Bayes' Revenge?
A Review of Equal-Weighting
As an Active Management Strategy

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Overview

- **Dueling Paradigms**
- **Empirical Results**
- **Recommendations**

Notes to "Duelling Paradigms"

Many active managers are currently underperforming their market-weighted benchmarks. Some attribute this to their equal-weighting discipline, and argue that an equal-weighted benchmark would be a better indicator of their skills. It is true that the equal-weighted S&P 500 has underperformed the market-weighted S&P 500 materially over the past several years.

Three questions follow from this:

Why would anyone equal-weight portfolios in the first place? I'll address this by talking about the theoretical basis for equal-weighting.

What has been the historic performance of equal-weighted benchmarks vs. market-weighted benchmarks? I have some preliminary data on this.

What should we do about it?

Observations

- **Most Managers Equal-Weight Portfolios**
  - MW inappropriate measurement of skill
- **Most Benchmarks are Market Weighted**
  - EW inappropriate measure of benchmark performance
- **Persistent Performance Differences**
  - Marketing opportunity for both MW and EW
  - Suggests an optimal mix can be identified

Notes on "Observations"

We generally ask benchmarks to do three things.

First, we expect them to measure skill - as we've already noted, they may or may not do this well. If the manager is equal-weighted, then an equal-weighted benchmark may provide a more "apples-to-apples" comparison. An EW benchmark gives you a good indication of the performance of the average stock in the benchmark.

Second, we expect them to represent the aggregate performance all investors in a particular group of stocks. Market-weighted benchmarks do this exceedingly well.

Third, some people believe that a MW portfolio represents an optimal or near-optimal portfolio, the optimal tradeoff of risk vs. reward. We will test this proposition later. If we find that the MW benchmark is *not* optimal, then we would want to consider the possibility that there are gains available from diversifying between MW and EW benchmarks.

But before we plunge into the data, I'd like to say a few words about the theoretical reasons for market-weighting and equal-weighting.

Theory: Market Weights

- **Pros:**
  - CAPM Theoretical Justification
  - Tax-Efficient
  - Low Transaction Costs
  - Takes Account of Pricing Information
- **Cons:**
  - Dominated by 25-30 Names
  - Depends on Definition of "Market"

Notes on "Theory: Market Weights"

You are all familiar with the CAPM/MPT rationale for market-weighting.

But even without the endorsement of an overarching financial theory, it looks like a good idea. Tax efficiency and low-cost are desirable characteristics in any portfolio.

My slide overstates the case for concentration in MW portfolios: as of last Friday, the 50 largest names in the S&P 500 accounted for about 30% of its market capitalization.

Note that the shortcut of calling the S&P 500 "the market" does not meet all of the assumptions of the underlying theory. MPT's specification of the Market Portfolio includes *all* tradable assets, including bonds, antiques, coins, stamps, etc.

Theory: Equal Weights

- **Pros:**
  - Might Exploit Regression to the Mean
  - Diversification - 500 names, not 30
  - Assumes no Prior Knowledge

- **Cons:**
  - Less Tax-Efficient: Sell Winners, Buy Losers
  - Rebalancing Increases Transaction Costs

# Notes on "Theory: Equal-Weights"

The theory behind equal-weighting is less well-developed, but I hope I can give you some rational reasons for the practice.

Since equal-weighted portfolios are rebalanced at regular intervals, they should be able to capture value-based market anomalies such as those reported by Fama & French and Dreman.

With 500 names contributing equally to the portfolio, a naive observer might expect greater diversification than one would get with a MW portfolio.

A naive observer would also not wish to make assumptions about the distribution of returns, which would argue for equal weights. Market-weighting carries with it the implicit assumption that stocks with greater market capitalizations will have superior risk-adjusted returns. The next slide illustrates this.

