Reports of Beta's Death Have Been Greatly Exaggerated

Beta remains a quite serviceable measure of downside risk.

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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 Treynor [1965].

The CAPM attempts 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 the CAPM is 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 from expected. 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 unfavor-

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able surprises and, thus, should be a serviceable measure of risk.

THE CAPITAL ASSET PRICING MODEL

Before the CAPM, risk was typically estimated by measuring the variability of the past returns for each individual security. Securities with a low variance of past returns were considered quite safe, while those whose past returns display large dispersion were deemed risky. The critical insight of the CAPM is 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%, a relatively stable stock, such as AT&T, might drop by only 5%. A less stable stock, on the other hand, such as Digital Equipment, might decline by 20%.

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 & Poor's 500 stock index) is accorded a beta of 1. 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 the CAPM is that only one of these risk factors is relevant for the pricing of individual issues. The CAPM argues 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 is 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 have a negative effect on the stock of another company that once had the most effective drug. 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, cannot be reduced by diversification. Indeed, even if an investor is perfectly diversified by holding all the individual stocks in the market, her portfolio would still be risky in the sense that it is subject to the ups and downs of the market as a whole. Thus, only systematic, or non-diversifiable 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. Exhibit 1 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.

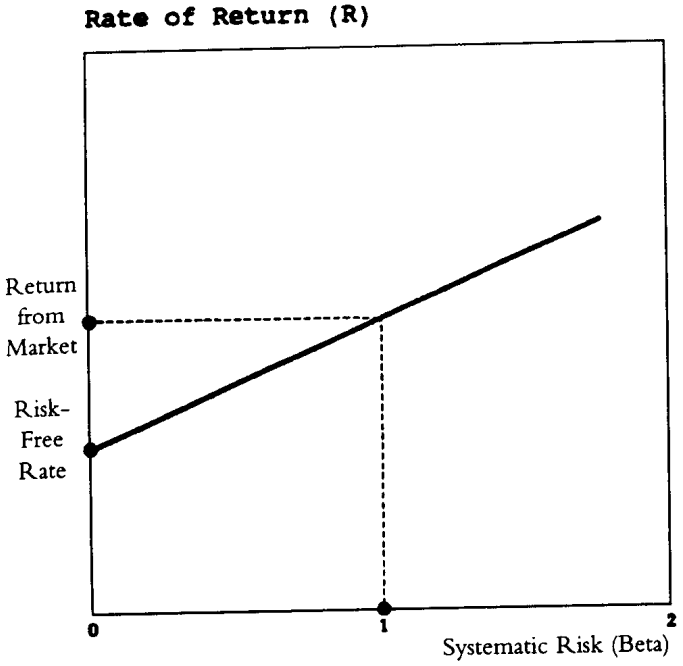
TESTS OF THE CAPM

At first, 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 are, 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 turns 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 the CAPM. Low-risk stocks appeared to earn higher rates of return and high-risk stocks lower rates of return than the theory predicted.

Other troubling aspects of the model came to light. Roll [1977] points out that it is impossible to observe the market's return, because the market includes *all* stocks, a variety of other financial instruments, and even non-marketable assets, such as an individual's investment in education. The S&P 500 index (or any other index used to represent the market) is an imperfect market proxy at best. Roll shows that by changing the market index against which betas are measured, one

EXHIBIT 1
RISK AND RETURN ACCORDING TO THE CAPITAL ASSET PRICING MODEL:

$$R = R_F + \beta(R_M - R_F)$$



The equation can also 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: $R - R_F = \beta(R_M - R_F)$.

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 the CAPM, however, came with publication of a study by Eugene Fama and Kenneth French [1992], which seemed to shatter any support for beta in the academic and professional community. Their empirical evidence is clear; beta and long-run average return are simply not correlated, as is shown in Exhibit 2. Beta appears to be of no use to investors.

With release of the Fama and French study, investment professionals almost universally condemned beta. Articles with titles such as "Bye-Bye to Beta" (Dreman [1992]) and "Is Beta Dead Again?" (Grinold [1993]) are representative. A comment typical 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."[1]

