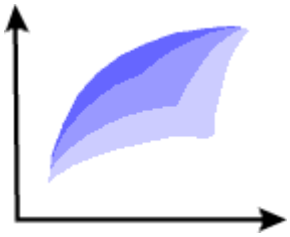
Efficient Frontier



An Online Journal of Practical Asset Allocation

Edited by William J. Bernstein

January 1999

Table of Contents

- The Best Market Indicator Ever
- The Gospel According to Ibbotson
- The Lake Wobegon Market Theory
- Momentum—Another Look
- The Coward's Portfolios
- What's Cheap
- Investment Whimsy — Doctor RTM and the Evil Robot CRAAL by Paul Harvey
- Link of the Month—***Journal of Finance*** Online

---

copyright (c) 1999, William J. Bernstein

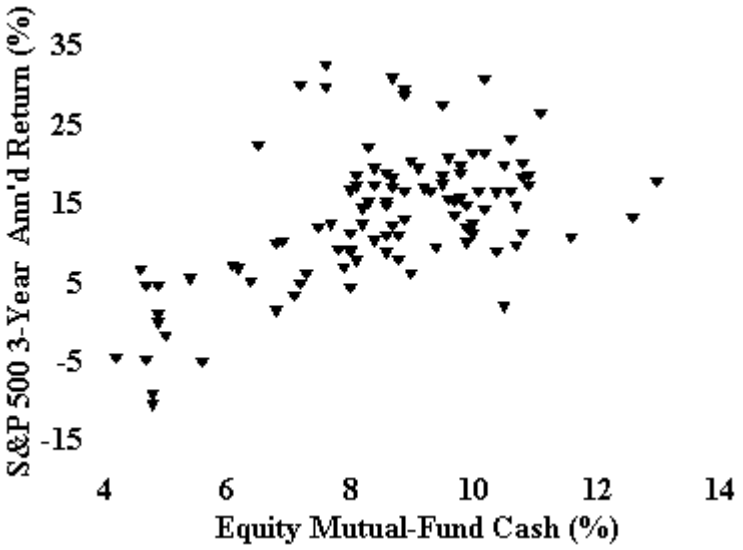
Efficient Frontier

William J. Bernstein

The Best Market Indicator Ever

I have a confession to make. I'm addicted to market indicators. Sentiment, valuation, insider behavior, even the odd moving average. Mind you, I take them all with a barrel of salt, but I can't resist the things.

My all-time favorite is equity mutual-fund cash. Over the past decade, I've been impressed with the coincidence of high fund cash with market bottoms, so when I came across a tabulation of this indicator back to 1970 on the Investment Company Institute site, I just couldn't resist. The data are striking—record low cash levels just before the 1973-74 debacle, and record high levels right at the bottoms in 1984, 1987, and late 1990. I greedily downloaded, pasted, and correlated, and hey, presto, came up with the following plot of fund cash versus forward 3-year annualized returns:



There's a pretty impressive upward slope to the data cloud, and in fact the correlation coefficient of the quarterly data points is 0.56. In other words, you can explain 31 percent (0.56 squared) of future returns with this indicator. For those of you unfamiliar with returns data, that's about as good as it gets short of a microphone in Alan Greenspan's living room. I'm not aware of any indicator that comes even close during the past three decades. The traditional valuation parameters—price-to-book, P/E, and dividend

yield—which have done so well since 1900, have fallen flat on their faces since 1994. And contrary to what you've heard, bullish or bearish sentiment among investors and newsletter writers is useless for predicting future returns.

Surely, had you had the foresight to tailor your equity exposure according to fund cash level, you'd have beaten the market or at least lessened your risk level by avoiding the rough patches…

So, I began formulating simple trading rules. The first is, an all-or-none policy of 100 percent S&P 500 above a given cash level or 100 percent Treasury bills below it, adjusted on a quarterly basis. In other words, if the filter was set at 6 percent, then 100 percent S&P 500 was held for the quarter when fund cash was above that level, and 100 percent Treasury bills were held when fund cash was below that level. Here are the results for the 28-year period from January 1970 to September 1998:

Fund Cash "Filter" (percent)	Annualized Return 1970-98	Standard Deviation 1970-98	Sharpe Ratio	% Periods Holding Stock
0 to 4	12.77	16.19	.370	100
5	12.93	15.94	.385	89.6
6	11.73	15.53	.319	83.5
7	11.33	14.86	.306	73.9
8	11.44	13.57	.343	59.1
8.5	12.03	13.30	.395	48.0
9	10.22	11.81	.292	37.8
10	7.89	8.24	.135	17.4
11	7.01	2.24	.103	2.6
12	7.19	2.05	.200	1.7

For starters, the first row simply shows that since the lowest cash position was 4.1 percent (April 1972), setting the filter below that value resulted in a 100-percent stock portfolio for the entire period, with a return of 12.77 percent, a standard deviation of 16.19 percent, and a Sharpe ratio of .370. The key number here is the Sharpe ratio (calculated as [return-T bill return]/SD, where the T-bill return for the period was 6.78 percent) This measures risk-adjusted return.

Notice that the only filters which result in superior risk-adjusted return are discrete values of 5 percent (Sharpe ratio of 0.385) and 8.5 percent (Sharpe ratio of 0.395). And, neither Sharpe ratio is much higher than the 100 percent S&P 500 buy-and-hold one. In fact, lowering or raising the filter

slightly, say to 8.4 or 8.6 percent, results in Sharpe ratios significantly less than the buy-and-hold value. Such are the vagaries of a system which requires switching back and forth between 100 percent cash and 100 percent equity—something which only newsletter writers and a few of their more gullible readers seem willing to do.

OK, you say, suppose we consider a more reasonable system—one in which we start with a "policy" equity exposure which we modify in "scaled" fashion according to cash level. Let's start with a "policy" mix of 60 percent stock and 40 percent T-bills. This results in a return of 10.73 percent for the 1970-98 period with a standard deviation of 9.68 percent and a Sharpe ratio of .408.

Now let's suppose an algorithm was established which allowed one to raise or lower the equity exposure according to a cash level "thermostat," above or below which equity was lowered or raised, and a "multiplier," which was used to calculate how sensitive the change in exposure was to be to such cash level changes.

For example, assume the "thermostat" was set at 8 percent fund cash and the "multiplier" was set at a value of 10. In a quarter when fund cash was actually 5 percent, then equity exposure was lowered by (8-5)*10, or 30 percent. If the fund cash level for the quarter was 9.5 percent, then equity exposure was raised by (9.5-8)*10, or 15 percent.