Implicit Assumptions About Returns
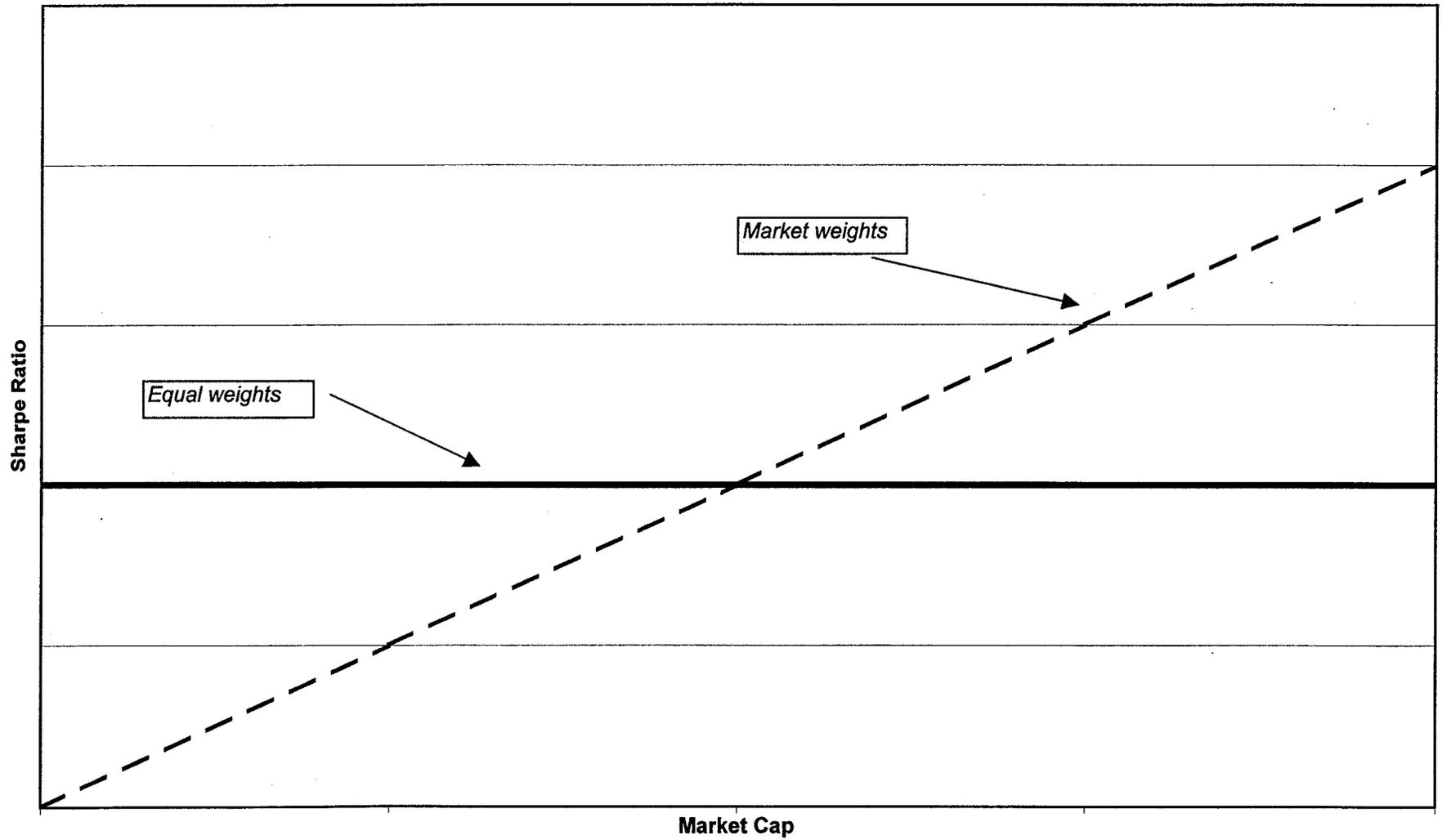
Notes on "Implicit Assumptions"

From an absolute returns viewpoint, when we choose to market-weight, we do so because we believe that companies with the highest market capitalizations will have the best risk-adjusted returns. When we equal-weight, we make no assumption about the relationship between market capitalization and return.