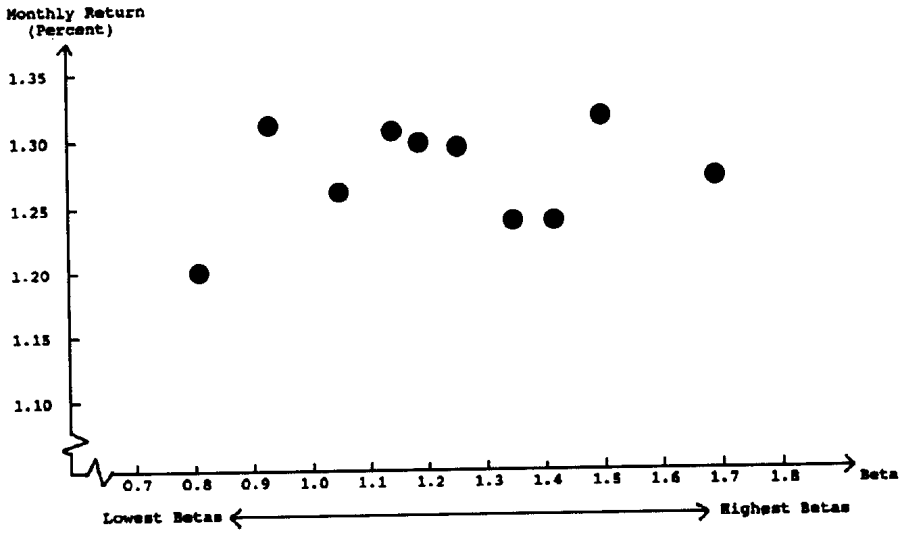
SHOULD WE CONSIGN BETA TO THE SCRAP HEAP?

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

In an article in this Journal, Fischer Black [1993] proposes 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. Indeed, Black argues 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

EXHIBIT 2
AVERAGE MONTHLY RETURN VERSUS BETA — 1963-1990



Source: Fama and French [1992].

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, 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 [1993, p. 17].

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 twenty-five-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 twenty-four months to sixty months, seems to matter little to the ultimate conclusion.

The first step in the study involves determination of appropriate declining market periods for examination. In an effort to replicate the Fama and French techniques, we focus the study on the years 1968 to 1992. This similar time frame will enable us to say that, although Fama and French find no overall beta and return relationship over the period, there *is* a clear relationship if we focus simply on declining markets during this period.

Unlike previous CAPM analyses, which limit their focus to defined periods of time (months or years usually), we allow for flexibility in the duration of declining markets. Declining market periods (bear markets) are determined by a graphical observation of weekly market returns for the S&P 500.

We select two value-weighted indexes of market activity, the S&P 500 and a value-weighted market index, and define a declining market as one where both indexes fall at least 10% from peak to trough. This definition focuses the study on periods when there are losses in the broader market as well as in the larger issues heavily weighted in the S&P 500.

The definition gives us thirteen periods between 1968 and 1992 that qualify as declining or bear markets. Exhibit 3 summarizes these market periods. Note that in all periods except one an equal-weighted market

EXHIBIT 3
Percentage Returns on Indexes 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

index also declined by 10% or more.

To test whether beta is a serviceable measure of risk in declining markets, we use every stock listed on the New York Stock Exchange and the American Stock Exchange during these declining market periods as available on the monthly Center for Research in Security Prices (CRSP) security price tapes. For each stock, we calculate four different measures of beta to determine if a specific measurement technique affects the ultimate outcome.

We use 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 regress 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 is used as a proxy for the risk-free rate.

Four measures of beta are calculated using different market proxies and lengths of time for the regressions. Two of the betas are 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 are calculated using a sixty-month window preceding the declining market and a shorter twenty-four-month window.

From these initial calculations, each individual stock is 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 rank the securities according to their preceding betas and form portfolio deciles, the lowest-beta stocks falling in the first decile, and the highest-beta stocks falling in the tenth decile. Portfolio betas are 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 is used to form the portfolios.

DECLINING MARKET RETURNS AND BETA

Using the CRSP tapes, we calculate period returns for securities listed during the declining-market periods. The returns include dividends and are compounded daily. Stocks not listed for the entire declining-market period were dropped.[2] These period returns are then matched with their corresponding securities in the portfolio deciles. Portfolio returns are 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 are determined by grouping all first deciles from each of the thirteen periods together and then recalculating a mean decile beta and mean decile return. The process is repeated for subsequent deciles. In the end, there are four pairs of portfolio betas and returns corresponding to the four calculation groups for each decile. Exhibit 4 summarizes

EXHIBIT 4
Summary of Aggregate Results for Thirteen Declining Market Periods (1968-1992)