I found that in all cases in which the multiplier was positive, Sharpe ratios were lowered using this algorithm. In fact, the only way that the efficiency of the portfolios could be raised (and then only slightly) was with the use of small negative multipliers and a "thermostat" in the region of 1 percent—something which no rational portfolio strategist would do. (In this bizarre case one always holds less equity than "policy," since fund cash is always more than the "thermostat," and the multiplier is negative. Further, the negative multiplier means that one *increases* stock exposure when fund cash decreases! If you find this counterintuitive, you're not alone.)

If you'd like to play with this algorithm yourself, click here for the self-executing zipped Excel file and text instructions.

The Moral of the Story

The take-home lesson of this rather frustrating exercise is this: The next time you hear some guru wearing an Armani suit telling Uncle Lou about what his sure-fire indicator shows this week, remember these two things:

1. He's likely not had the courage (or worse, doesn't know how) to calculate a correlation with past returns. If he did, the correlation would probably be much less than the .56 value for equity-fund cash.

2. Even if it were as high as the fund-cash indicator, it still won't make you a risk-adjusted dime.

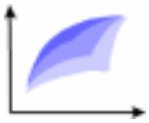
The reason why even the best predictors of future returns known to mankind do not improve portfolio efficiency is simple: Since 1926 stock prices have risen in two out of three years. For any timing system to succeed, it must therefore supply correct calls 70 percent of the time. Even the proverbial microphone in the chairman's townhouse isn't *that* good.

My head will still get turned by every pretty market indicator I see, but if I make any portfolio changes because of them, they will be small and infrequent.

Home E-Mail

copyright (c) 1999, William J. Bernstein

Efficient Frontier



William J. Bernstein

The Gospel According to Ibbotson, Part II

In the short run, the market is a voting machine. In the long run, it's a weighing machine.—Ben Graham

(Author's Note: This article is an edited and updated version of a previous piece.)

Roger Ibbotson and Rex Sinquefield are two of the great pioneers of modern finance. They spent years toiling in obscurity so that investors could obtain an accurate picture of the long-term returns and risks of various classes of stocks and bonds. They have since achieved well-deserved fame and fortune for their many accomplishments. Anyone citing financial data beginning in 1926 without mentioning their names commits petty plagiarism. But just how likely is it that the next twenty or thirty years are going to look anything like the last seventy?

For those who have just arrived from another galaxy (or spent too much time watching X-files), the "Gospel According to Ibbotson" is as follows:

1) When one invests in a very safe asset, such as T-bills, she obtains a paltry long-term return, barely greater than inflation. For 1926 through 1998 this was about 3.75 percent.

2) Investment in longer-term high-grade bonds is riskier because interest-rate fluctuations can affect principal value. For bearing this risk, one was rewarded with a premium of about 2 percent over the risk-free Treasury bill or about 5.75 percent (3.75 percent + 2 percent) for 1926-98.

3) The common stock of large US corporations is even riskier, and for bearing this risk, one was rewarded with an "equity risk premium" of 7 percent over T-bills or 10.75 percent (7 percent + 3.75 percent) for 1926-98.

4) Finally, there was a 2 percent "small-stock premium" earned for exposure to this dicey area, with a long-term return of 12.75 percent for 1926-98.

This catechism has become the conventional financial wisdom of our time. Read the business section of the ***Peoria Tattler*** for more than a few days and you quickly become aware that for the long haul, stocks beat bonds by a wide margin.

The Dividend Discount Model

Probably the most time honored method of estimating future stock returns involves the so-called "dividend discount" method. It goes something like this: Over a long enough time period, all companies go bankrupt. (Take a look at the stock page from the Civil War and you will find that almost none of the names are recognizable.) The value of a stock thus comprises the inflation-adjusted total of all of its future dividends. If you were a Rip Van Winkle investor who invested $10,000 in the stock market and then went to sleep for 200 years, all you would be left with when you woke up would be generations of reinvested dividends from a long list of mostly defunct companies. (Mind you, this would be a very large amount of money.) Estimating the value of a stock or stock market by this method is a very complicated calculation, but can be simplified as follows:

Long-term stock return = dividend yield + growth rate

The return of a long bond is even simpler to calculate: it will be very close to its coupon.

In 1929 stocks actually yielded about 4 percent, which almost exactly predicted the 9.5 percent long-term return from that date. There were, of course, a few bumps on the road to that return. In 1929 the coupon on long-term AAA corporate bonds was 4.8 percent—also almost exactly on the mark.

As we start 1999, things look a little different. The current dividend yield of the S&P 500 is about 2 percent, and the most generous estimates of economic growth are about 5 percent. This gives an expected return on common stock of only about 7 percent, which is not much greater than the 5.5 percent coupon on corporate bonds. Thus, over the next few decades, stock returns should be only slightly higher than bond returns. Simply put, the current optimism surrounding stock investing does not appear to be well founded. (In fact, earlier this year the expected returns of corporate bonds calculated in this manner briefly exceeded that of stocks.)

Market history also provides some clues concerning future return. Consider the famous 1929 ***Lady's Home Journal*** interview with financier John Raskob:

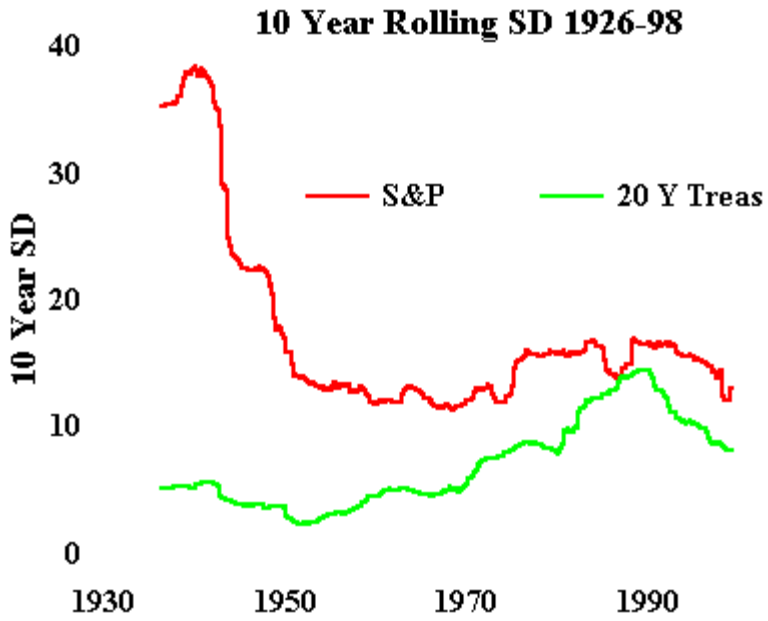
> *Suppose a man marries at the age of twenty-three and begins a regular savings of fifteen dollars a month—and almost anyone*

> *who is employed can do that if he tries. If he invests in good common stocks and allows the dividends and rights to accumulate, he will at the end of twenty years have at least eighty thousand dollars and an income from investments of around four hundred dollars a month. He will be rich. And because anyone can do that I am firm in my belief that anyone not only can be rich but ought to be rich.*

Sound familiar? At the end of the day, the primary rule of investing is this: *one is compensated mainly for shouldering perceived risk.* The operative word here is *perceived*. In 1929 stocks were perceived as not all that risky; hence 10- to 20-year returns were not all that high. Of course in 1929, the actual risk was much higher than the perceived risk. In 1933 the reverse was true—the only prudent investment at that point was high-quality bonds, and only a fool invested in stocks. The perceived risk of equity was very high. And, as we all now know, 1933 was the best time this century to buy common stocks.