Imagine you travel back in time and meet Bayes (or perhaps Laplace, who did much of the work we now call "Bayesian").

You say: "I have a list of stocks here, and I am trying to decide how to weight them. I come from a marvelous time in the future, and we have developed a financial theory that tells us we should market-weight our portfolios."

He says: "Oh? Have you developed a method for accurately predicting the return distribution of stocks?"

You say: "Well, no, not really."

He says: "But at least you have significant empirical evidence that larger-capitalization stocks outperform others?"

You say, "Not exactly. Actually, the empirical evidence probably points the other way..."

And I think he would say, "Then I don't understand why you market-weight." Absent significant prior knowledge about the likely distribution of returns, he would probably suggest equal weighting.

The Manager's Perspective

- Managers must assume that they can consistently generate alphas.

- Most managers cannot tell beforehand which ideas will work.

- Therefore...

  - Absolute Returns: Equal Weights
  - Relative Returns: Equal Factor Bets

Notes on "The Manager's Perspective"

Now think of the position of the active manager.

The manager believes she has skill, otherwise why would she be a manager?

For most fundamental managers, skill manifests itself in the form of ideas. The manager reads a lot and analyzes financial statements and develops ideas about why this stock or that stock might be mispriced. At any given time, the manager has a list of ideas she wants to invest in. How should she weight the portfolio?

I talked with several money managers before giving this talk, and they were unanimous in the judgment that they did not know beforehand which ideas would work and which would not. Moreover, they rejected the notion that there was some strong relationship between market capitalization and the likelihood that their ideas would work.

This suggests to me that the most rational course for active managers is to use equal weights.

On the slide I have put down that those interested in relative performance should equal weight vs. a benchmark, but I assume that sophisticated institutional investors would prefer to invest their indexed funds directly in indexes, not with an active manager. The active manager's value-added comes from her ideas, not from her ability to buy an index.

So that brings us back to strict equal-weighting and a focus on absolute performance.

Quantifying Confidence

- **Coca-Cola Idea:**
    - Hit rate for S&P 500: 50%
    - Warren Buffett owns it: 65%
    - My research dept. doesn't like it: 45%

Notes on "Quantifying Confidence"

I am not saying that equal-weighting is the optimal policy, however. I believe we could do better if we could develop some way of quantifying our level of conviction.

Here is an example of how conviction-weighting might work: Suppose we have two indicators of the relative performance of a stock: If Warren Buffett owns it, we think there is a 65% probability it will outperform over our investment horizon. If our Research Department likes it, we think there is a 55% probability it will outperform - on my slide I show the dept. hating it, so I assign a 45% probability of outperformance.

As a third indicator, we might assume that 50% of the stocks in the S&P 500 will outperform the MW benchmark, although I have seen this number vary between ca. 35% and ca. 60% for certain time periods in the 90s.

We could then use Bayes' theorem to develop a blended level estimate of the likelihood of outperformance using these multiple indicators.

Portfolio Construction

| Stock	Likelihood
Merck	73%
Kellogg	67
Schlumberger	54
Coca-Cola	39
Nucor	18
Warner-Lambert	13

Notes on "Portfolio Construction"

Here you can see a [fictional] ranking I have made up. We could use such a ranking to weight our ideas according to our level of conviction, and might consider excluding entirely those that fall below 50% probability of outperformance.

I don't know of managers who currently do this, but the implementation does not appear mathematically difficult.

The real challenge, of course, would be to find a reliable way of quantifying conviction - until that develops, I believe that equal-weighting makes sense.

So, that's all I have from a theoretical perspective. Now, let's look at some data.