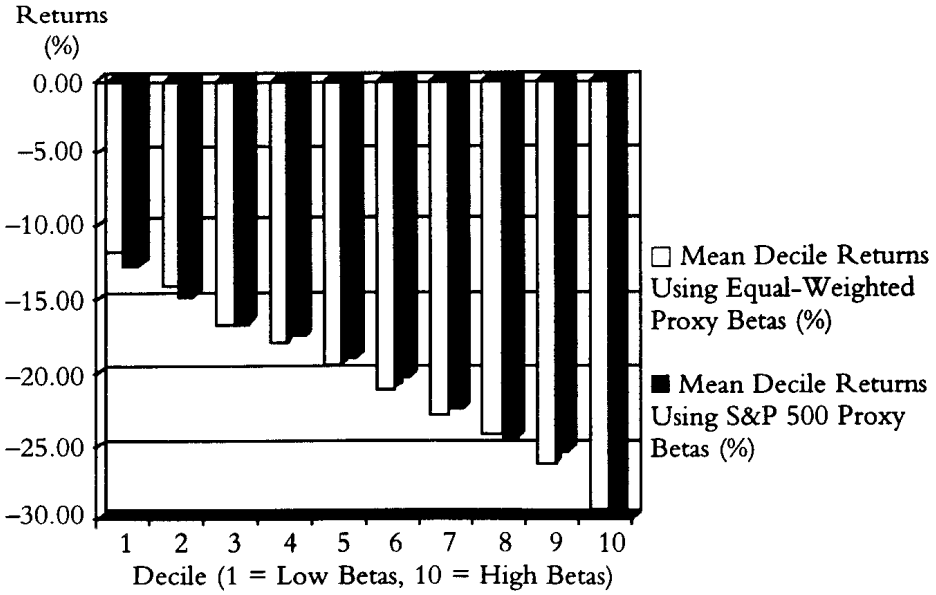
24-Month-Preceding Betas	Deciles									
Mean Decile Betas with Equal-Weighted Market Proxy	0.18	0.46	0.63	0.76	0.89	1.02	1.15	1.31	1.53	2.02
Mean Decile Betas with S&P 500 Market Proxy	0.14	0.48	0.67	0.83	0.98	1.12	1.29	1.47	1.73	2.27
Mean Decile Returns Using Equal-Weighted Proxy Betas (%)	−11.70	−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

these aggregate results.

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 indexes drop at least 10%. The result holds regardless of the market proxy or the length of time used to calculate the betas.

Exhibits 5 and 6 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.[3] As one increases the portfolio beta from the lowest deciles, the portfolios perform progressively worse in declining markets, regardless of the market proxy used.[4]

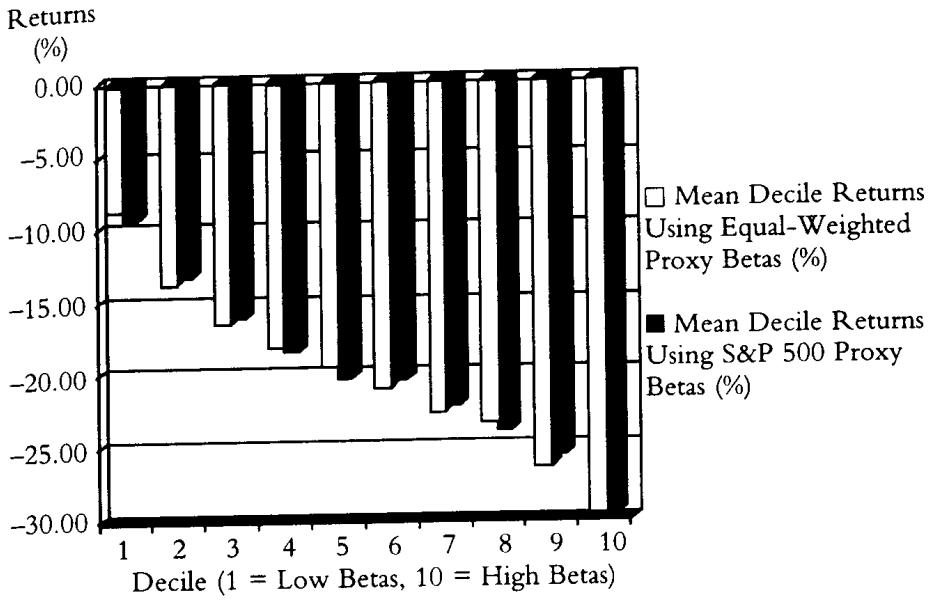
EXHIBIT 5
MEAN DECILE RETURNS DURING DECLINING-MARKET PERIODS (1968-1992): DECILES FORMED USING 24-MONTH-PRECEDING BETAS



INDIVIDUAL PERIOD RESULTS

As striking as the aggregate results are, it is also important to break down the analysis

EXHIBIT 6
MEAN DECILE RETURNS DURING DECLINING-MARKET PERIODS (1968-1992): DECILES FORMED USING 60-MONTH-PRECEDING BETAS



by period. If investors plan to use beta as their risk measure in choosing a portfolio, they will be concerned with not only the aggregate performance of beta in forecasting downside exposure but also its consistency in each market period. Analyzing data for each of the thirteen 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, our data suggest that the short-run relationship between return and beta in declining markets following 1980 did not significantly weaken.[5]

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 the portfolio. The empirical study presented here indicates that beta, however measured, remains a useful tool in forecasting short-term risk in declining markets.

ENDNOTES

[1]Cited in Dreman [1992, p. 148].

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

[3]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.

[4]Chan and Lakonishok [1993] perform a somewhat similar study. In an examination of the ten largest down-market months since 1932, they find that higher-beta stocks consistently declined more than low-beta stocks in each of the periods covered. Our study shows that such results hold consistently in each individual declining market during a recent twenty-five-year period.

Chan and Lakonishok also find 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.

[5]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 farther in future bear markets.

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