What of debt? The bond debacle of the late 1970s and early 1980s was unlike anything previously experienced in the fixed-income markets since the revolutionary war. Even today's youngest investors were likely scarred by the bond market carnage of 1994. The perceived risk of bonds is historically quite high, and consequently so is their expected return. A buyer of long-term corporate debt can reasonably anticipate a 4 percent real rate of return, and if you wish the full faith and credit of the US government you are guaranteed a 3.6 percent real return with the new inflation-adjusted bonds. Both of these returns are significantly higher than the historical 2 percent real bond return. (In 1982 investors would have given their right arms for 3.5 percent above inflation, government guaranteed.)

Is it possible to measure perceived risk in an objective manner? Yes. The popular investment memory extends back 5 to 10 years. By measuring the trailing 10-year standard deviation of returns we obtain a good proxy for the investing public's perception of the given asset’s risk. I've plotted the trailing 10-year SDs for common stocks and 20-year Treasury bonds for 1926 through 1998:



What does this graph tell us? Sixty years ago the perceived risks of stocks were extraordinarily high and the perceived risks of bonds quite low. Over the past 60 years the two have almost converged. Until this year's stock market turmoil, in fact, stocks were perceived as being only marginally more risky than bonds. If the perceived risks of stocks and bonds are similar, is it reasonable to continue to expect a 5 percent equity premium?

The REIT Stuff

Real Estate Investment Trusts (REITs) are a relatively recent creation. These companies manage pools of properties and mortgages, and by law pass through 95 percent of their earnings as dividends. Consequently, their dividend yield is quite high—always in excess of 4 percent—and when they fall out of favor, as high as 8 percent. Over the long haul, REIT returns seem to be about on a par with industrial stocks.

Currently REITs yield 7 percent, and historically this yield seems to have about a 5 percent growth rate. In other words, they have the same expected growth rate as industrial companies, *but a 5 percent higher yield*. Using the dividend discount model, their expected return should thus be 5 percent higher—about 12 percent. What's going on here? Why should an asset class with roughly the same risk as the S&P 500 have a much higher expected return? To add to the mystery, the correlation of REIT returns with other asset classes is in general much lower than that of the S&P 500. For example, the correlation of monthly returns for the past 23 years for the S&P/EAFE pair is .47, while for REIT/EAFE it is .37. According to classical theory, an asset with a lower correlation with the overall market should have a lower, not a higher, return.

I suspect that we are staring at a huge market anomaly. For future returns of the S&P 500 and REITs to be equal, REIT earnings/dividends must grow 500 basis points more slowly than industrial stocks annually from now to eternity. Possible, but not likely. Why this apparent discrepancy? There is a fair amount of evidence that companies do not make terribly efficient use of retained earnings. (Can you spell Snapple?) In other words, shareholders do a better job of investing a company's earnings than the company itself. It's quite possible that we would all be better off if Congress mandated a 95% payout ratio for industrial stocks as well as REITs.

The Coward's Approach

To summarize, a rudimentary but time-tested model predicts an expected return for the S&P 500 of 7 percent, for long-term corporate bonds 5.5 percent, and for REITs 12 percent. Does this mean we should all own portfolios consisting of 100 percent REITs? Hardly. First of all, such a portfolio would fairly ooze nonsystematic risk. Second, our predictions could be wildly inaccurate. If you don't own REITs, however, now might be a good time to allot a few percent of your portfolio to them. If you already do, a few percent more might be in order.

For simplicity's sake I've not addressed the expected returns of other important asset classes—chiefly small stocks and foreign stocks. However, they are probably slightly larger than the S&P 500 by a percent or two. For example, the dividend yield of the Russell 2000 small-stock index is about the same as the S&P 500, but the earnings/dividend growth of this index will probably be slightly higher. Emerging markets stocks currently have much higher dividend yields and long-term expected growth rates as well, but also have risks to match.

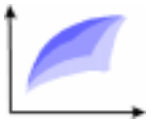
At the end of the day, stock returns do not issue from historical data, regression analysis, or multi-factor models, but are the direct result of owning a slice of the economy. The equity valuations of 1999 do not even faintly resemble those of 1926, and it is dangerous to extrapolate the next few decades of equity returns from the post-1926 data.

We owe a debt of gratitude to Ibbotson and Sinquefield for providing us with an accurate estimate of past stock returns. In the process they have accomplished something even more valuable: their historical data validates the dividend discount model to within a few dozen basis points. This model is likely to provide us with a more accurate estimate of future returns than simply expecting a reprise of past results.

To paraphrase Mr. Graham, in the long run the market is a weighing machine, not a Xerox machine. The scales still work. The parcels will be lighter.

copyright (c) 1999, William J. Bernstein

Efficient Frontier



William J. Bernstein

The Lake Wobegon Market Theory

For those of you with a congenital dislike of public radio, for nearly two decades show host, writer, and (dare I say it) singer Garrison Keillor has produced "A Prairie Home Companion," set in the mythical town of Lake Wobegon, Minnesota. (A small confession: I listened to the show for over two years, before nagging doubts sent me to my Rand McNally to find there was no such place.) Mr. Keillor is heard to intone at the beginning and end of each show that in Lake Wobegon, "all the women are strong, the men are good looking, and the children above average."

Well, on Wall Street everyone's above average too. In case you missed it, there was a piece on investor preconceptions in the September 14 "Abreast of the Market" series in the *Wall Street Journal*. Writer Greg Ip examined the revision in investor attitudes caused by the third-quarter carnage. Here's his tabulation of the change in investors' return expectations:

Expected Returns	June 1998	Sept. 1998
Next 12 months, own portfolio	15.2%	12.9%
Next 12 months, market overall	13.4%	10.5%
Next 10 years, market overall	(NA)	15.9%

Two things fairly leap out of the table. The first is that the average investor thinks that she will best the market by 2 to 2 1/2 percent. The second is, now that prices are off 15 to 25 percent (depending what market segment you're looking at), the stock returns expected by investors are *lower*.