S&P 500 Total Return:
Market-Weight vs. Equal-Weight
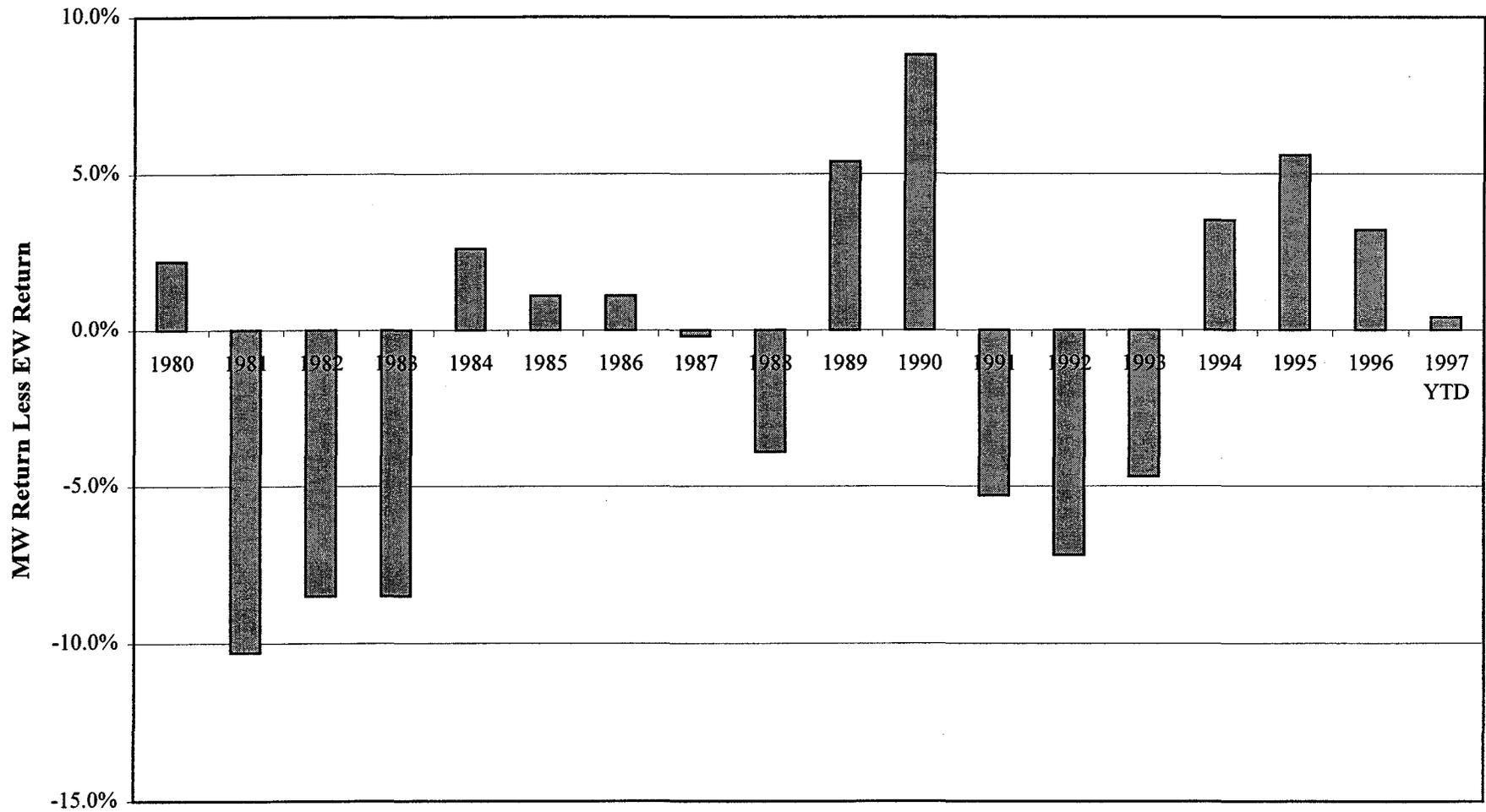
Notes on "S&P Total Return"

