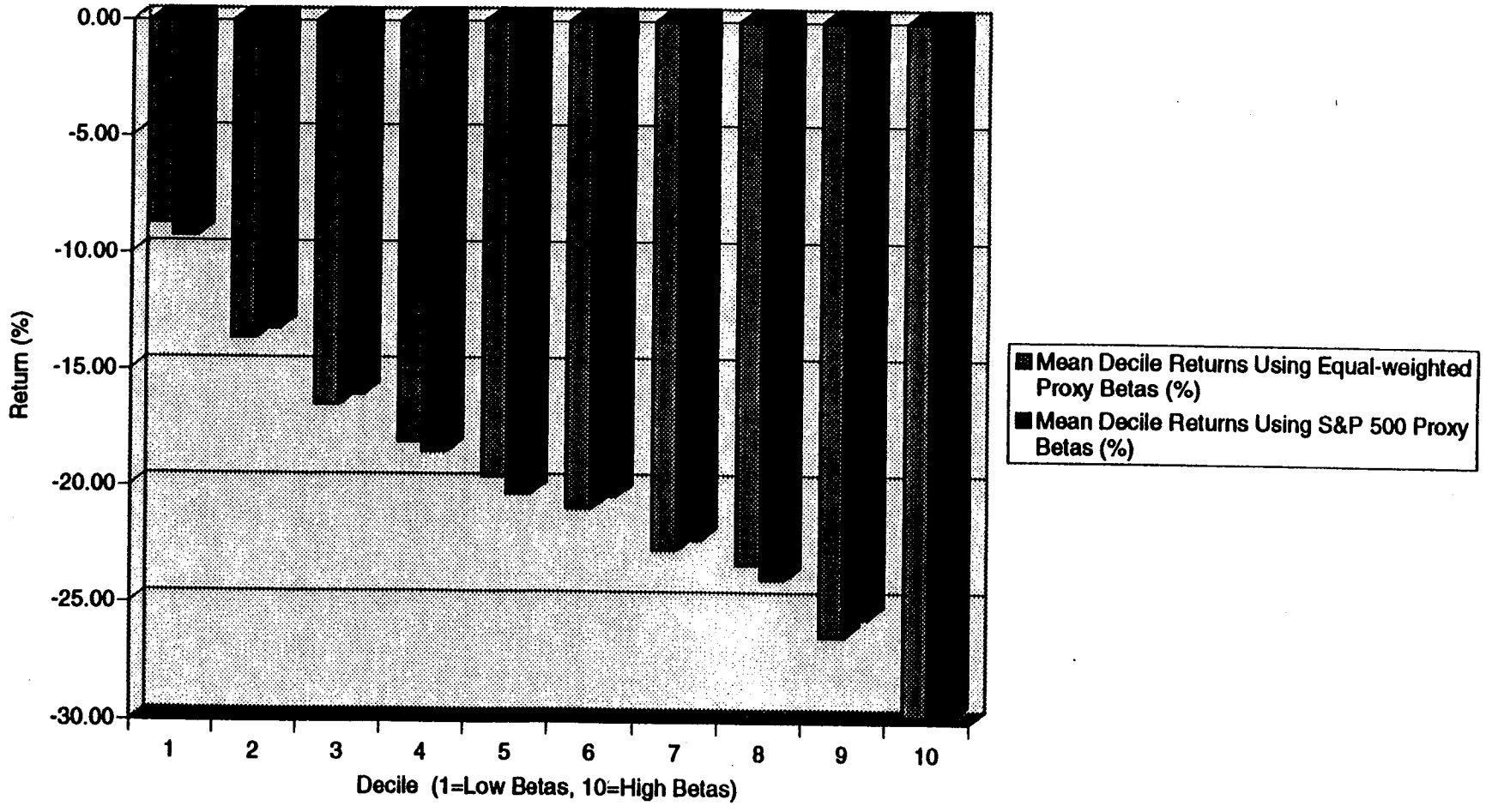


Figure 4 - Mean Decile Returns during Declining Market Periods (1968-1992): Deciles Formed Using 60-Month Preceding Betas.



ENDNOTES

1.David Dreman, "Bye-bye to Beta," (1992); and Richard C. Grinold, "Is Beta Dead Again?" (1993).

2.Dreman, *Op. cit.*, 148.

3.Fischer Black, "Beta and Return," (1993).

4.*Ibid.*, 17.

5.Note that in all periods except one an equal-weighted market index also declined by 10 percent or more.

6.This procedure obviously imparts some survivorship bias to our results. We believe, however, that it strengthens our results since high-risk stocks are likely to generate even lower returns than we have estimated during periods of declining markets.

7.Non-parametric tests of the data reveal a high and statistically significant degree of correlation between *ex ante* beta and *ex post* return in declining markets. Both Spearman's rank correlation coefficients and Kendall's tau correlation coefficients for *ex ante* beta and declining market return are highly significant.

8.A somewhat similar study was done by Chan and Lakonishok. They examined the 10 largest down market months since 1932. They found that higher-beta stocks consistently declined more than low-beta stocks in each of the periods covered. See Louis U.C. Chan and Josef Lakonishok (1993), 51-62. Our study shows that such results hold consistently in each individual declining market during a recent 25-year period.

Chan and Lakonishok also found that high-beta stocks rose significantly more than low-beta stocks in bull markets. What Fama and French have found, however, is that these effects have been roughly offsetting producing a generally flat long-term relationship.

9.Another way to look at our results is to conclude that we have simply tested for the stationarity of our beta portfolios. If betas for portfolios are reasonably constant over time then, by definition, high-beta stocks will tend to fall further in future bear markets.

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