Let's examine each proposition in turn. Regarding the first, it is possible that many investors may in fact beat the market by a few percent next year. However, it is of course mathematically impossible for the average investor to do so. In fact, the average investor must of necessity obtain the market return, minus expenses and transaction costs. Even the most casual observer of human nature should not be surprised by this paradox—folks tend to be overconfident. "Overconfidence" is currently a hot topic in behavioral

finance circles, and it's worth a brief tour of the subject.

Overconfidence likely has some survival advantage in a state of nature, but not in the world of finance. Consider the following:

- In one study 82 percent of drivers considered themselves in the top 30 percent of their group in terms of safety. (In Sweden, not unsurprisingly, the percentage is much lower.)

- In another study 81 percent of new business owners thought they had a good chance of succeeding, but that only 39 percent of their peers did.

- Several housewives from Beardstown form an investment club, incorrectly calculate their portfolio returns, and then write a bestseller describing the reasons for their "success."

- A neurologist in rural Oregon reads the classic books on portfolio theory and produces a website on the topic.

The factors associated with overconfidence are intriguing . The more complex the task, the more inappropriately overconfident we are. "Calibration" of one's efforts is also a factor. The longer the "feedback loop" between our actions and their "calibration" (receipt of results), the greater our overconfidence. For example, meteorologists, bridge players, and emergency room physicians are quite well calibrated. Investors most certainly are not.

The second observation, that investors reduce their return estimates after sharp market reversals, is on its face even more astonishing. Consider the following question:

> On January 1, you buy a gold coin for $300. In the ensuing month the price of gold falls, and your friend then buys an identical coin for $250. Ten years later, you both sell your coins at the same time. Who has earned the higher return?

Very few investors would not chose the correct answer—your friend, having bought his coin for $50 less, will make $50 more than you. Viewed in this context, it is astonishing that any rational investor would impute lower expected returns from falling stock prices. The reason for this is what the behavioral scientists call "expectancy"— we tend to overweight more recent data and underweight older data, even if it is more comprehensive. Had any conversations lately with someone with less than five years investing experience and tried to convince him that he cannot expect 20 percent equity returns over the long term? Blame expectancy. Make the recent data spectacular and/or unpleasant, and it will completely blot out the more

important, if abstract, longer term data.

All very interesting, you say, but of what use are such metaphysics? First and foremost, it explains why most investors are "convex" traders. This is a term coined by Sharpe and Perold to describe "portfolio insurance" strategies in which equities are bought as prices rise and sold as they fall. A "concave" strategy represents the opposite—buying as prices fall and selling as they rise. Although some may find one or the other strategy more appealing, Sharpe and Perold make a more profound point: in a world populated by concave traders, it is advantageous to be a convex trader, and vice versa. Financial history in fact suggests that the overwhelming majority of equity investors are convex. This is because of expectancy—when prices rise, investors' estimates of returns irrationally rise, and they buy more. If indeed most investors exhibit such convex behavior, then the rational investor is concave. (Bond investors, on the other hand, appear to be a bit more concave, probably because falling bond prices make the most overt feature of a bond, its current yield, more immediately attractive to the investing public.)

Sharpe and Perold make another point. Markets dominated by convex traders are considerably more volatile than those dominated by concave ones. Which world do you think we've been living in the past several months?

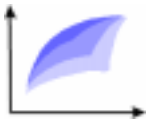
Expectancy and overconfidence have grave implications for the efficient market hypothesis, which is placed firmly on a foundation of investor rationality. Many observers, both in and out of academia, would conclude from the above that this foundation has been built on quicksand. How else to explain an investment climate in which from time to time initial public offerings of companies, most of which will not survive the decade, are priced at astronomical multiples of sales and book value? (Not to mention earnings, as in "what earnings?")

Socrates said that the unexamined life is not worth living. Self-examination is also a profitable investor attribute. Look in the mirror, dear reader. See anything familiar in the above behavioral characteristics?

Home E-Mail

copyright (c) 1999, William J. Bernstein

Efficient Frontier



William J. Bernstein

Momentum

How Random a Walk?

Technical analysis is the Rodney Dangerfield of financial work—it gets no respect. The notion that one can divine the future price of a stock or index simply by looking at its price graph seems preposterous. The fastest way to bring a sneer to the face of most finance professionals and academics is to say the words "resistance level."

Pooh-poohing charts is equivalent to saying that security prices are a "random walk." To wit, there is no information contained in an asset's prior price behavior: the fact that a security or market has just risen or fallen in price over a certain time period tells us nothing going forward.

I've been as guilty of this attitude as most; consider this gem from ***The Intelligent Asset Allocator***:

> In fact, there is an entire school of stock analysis which relies on the so called "relative strength" of a stock… the more rapidly it is rising, the better a buy it must be! Such idiocy boggles the mind.

Well, I didn't get it quite right. It turns out that there is a pretty impressive literature demonstrating that asset prices are nonrandom, and that gazing at charts may not be a waste of time.

The Process

First of all, how exactly does one go about looking for nonrandom behavior? There are dozens of ways to do so, but the simplest is to look for "autocorrelations" in price changes. What we are in effect asking is, "Does the price change from the previous day/week/month/year/decade correlate with the price change of the succeeding day/week/month/year/decade?"

Let's take the monthly returns for the S&P 500 from January 1926 to September 1998. That's 873 months. What we now have is two series of 872

monthly returns, offset by one month. Thanks to the magic of modern spreadsheets, it is a simple matter to calculate a correlation coefficient of these two series. In other words, we are correlating each month's return with the next. (To review, a correlation of +1 means that two series of data are perfectly correlated, 0 means that they are not correlated, and -1 that they are perfectly inversely correlated.)

It turns out that the autocorrelation of the monthly returns for 1926 through 1998 is 0.081. Not terribly impressive, but positive nonetheless, meaning that a good return this month means a slightly better than average chance of a good return next month. What are the odds that this could have happened by chance? In order to determine this, we have to calculate the standard deviation of autocorrelations for a data series of 873 random data points. The formula for this is sqrt(n-1)/n, which for 873 is 0.034. Thus, the autocorrelation of 0.081 is more than twice the "random walk" standard deviation of 0.034. This in turn means that the odds of this occurring with 873 random numbers is less than one in a hundred.

So, yes, US security prices exhibit some momentum over periods of one month.

An Unfair Advantage

You probably didn't know this, but investors come in two shapes—convex and concave. Sharpe and Perold, in a classic piece in ***Financial Analysts Journal*** in 1985, defined the former as one who tends to buy when prices are rising, and the latter as one who buys when prices are falling: in other words, momentum players and contrarian investors. I suspect that the convex/concave dichotomy is a deeply behavioral phenomenon—you're born either one or the other. The percentage of each who enjoy long walks in the park versus those who sky dive is probably radically different. The authors make the interesting point that in a market dominated by concave investors, it is better to be convex, and vice versa.