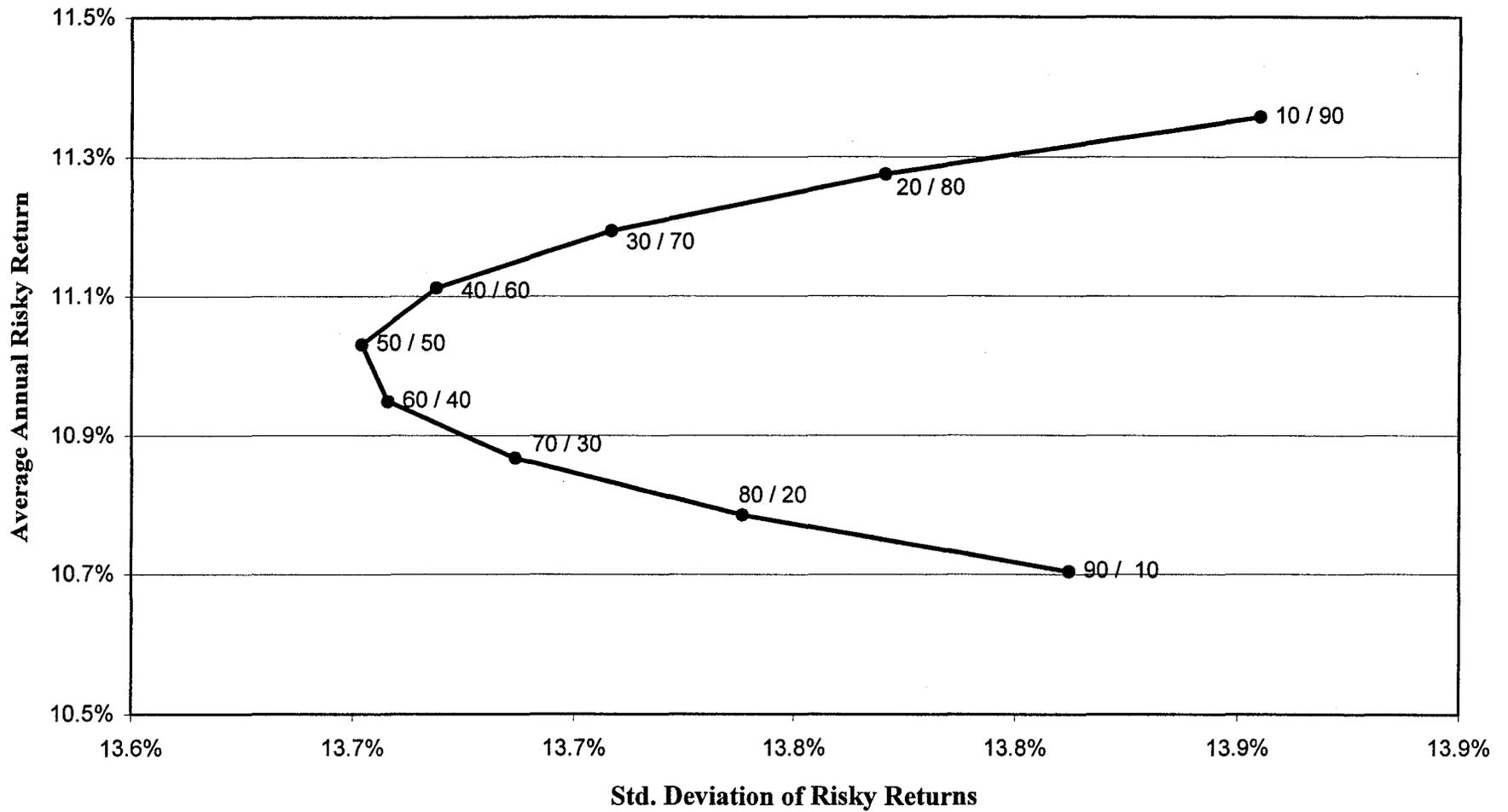This plots the S&P 500's MW return minus its EW return since 1980.

There are two things to notice here:

First, the two series are *very* different - early in the series you can see that the EW index outperformed by more than 1,000 basis points in one year. At other times (such as the past three years), it underperformed the MW index materially. This suggests to me that there ought to be some gains to diversification

Second, there appears to be some regularity to the pattern - good years seem to be autocorrelated to some degree. I have no idea what to make of this - my guess is that we would want to look back much further before getting excited about it.

