# The S&P 500 Anomaly

**BY RICHARD GRINOLD & JOHN FREEMAN**

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A curious thing has been happening throughout the decade of the 1980s. Stocks belonging to the S&P 500 index have had significantly higher returns (about 3.9% per year) than similar stocks not included in the S&P 500. Could it be that membership in this exclusive club makes a stock a better performer? Could it be that the S&P picks the winners in advance?

This article presents evidence to show that the anomaly is real — not a statistical fluke.[1] We discuss the causes, the likelihood of continuation, and ways to exploit the S&P 500 anomaly.

## The Evidence

We can see evidence of the S&P 500 anomaly in three different ways; each more refined than the next. Our first test is an uncontrolled comparison. We simply looked at the difference in returns between S&P 500 and non-S&P 500 stocks.[2]

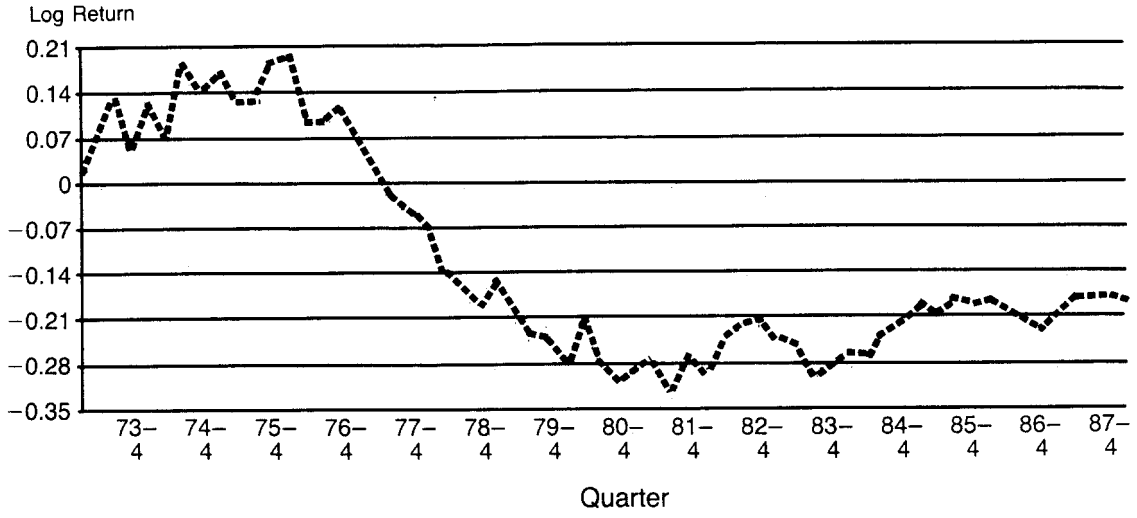
In our second test, we controlled for a single factor: exposure to the market.

In the third test, we will control for several factors to insure that our measurements are not confounded by things like the S&P 500's concentration in the oil industry, higher capitalization stocks, and so forth. This will allow us to get down to the basic issue: membership. We want to know if membership in the index is important — and we want to control for the fact that index members tend to be large and oily, compared to non-members.

## First Test

First, let's look at a simple comparison of S&P 500 returns with those of a non-S&P 500 portfolio. To make this comparison, we used the MIN S&P, a BARRA maintained portfolio composed of the 7000 or so U.S. stocks that are not in the S&P 500. Its returns are value weighted. Exhibit I shows the simple comparison.

**EXHIBIT I**
S&P 500 minus MIN S&P
Difference in Cumulative Returns
1973-1987




Over the entire time period, the S&P 500 underperforms the MIN S&P 500 by 1.6% per year. In the 1980's, however, the S&P 500 outperforms by 90 basis points per year. This seems to indicate that S&P 500 stocks performed better in the 1980's — but it is hardly conclusive. We need a more refined look.