The two styles of investing are completely different—browse any investment discussion board and you'll find that these two species tend to get on each other's nerves quite easily. ***Efficient Frontier*** has a most definite concave bias towards buy-and-hold and rebalancing. This mandates buying when prices are falling.

The plain fact of the matter is, demonstrating that short-term momentum exists (or does not exist) is relatively easy, whereas demonstrating the same for long-term mean reversion is nearly impossible. Consider the 1926-98 period. Since 1926 there have been over 18,000 trading days, 3800 weeks, 873 months, 72 years, and 18 four-year periods. (Four years is the sort of time frame in which mean reversion of asset prices occurs.) Thus, while there is an abundance of data with which to look for short-term momentum, there is a distinct shortage of data with which to look for long-term mean

reversion. If you toss 100 coins and come up with 55% heads, the result is most likely due to chance. But if you toss one million coins and come up with 55% heads, the coin is almost certainly loaded. This is because the standard deviation of percent heads tossed for 100 coin tosses is much larger than for one million.

In the case at hand, the large number of monthly data points with respect to momentum investing results in a standard deviation of autocorrelations of only 0.034. This means that any autocorrelation of more than 0.07 is highly statistically significant. Similarly, if you're using daily data points for that period, then any autocorrelation above 0.015 is significant. On the other hand, a contrarian's juices are stimulated by poor returns over several years. As noted above, you can divide the 72 years from 1926 to 1997 into 18 periods of four years each. This means that you'll need an autocorrelation of -0.44 to establish statistical significance. (Negative autocorrelations define contrarian strategies: a good return in one period forecasts a higher probability of a poor one in the next.) Put another way, an autocorrelation of -.08 (similar to that seen with monthly periods) would require 3500 years of data to attain the same degree of statistical significance.

What this all means is that contrarian strategies are essentially untestable, and if we want to disprove the random-walk hypothesis, we are stuck with testing for momentum.

The Historical Data

A nice summation of the autocorrelation data for US stocks is found in Campbell, Lo, and MacKinlay's ("CLM") ***The Econometrics of Financial Markets***. The following table summarizes their autocorrelation data for 1962 through 1994:

	CRSP Value Weighted ("large stocks")	CRSP Equally Weighted ("small stocks")
Daily Returns	.176	.350
Weekly Returns	.015	.203
Monthly Returns	.043	.171

CRSP refers to the Center for Research in Security Prices. The value-weighted and equally-weighted indexes can be very roughly thought of as large and small stock proxies, respectively.

This data pretty conclusively demonstrates momentum effects of high statistical significance for an index of large stocks from day to day, but not for longer periods. An index of small stocks does demonstrate momentum

over days, weeks, and months. (I wouldn't get too excited over the 0.350 autocorrelation for small stocks for daily periods. Remember that many of these securities do not trade every day, so that a big market move up or down one day will be followed by appropriate moves in ensuing days in the stocks that did not trade.)

In light of the above, it is rather amazing that when CLM looked for momentum in individual stocks, none was found. In other words, the generations of investors who have been gazing at stock price charts likely have been wasting their time, but the recent phenomenon of charting mutual fund prices may have some validity. CLM explain this apparent paradox by noting that there are highly significant "cross autocorrelations" between large and small stocks, meaning a rise/fall in large stocks is usually followed by a rise/fall in small stocks.

Foreign Markets

What about non-US bourses? It's a good news/bad news story. The good news is that there are dozens of them out there to look at. The bad news is that their historical record is considerably shorter, some less than 11 years. Oh, and one other problem. The data is very hard to get, unless your name is Morgan Stanley. Still, I was able to scrounge a fair amount of relevant data from Morningstar's *Principia Plus*®. The US, UK, and Japanese data were obtained from Dimensional Fund Advisors. Here's the data for autocorrelations of monthly returns:

Country	Number of Months	Autocorrelation	p value
Argentina	129	.050	.286
Austria	201	.137	.027
Brazil	129	-.149	.046
Chile	129	.148	.047
France	201	.002	.487
Germany	201	-.040	.284
India	140	.123	.073
Indonesia	129	.129	.072
Ireland	129	-.090	.209
Italy	201	-.057	.209
Japan (large)	345	.084	.060
Japan (small)	345	.104	.027
Korea	128	-.076	.195
Malaysia	129	.133	.066

Mexico	129	.103	.122
Philippines	129	.244	.006
Portugal	129	.055	.265
Singapore	201	.033	.318
Spain	201	.090	.102
Switzerland	201	-.020	.367
Taiwan	129	.140	.056
Thailand	129	.129	.057
Turkey	129	.082	.174
U.K. (large)	524	.079	.036
U.K. (small)	523	.222	.00000026
U.S. (large)	873	.081	.009
U.S. (small)	873	.193	.0000000074

All in all, this table provides pretty impressive evidence of momentum abroad. Consider that of the 26 non-US markets studied, all but six had positive autocorrelations, six had p values which reached the .05 level of significance, and another six which reached it at a 0.1 level, whereas by chance we would have expected only one of each. Second, note that the longer the historical record, the more impressive the statistical power, particularly the US and UK. In fact, it is rather amazing that Philippines reached the .05 level of significance with only 129 data points (10.75 years).

What's It All Mean?

OK, so stocks around the world do not do the random walk. How does this data affect the average investor? Only at the margins. Lest we get too carried away, the most impressive autocorrelations we've encountered are in the 0.2 range. That means that no more than 4% (0.2 squared, or "R-squared") of tomorrow's price change can be explained by today's. That doesn't buy a lot of yachts. For the taxable investor, this stuff is totally irrelevant—whatever advantage there is to this technique is obliterated by the capital gains capture mandated by buying and selling with the high frequency necessitated by momentum techniques.

Certainly, however, these effects cannot be ignored. For the sheltered asset allocator, the message is loud and clear: *Do not rebalance too frequently.* If asset class prices have a tendency to trend over relatively long periods (say months, or even one to two years) then rebalancing over relatively short periods will not be favorable. This is a somewhat tricky concept. Remember that asset variance (which is the square of the standard deviation) is one of the main engines of rebalancing benefit. If an asset has momentum, then the annualized variances will be greater over long periods than over short

periods—this is in fact a good way to test for momentum.

Think about the Japanese and US markets. Both have exhibited pretty impressive momentum (in opposite directions) since 1989. Obviously, rebalancing as little as possible from the US to Japan would have been more advantageous than doing it frequently.

Yet another way of thinking about this is the following paradigm—rebalance only over time periods where the average autocorrelation of your assets is zero or less. For practical purposes, this means no more than annually, and preferably less.

Yin, Yang

Rather than being polar opposites, momentum investing and fixed asset allocation with contrarian rebalancing are simply two sides of the same coin. Momentum in foreign and domestic equity asset classes exists, resulting in periodic asset overvaluation and undervaluation. Eventually long-term mean reversion occurs to correct these excesses.