MW/EW S&P Combinations
1980 - 1997 (Q3)

Chart plotting Average Annual Risky Return (y-axis, 10.5% to 11.5%) against Std. Deviation of Risky Returns (x-axis, 13.6% to 13.9%), showing a backward-bending curve with data points labeled: 10 / 90, 20 / 80, 30 / 70, 40 / 60, 50 / 50, 60 / 40, 70 / 30, 80 / 20, 90 / 10.
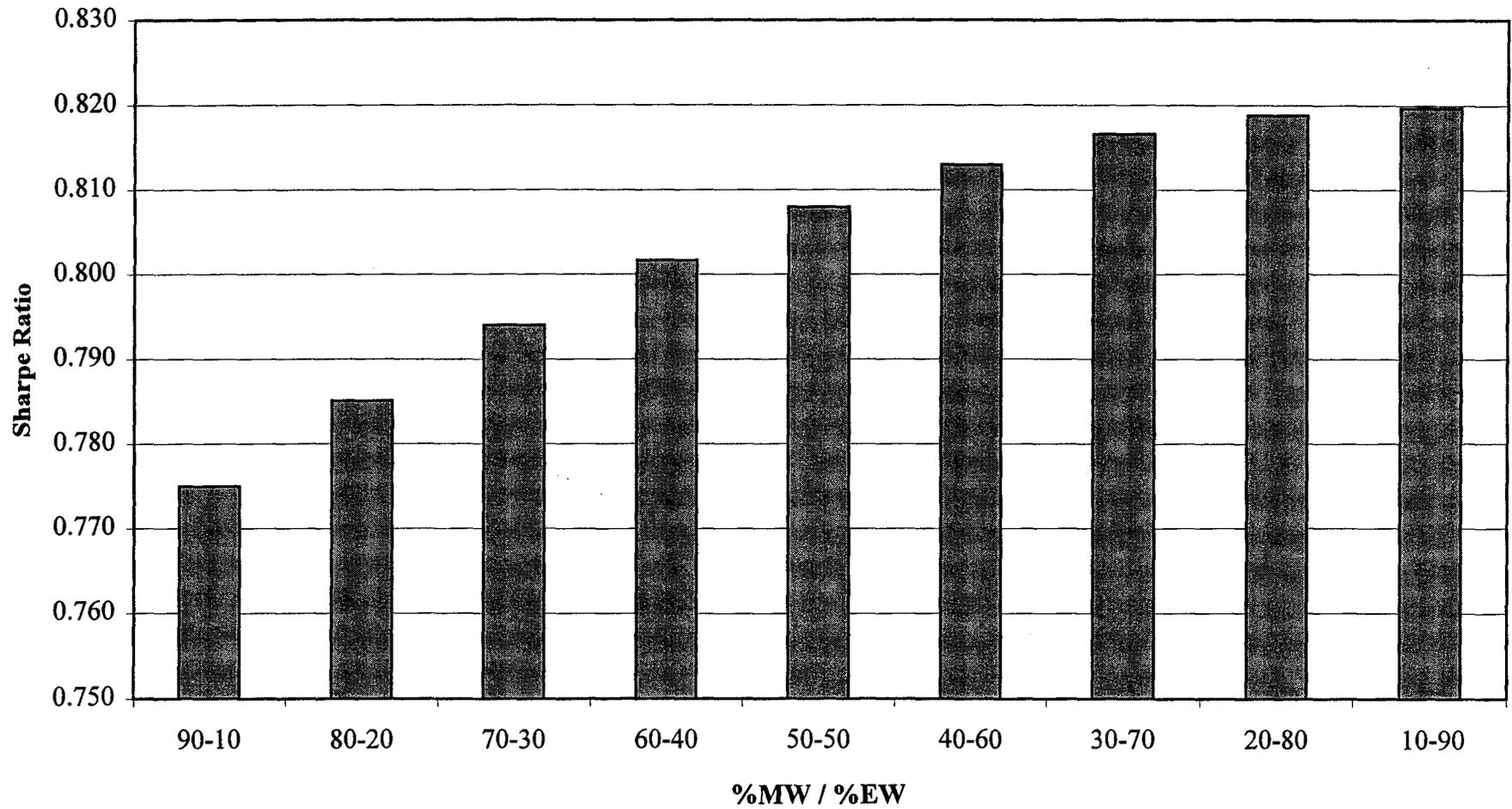
Notes to "MW/EW S&P Combinations"