## Second Test

For our second test, we made what might be called the CAPM comparison.[3] Here we used the broad based FRMSU[4] portfolio as the market, and split the S&P 500 returns into two components: market return (due to the S&P 500's exposure to market risk) and residual return (due to the differences between the S&P 500 and the market).

The returns can be split by using linear regression. We performed the regression test over the 1970s (January 1973 through December 1979), and the 1980s (January 1980 through December 1987). The results of those regressions are seen in Exhibit II.

The key numbers in Exhibit II are the alphas and betas. The beta of the S&P 500 shows its exposure to market risk. We can see that the S&P 500's beta was low (0.95) in the 1970s and has risen to 1 in the 1980s.

The alpha of the S&P 500 shows the average of the non-market or residual risk. The CAPM asserts that this alpha should be zero. We find, however, that the alpha was negative in the 1970s (-1.41% per year) and positive in the 1980s (0.68% per year).

Was this bad performance in the 1970s and good performance in the 1980s due to something exceptional or was it merely the luck of the draw?

One way to find out is to look at the t-statistic for the alpha. A crude interpretation of the t-statistic of 0.74 for alpha in the 1980s is that there is one chance in four that this happened by luck. In contrast, if the t-statistic had been 2.0, we could say there was only one chance in forty of getting such a strong outcome by luck.

**EXHIBIT II**
S&P 500 Performance in the
1970s & 1980s

| Period | Alpha | t-Alpha | Beta |
|---|---|---|---|
| 1973-79 | -1.41 | -1.41 | 0.95 |
| 1980-87 | 0.68 | 0.74 | 1.00 |

Once again, we have some evidence of strong performance by the S&P 500 in the 1980s. To find more convincing evidence, we have to dig deeper.

## Third Test

We performed the third test by adding a new factor, S&P 500 membership, to BARRA's multiple factor risk model. Starting in January 1973, we gave each security in the

S&P 500 a unit exposure to S&P 500 membership. Non-members were given an exposure of zero. Then we estimated the factor return associated with S&P 500 membership.[5]

The return on the S&P 500 membership factor is the difference between the returns on two portfolios. The first portfolio (L for long) and the second portfolio (S for short) are identical in most respects. One can think of L as a portfolio with heavy S&P 500 concentration; while S is seen as a hedge against L.

Portfolios L and S have the same holdings in each of BARRA's 55 industries. They also have the same exposure to each of BARRA's 12 common factor risk indices.[6]

The two portfolios differ in just one respect: exposure to S&P 500 membership. Portfolio L's S&P 500 membership exposure is 1.0 greater than portfolio S's. So the exposure of the difference (L-S) is equal to 1.

Lastly, L and S are selected so that the risk forecast for the return on the difference (L-S) is as small as possible. The return on L-S captures the unique characteristics of S&P 500 membership and controls for other common factors and industry exposures.

This procedure is repeated for each month from January 1973 through December 1987. In each month, we use an updated S&P 500 membership list, rebuilding the L and S portfolios to make sure that they have identical BARRA industry and common factor exposures. We then record the difference in their returns. This difference is the factor return due to S&P 500 membership.

The factor returns for S&P 500 membership are shown in Exhibits III and IV.

In Exhibit III, we see just what we would expect. Capital market theory tells us that membership in the S&P 500 should not make any difference and, in fact, it did not in the 1970s.

If we look at Exhibit IV, however, we see a different picture in the 1980s.

In the 1980s, there has been an explosion of positive returns for the S&P 500 factor. It works out to approximately 3.9% per year over the decade.[7]

Exhibit V shows the results of regressing the S&P 500 factor returns against the FRMSU (market) returns. Since the factor returns are from a hedged portfolio, we would expect a very low beta — which is what we found.

There were no exceptional S&P 500 factor returns in the 1970s. In the 1980s, there have been a highly significant, positive returns. The t-statistic indicates that the chances of observing something like this because of luck is roughly 1000 to 1. Clearly, something is helping S&P 500 stocks perform better than similar, non-S&P 500 stocks.