Over two decades ago, Eugene Fama made a powerful case that security price changes could not be predicted, and Burton Malkiel introduced the words "random walk" into the popular investing lexicon. Unfortunately, in a truly random-walk world, there is no advantage to portfolio rebalancing. If you rebalance, you profit only when the frogs in your portfolio turn into princes, and vice versa.

In the real world, fortunately, there are subtle departures in random-walk behavior which both the asset allocator and momentum investor can exploit. Writer/money manager Ken Fisher calls this change in asset desirability, and the resultant short term-momentum and long-term mean reversion, the "Wall Street Waltz."

Even investors who eschew momentum techniques should be aware that momentum exists. Understanding what it means for rebalancing and asset behavior will make you a better asset allocator.

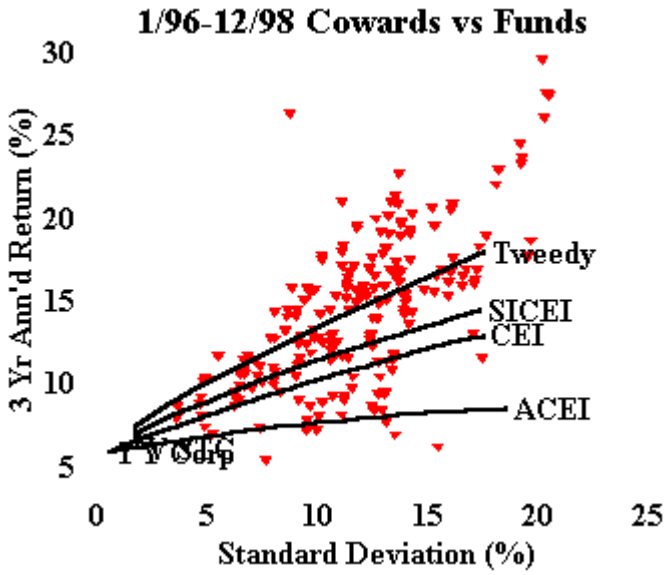
copyright (c) 1999, William J. Bernstein

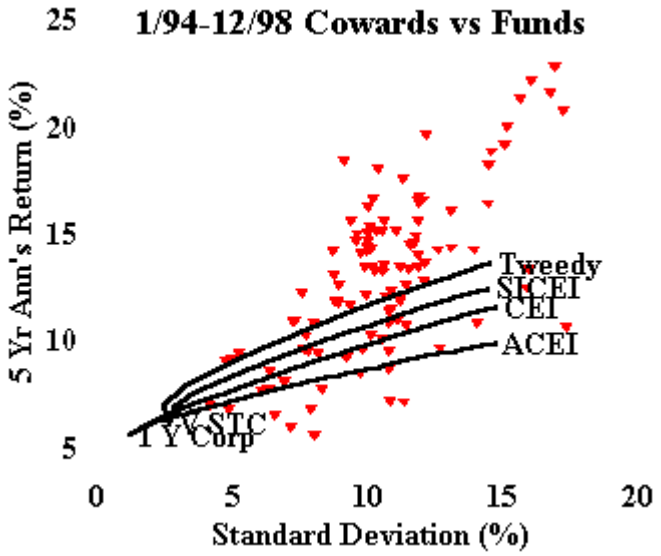
Efficient Frontier

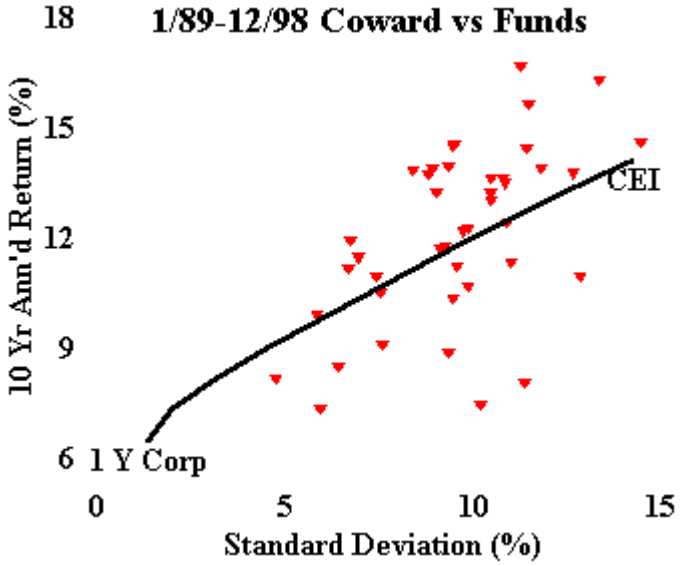
William J. Bernstein

The Coward's Update

In September's Coward's Update, I concluded that with the continued dominance of the S&P 500 things couldn't get much worse for the cowards. I was wrong. Although the last half of the year was a roller coaster for all global assets, the bumps were softer and the rebounds were better for everybody's favorite blue chips. Here's the bad news for the cowards for 3, 5, and 10 years:







For those of you unfamiliar with the cowards, take a look at the July 1997 update for a detailed description.

Over the past 3 and 5 years, the supposedly hapless professional global fund managers have bested our fearless automatons. The reason is not difficult to fathom: in the past decade every penny you invested outside big US growth stocks cost you dearly. Consider the following 3-year and 5-year returns for the index funds tabulated below:

Index	(Index Fund Sampled)	3 Yr. Return	5 Yr. Return
Continental Small Companies	DFA Continental Small Compny	15.15	11.13
Emerging Markets (Equally Weighted)	DFA Emerging Markets	-6.47	NA
Small Japanese Stocks	DFA Japanese Small Company	-26.00	-12.74
EAFE Index	DFA Large Cap International	9.88	9.57
Pacific Rim Small Companies	DFA Pacific Rim Small Compny	-18.78	-14.47
US Small-Medium Companies	DFA U.S. 6-10 Small Company	11.37	12.15
US Small Companies	DFA U.S. 9-10 Small Company	10.21	13.17
UK Small Companies	DFA United Kingdom Small Co	6.08	6.71
REITs	DFA/AEW Real Estate Secs	10.56	6.78
S&P 500	Vanguard 500 Index	28.16	23.96
Emerging Markets (Cap Weighted)	Vanguard Emerg Mkt Stk Idx	-7.60	NA
EAFE-Europe	Vanguard European Stock Idx	24.74	19.32
Precious Metals Stocks	Vanguard Gold & Precious Met	-16.48	-12.05
US Growth Stocks	Vanguard Growth Index	33.87	27.79
EAFE Pacific	Vanguard Pacific Stock Idx	-11.14	-4.01
US Value Stocks	Vanguard Value Index	21.91	19.79

It's not surprising that the global fund managers, favoring conventional portfolios heavy with Microsoft and Merck, have done so well. The worst performing automaton was the academic coward, with its heavy exposure to Japan and very small stocks. The best was the Tweedy Browne coward, which avoided these areas. Perversely, the more passively managed the coward, the worse it performed.