It turns out that there *are* gains from diversification, at least retrospectively. This efficient frontier shows that, for any given level of risk, you were better off owning at least 50% of the EW S&P 500 than the MW S&P 500 alone.

The EW S&P 500 numbers I used did not include transaction costs, but even if you include 50 bp per year in transaction costs, this relationship still holds.

The 100% MW S&P 500 was the *least* efficient of the portfolios tested.

MW/EW S&P Combinations
1980 - 1997 (Q3)

Bar chart showing Sharpe Ratio (y-axis, 0.750 to 0.830) versus %MW / %EW (x-axis):

%MW / %EW	Sharpe Ratio
90-10	0.775
80-20	0.785
70-30	0.794
60-40	0.802
50-50	0.808
40-60	0.813
30-70	0.817
20-80	0.819
10-90	0.820

Notes to "MW/EW S&P Combinations" (Sharpe Ratios)

It turns out that the optimal portfolio is the 100% EW S&P 500.

MW/EW S&P Combinations
1980 - 1997 (Q3)
Assuming 50 bp Annual Trans. Costs
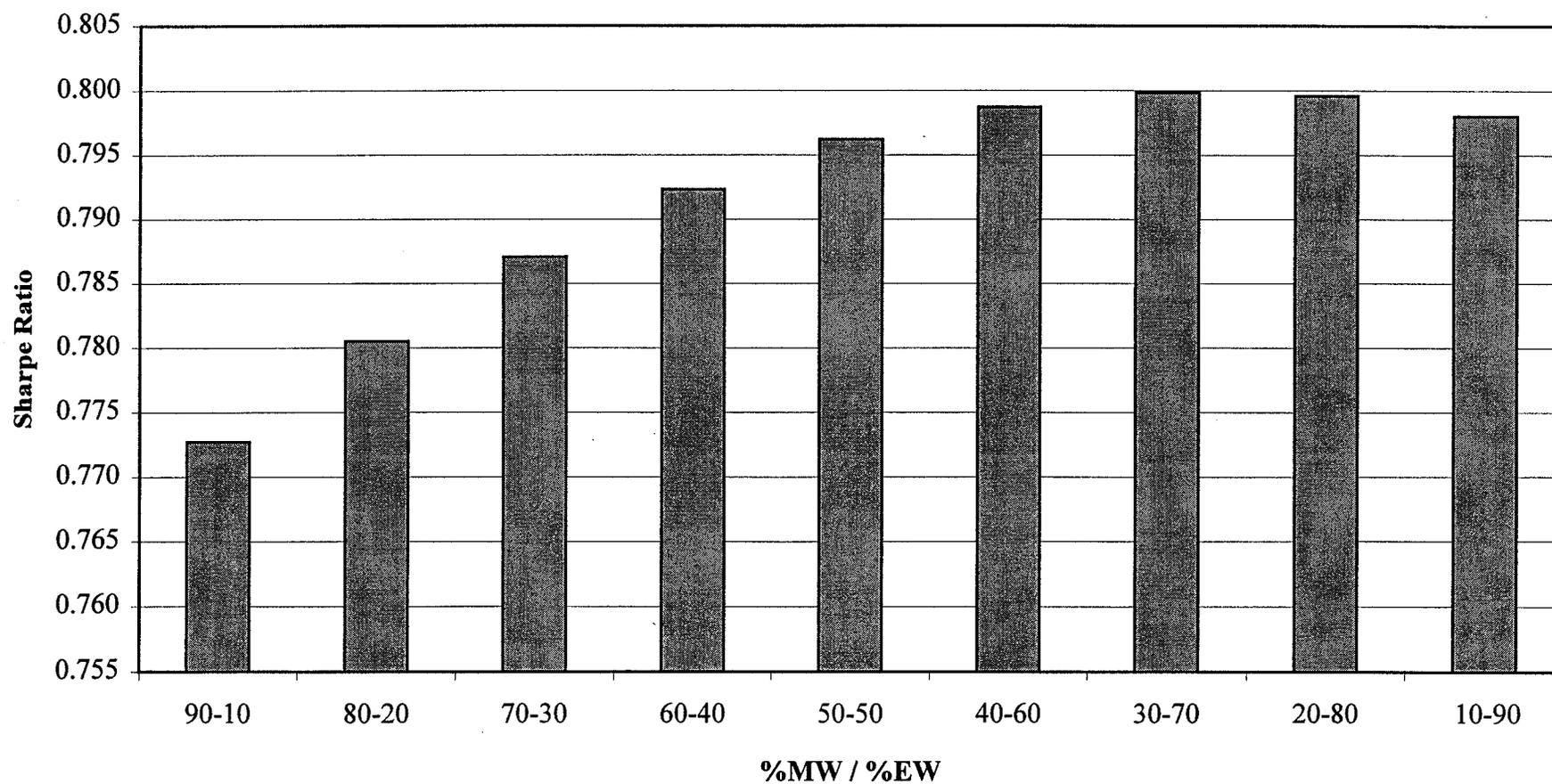
Notes to "MW/EW S&P Combinations" (Sharpe Ratios), with transaction costs