## What's Going On?

What could be causing such exceptional returns to S&P 500 membership in the 1980s? Many explanations have been offered: liquidity, financial futures, portfolio insurance, indexing, foreign money, and the increased use of the S&P 500 as a performance benchmark.

The most plausible explanations have to do with price insensitive shoppers. When pension plan sponsors move $500 million into an S&P 500 index fund, they ask: "Is the S&P 500 a good index?" But they fail to ask: "Is the S&P 500 a good value?" These indexers are going to revise their portfolios with the sole objective of tracking the S&P 500; they will buy the assets regardless of price.

Likewise, foreign buyers, presumably, come to the US equity market with a shopping list of nothing but S&P 500 stocks. If the foreign buyers — who were so significant in 1986-87 — are only shopping for S&P 500 stocks, they will be unaware of price differentials across the S&P 500/non-S&P 500 universe.

Portfolio insurance may have concentrated some portfolios more heavily in the S&P 500. Many insurance programs (particularly those using S&P 500 futures) are aimed at the S&P 500 component of the portfolio; the non-S&P 500 component is not covered and thus could be perceived as more risky. Indeed, the existence of S&P 500 futures has generally

made portfolios concentrated in S&P 500 stocks easier to hedge. This makes them even more attractive!

Finally, if money managers — internal as well as external — are being measured against the S&P 500, they incur an additional risk by holding a non-S&P 500 stock. Relative performance measurement puts an added onus on non S&P 500 stocks.

**EXHIBIT III**
S & P 500 FACTOR
Cumulative Logarithmic Returns
January 1973-December 1979

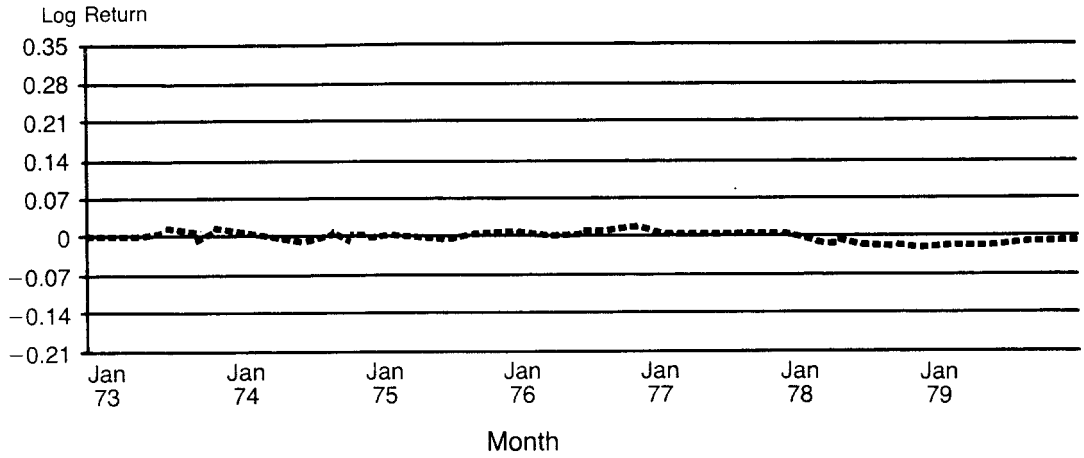
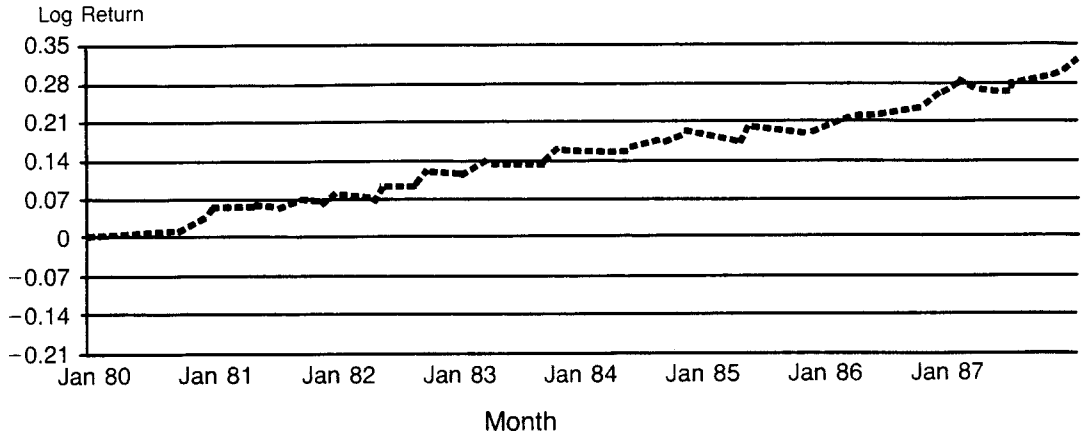