It's well to step back and consider some market history. Ten years ago the

Japanese were buying up the crown jewels of American real estate and industry, fatuous novels were being written about a world controlled from Tokyo, and the Nikkei was the place to be. Twenty years ago? Real estate and gold. And thirty years ago? The one-decision big growthies of the Nifty Fifty. Sound familiar? In each case, capitulating to the era's asset class zeitgeist would have been a disaster.

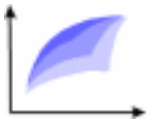
On a more prosaic note, the last 5-year period the S&P 500 outperformed foreign stocks was 1979-84, with five year annualized returns of 17.27% and 10.06% (EAFE), respectively. The annualized return for the following five years was 20.41% for the S&P and 36.52% for the EAFE.

So, patience. The cowards will soldier on. You'll see them again next year.

Home E-Mail

copyright (c) 1999, William J. Bernstein

Efficient Frontier



William J. Bernstein

What's Cheap

Below are the valuation numbers for the major global asset classes, as sampled from their respective index funds. The 12/31/98 NAVs are presented in the first column as reasonable guides for adjusting these parameters for subsequent price changes—if the NAV declines by, say, 20 percent, then the PB, PE, and PC will also decrease by approximately the same proportion, at least over the next several months.

These numbers speak (nay, scream) for themselves, and are offered without further comment.

Fund Name	12/31 NAV	12 Mo Ret	3 Yr Ann'd	5 Yr Ann'd	3 Yr SD	P/E Ratio	Div Yield	P/B Ratio	P/C Ratio	Cap $MM
Am Cent Gold	5.52	-12.18	-20.64	-14.58	41.84	29.7	0.88	2.6	16.2	2251
Am Cent Nat Res	10.58	-6.3	3.5	-	17.1	27.3	1.73	2.7	11.4	27708
DFA Cont Sm	15.38	19.55	15.15	11.13	14.49	20.3	1.69	2.6	9.1	429
DFA Em Mkt	8.3	-9.43	-6.47	-	27.1	19.9	1.12	2.9	9.6	2040
DFA Intl HBM	13.79	14.96	6.34	7.83	15.87	24.8	2.07	1.9	9.5	10198
DFA Intl SCV	7.18	5.27	-6.35	-	13.88	19.8	1.99	1	9.3	223
DFA Intl Value	11.99	14.87	6.25	-	15.86	25.5	1.92	1.8	10.1	6533
DFA Japan Sm	8.85	16.06	-26	-12.74	26.39	30.5	0.71	1.2	10.3	228
DFA Lg Cap Intl	16.5	18.21	9.88	9.57	16.29	29.9	1.56	5.1	13.4	28499
DFA Pac Rim Sm	6.14	-19.08	-18.78	-14.47	28.99	17	3.6	1.2	10.9	162
DFA US 6-10	12.93	-5.51	11.37	12.15	22.97	23.2	2.7	3.4	17.1	372

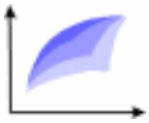
6-10										
DFA US Sm Val	17.93	-7.3	14.03	14.18	20.14	19.8	1.73	1.7	12.4	280
DFA US 9-10	10.76	-7.32	10.21	13.17	23.01	21.5	1.4	2.9	15.7	137
DFA US LCV	19.76	11.98	19.93	17.9	20.98	18.3	1.49	2	10.4	7874
DFA US Lg	36.33	28.68	28.06	23.86	20.37	32.7	1.18	8	22.3	56951
DFA UK Sm	18.11	-11.18	6.08	6.71	13.4	13.3	3.83	3.2	10.9	182
DFA REIT	12.13	-15.38	10.56	6.78	14.19	23.3	5.36	1.4	17	1518
Schwab 1000 Inv	33.51	27.16	26.82	22.72	20.41	33	0.75	7.9	23	45554
Schwab Intl Idx	15.27	15.85	10.7	9.98	16.29	29.3	0.88	5.1	13.7	25037
Schwab Sm Cap	16.25	-3.57	11.86	11.61	21.79	23.8	0.32	4	17.2	706
Scudder Latin Am	17.73	-29.7	5.8	-0.65	34.61	16	2.01	2.1	9.8	3780
Vanguard 500 Index	113.95	28.62	28.16	23.96	20.46	32.9	1.16	8	22.5	57109
Vanguard Emg Mkt	7.91	-18.21	-7.6	-	27.82	17.6	3.29	2.8	12.2	4315
Vanguard Energy	18.42	-20.53	6.95	8.57	23.47	24.1	1.86	2.4	7.5	5432
Vanguard Europe	25.28	28.86	24.74	19.32	17.46	29	2.05	5.9	13.4	29219
Vanguard Ext Idx	30.62	8.32	17.31	16.24	22.69	27.7	1.14	4.8	20.5	1635
Vanguard Gold	6.61	-3.91	-16.48	-12.05	34.7	31.5	1.36	2.5	18.4	1290
Vanguard Growth	31.67	42.21	33.87	27.79	22.32	40.2	0.69	12.1	28	97635
Vanguard Pacific	7.84	2.41	-11.14	-4.01	19.11	33.1	0.83	2.4	12.2	12513
Vanguard REIT	11.08	-16.32	-	-	-	23.3	7.31	1.3	16.6	1556
Vanguard SCG	9.53	-	-	-	-	27.5	-	5.4	22.6	1021
Vanguard Sm Cap	21.2	-2.61	12.75	12.92	22.45	23.1	1.34	3.8	16.8	671
Vanguard SCV	8.74	-	-	-	-	20.1	-	1.8	11.9	533

Vanguard Utilities	16.54	21.83	17.07	14.48	11.97	23.6	3.36	3.2	11.2	7180
Vanguard Val Idx	22.51	14.64	21.91	19.79	19.48	23.9	1.54	3.4	15.6	24073

Home E-Mail

copyright (c) 1999, William J. Bernstein

The Intelligent Asset Allocator



William J. Bernstein

Future Financial Fables:

Doctor RTM and the Evil Robot CRAAL

Paul W. Harvey

Editor's Note: Paul is an occasional writer of financial humor who lives in Massachusetts, and a regular contributor to the MFI Board. The Board is the site of lively discussions of many practical and theoretical investment issues, and over time has developed some acronyms peculiar to it. Among them are ***CRAAL*** *(Constant Ratio Asset Allocation — a policy of fixed allocation to various asset classes, with periodic rebalancing) and* ***RTM*** *(Reversion to the Mean, the tendency of above and below average asset performance to reverse. This phenomenon, where it exists, makes portfolio rebalancing profitable.)*

If you visit enough planets, you'll hear a lot of different theories about Doctor RTM and his glorious term as Grand Master of the Universe (GMOTU). One theory has it that RTM was handpicked by God during a crap game—a serious blow to Einstein's theory that God didn't play craps with the universe. Of course, there are just as many people who will tell you that God didn't enter into it at all. RTM was just stepping in for a friend according to this theory, a friend who happened to be the previous GMOTU. Even a GMOTU can make mistakes, and this particular one made a doozy: he was concentrating so hard on rebalancing the quadrants in his investable universe that he forgot to look out for black holes.