After adjusting for transaction costs (50 bp) per year, the optimal combination appears to be 30% MW and 70% EW.

Possible Explanations

- **Small Cap Effect**
  - Russell 50
- **Regression Effects**
  - Fama & French
  - Dreman
- **Mispricing Based on Capitalization**
  - Premium for Liquidity?
  - Neglected stock effect?

Notes to "Possible Explanations"

My first assumption was that these performance disparities were caused by the size effect. But I repeated the analysis using the Russell 50, and got the same answer. So I don't think it's that simple.

My best guess is that equal weighting the index captures regression effects such as those described by Dreman and Fama & French. Equal weights force you to buy low and sell high.

The other notions on the slide are just speculation.

Empirical Results: Summary

- Market Portfolio was not Optimal
- Equal Weights Did Not Reduce Risk
- Equal Weights Led to Higher Returns
  - Nominal
  - Risk-Adjusted

Notes to "Empirical Results: Summary"

Interestingly, neither theoretical argument held up as originally expressed: the MW portfolio was not optimal, but the EW portfolio did not have lower risk. The EW portfolio outperformed because of its strength on the return side.

Recommendations

- **Use Blended Equity Benchmarks**
- **If Concerned with Aggregate Sharpe Ratio**
  - Reduce Sharpe-inspired use of MW benchmarks
  - Mix MW and EW Portfolios
  - Equal-weight bets
- **Concerned with Absolute Returns**
  - Find managers with skill
  - Tell them to equal-weight portfolios

Notes to "Recommendations"

Neither theory seems to be working very well. If history is any guide, you will want to own some combination of EW and MW portfolios, probably with a tilt toward EW.

William Sharpe introduced a new ratio in Vanguard's client newsletter, which he calls the Selection Sharpe ratio - this ratio punishes deviation from a selected benchmark. Ironically, if you want to improve your Sharpe ratio, you may have to accept a lower Selection Sharpe ratio, because the optimal portfolio is unlikely to be market-weighted, and will therefore deviate materially from the MW benchmark.

If your chief concern is with absolute performance, my best recommendation is that you find an active manager in whom you have confidence and ask them to equal-weight their holdings.