**EXHIBIT IV**
S & P 500 FACTOR
Cumulative Logarithmic Returns
January 1980-December 1987



Each of these possible reasons is based on the existence of investors who are — to varying degrees — insensitive to price. They find that S&P 500 membership makes a stock more attractive than investment fundamentals would otherwise have it.

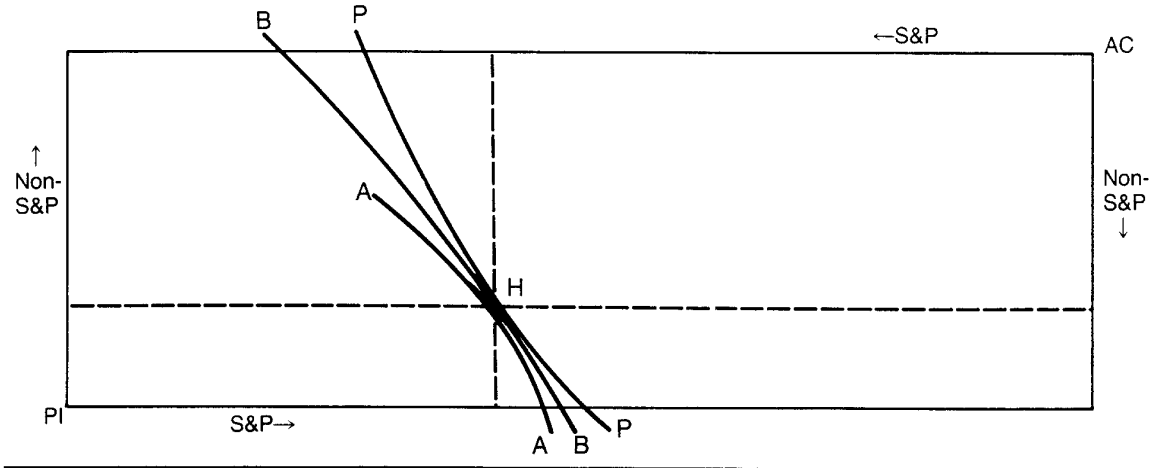
## An Illustration

We can illustrate the effect of price insensitive buyers, by using a contraption called an Edgeworth box.[8] We want to look at two investors: PI and AC. PI is the price insensitive investor; AC is the rest of the investors (the accommodators). Together PI and AC hold all the stocks. Let's consider the situation before PI decides that an S&P 500 index fund is just the thing for him. The before picture is shown in Exhibit VI.

**EXHIBIT V**
Performance of the S&P 500 factor
in the 1970s and 1980s

| Period | Alpha | t-Alpha | Beta |
|---|---|---|---|
| 1973-79 | 0.00 | 0.07 | 0.01 |
| 1980-87 | 3.85 | 3.56 | 0.03 |

**EXHIBIT VI**
Allocations and Prices:
*Before* PI gets the Index Bug.



PI looks out from the bottom left corner. He has his S&P 500 holding on the horizontal axis, and his non-S&P 500 holding on the vertical axis.