Whatever the reasons for his ascension to the universe's most exalted post, Doctor RTM was superbly qualified for the job. He excelled at running large companies such as Megasoft, which had grown so large under his leadership that it occupied all the habitable planets in six galaxies. There were other feathers in RTM's cap as well. He had made several fortunes for himself with the aid of a time machine and some wealthy but clueless planets that hadn't caught on to the power of compounding. He would find such a planet, go back 2000 years, invest a dollar at a guaranteed 3 percent per year (yes, some planets were so dumb as to guarantee returns like this!), and insist on payment in gold at the end of the 2000-year term. The first time he did this, his trophy was a gold sphere larger than our moon. RTM's second foray into time-machine compounding netted him enough money to buy Megasoft, which was called Gettingbiggersoft at the time.

Frankly, by now Doctor RTM had pretty much everything he wanted out of life—gold, prestige, access to the fastest and most luxurious spaceships in the cosmos. His assistant, the evil robot CRAAL, was not so lucky. CRAAL had the most formidable computerized brain that the scientists at Megasoft could devise—so formidable that he was chronically underchallenged and unhappy. In truth, CRAAL was driving RTM nuts with his constant claims that RTM could not possibly have amassed his great fortunes in a truly efficient universe. The idea that so many planets could be wealthy enough to guarantee RTM astronomical riches, but dim enough that they couldn't foresee his eventual triumphs had to be impossible in a random walk universe. Once time-machine technology came into common use, it could easily have been used defensively by the planets that had lost their gold to RTM. Why wasn't it?

"CRAAL," said Doctor RTM one day, "I am going to be appointed Grand Master of the Universe. I think that you would be the perfect candidate for second in command.....

"It is said that that is the most difficult job in the universe," CRAAL protested.

"It will still be too easy for you," Doctor RTM said, "but we all have to make sacrifices. Anyway, I want you to iron out some kinks that are developing in the universe. Things have gotten. pretty ragged on some planets since my predecessor had his unfortunate accident. We want uniformity and discipline. See what you can do!"

The evil robot pretended to be unhappy with his new job, but deep down he was glad to have it. In his first week on the job, he eliminated three things that seemed to serve no purpose in the universe: three-toed sloths, nipples on men, and large growth companies. Unbeknownst to CRAAL, he was heading for a major conflict with his master.

CRAAL began borrowing time machines so that he could warn RTM's rich clueless planets about the long-range outcomes of their business dealings with him. This was not a case of disloyalty, however: CRAAL had investments of his own, which entailed indexing the universe's stocks across all time periods. He reasoned that, as a stockholder in RTMs competitors, he had a vested interest in ensuring that they had a level playing field**.**

One day, the bottom fell out of RTMs empire. No rich, clueless planets would do business with him. Even Megasoft was imploding before his eyes, throwing the inhabitants of six galaxies out of work.

" CRAAL, I'm through with you!" RTM screamed at his assistant not long after the post of GMOTU was taken away. "You have not been helpful to me."

"Surely you know that your success was a fluke," CRAAL replied logically,

"you're just regressing to the mean, that's all. You'll have other chances sooner or later."

"But where will I get investors to bankroll my new projects?" RTM demanded. "Infinitesimalsoft is almost out of business, and my gold planet has been repossessed."

"I hear that there are opportunities in paper products," CRAAL suggested.

"Fine! I think I know of a product that will take the universe by storm.

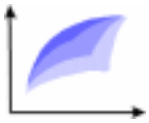
"What is it?"

"Trees that grow to the sky!"

Home E-Mail

copyright (c) 1999, Paul Harvey

Efficient Frontier



William J. Bernstein

Journal of Finance Online

Picture sitting in the drafty examining room at your doctor's office, dressed in one of those nifty blue gowns and feeling a bit green at the gills. She looks at you and tells you that you have that dreaded disease, Somali camel bite fever. Is it treatable? "Well, my cousin, who's a dermatologist in Cincinnati, saw a case a few years back and tells me that a new antibiotic called threeblindmycin seemed to work." Hmmm . . . . .

What you really wanted her to say is that she searched the world's medical journals for well executed therapeutic trials of the disease, and after a thoughtful review of the relevant literature and expert consensus . . . . .

Investing isn't much different. There is an extensive academic finance literature, and it's a pretty safe bet that your brother-in-law who sells you stocks and mutual funds isn't even dimly aware of it.

So what if I told you that the world's most prestigious finance journal, chock full of data about what works and what doesn't in investing, is available online, for free? The good news is that is in fact the case. The ***Journal of Finance*** comes out on a quarterly basis, and it is yours for the taking. The bad news is that most articles are not really written in the English language, but instead in a dense jumble of stochastic calculus and academic jargon. Only about 5%-10% of the articles are accessible to ordinary mortals for this reason. Fortunately the most relevant articles are usually the best written, but you're going to have to do a lot of sifting to find them. Here are the ground rules:

- The articles are all in pdf format, so you'll need to have downloaded and installed the Acrobat Reader.
- Rather bizarrely, pieces from future issues are featured indiviually, but when an issue finally makes it into print, you have to link to that month's edition on a separate page. If you're going to make a habit of downloading pieces, I'd recommend creating a directory\subdirectory system on your hard drive (i.e., c:\jf\dec98\ ) so you can organize them for future reference.
- The first pass is at the abstracts to pick out the ones you might be interested in. The second pass is a fast scan at the piece to make sure that it is not strewn with formulae. Only then do you commit your

time to it.
- Do not reproduce without permission. If you do Gene Fama, clad in a flowing gown, will smite you with either the stone tablets in his right hand or the tennis racquet in his left.

To start you out, here are a few worthwhile pieces currently available:

- Volume, Volatility, Price, and Profit: When all Traders are Above Average
- What is the Intrinsic Value of the Dow?
- Value versus Growth: The International Evidence
- Global Stock Markets in the Twentieth Century
- Are Some Mutual Fund Managers Better than Others?

This may be tough sledding at first, but eventually you'll become conversant with the cutting edge of financial thought. And even if you're not, you'll learn more than enough buzzwords with which to intimidate your broker brother-in-law.

copyright (c) 1999, William J. Bernstein