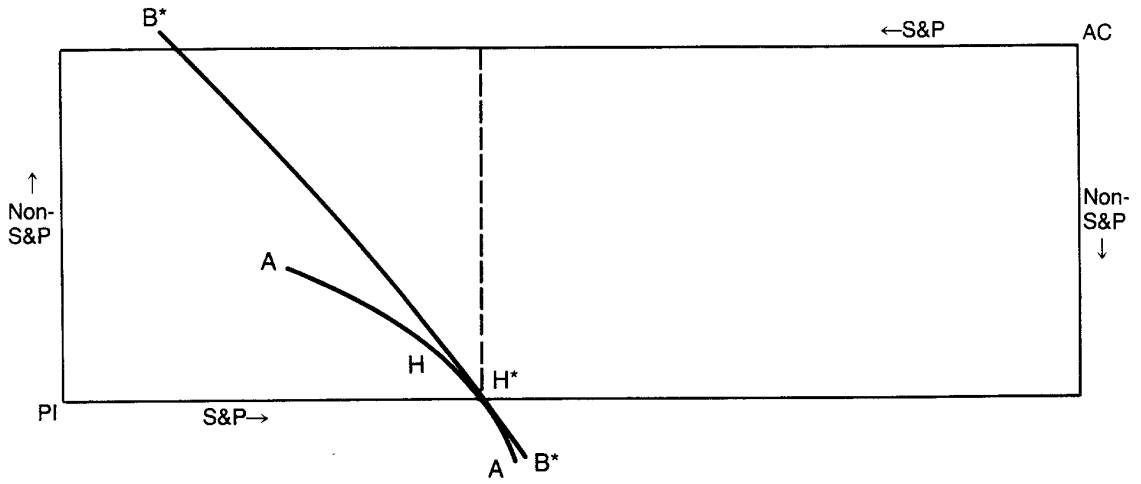
AC looks out from the top right corner, with his S&P 500 on the horizontal and non-S&P 500 on the vertical. You can turn the page upside down to see the world from AC's perspective.

Given the prices of S&P 500 and non-S&P 500, both PI and AC choose a mix that will maximize their utility subject to a budget constraint; the line P to P shows PI's utility and A to A shows AC's utility. The budget line is the straight line B to B. As we can see, the situation is ideal. Both PI and AC are maximizing their utility, and we have 100% of the S&P 500 and non-S&P 500 being held.

What happens when PI decides to get rid of his non-S&P 500 stock and go 100% S&P 500? He would initially sell his non-S&P 500 to AC and buy S&P 500 from AC. This would imbalance AC's portfolio and threaten to reduce his utility. In order to compensate, AC would pay less for PI's non-S&P 500 stock and require a higher price for giving up his S&P 500 stock. We would end up in the situation shown in Exhibit VII.

PI is now 100% invested in S&P 500 stocks. AC is still diversified, although his holdings in the non-S&P 500 stocks have increased in order to accommodate PI. Prices have shifted too, in order to keep AC at maximum utility in this new situation. Notice the new budget line B* to B*. The shift in prices, of course, means an increase in the price of S&P 500 stocks and a decrease for non-S&P 500 stocks.

**EXHIBIT VII**
Allocations and Prices:
*After* PI gets the Index Bug.




This analysis shows what can happen to relative prices when there is a large group of price insensitive investors in the market. Does this present a profit opportunity for adept investment managers? That's the next question.

## Implications for Money Managers

The money manager who sees phenomena similar to the S&P 500 effect is faced with a bubble timing decision. Ideally, you would like to move as follows: Anticipate the arrival of price insensitive investors, get aboard early, ride to the top as the price insensitive buying increases and get off before the bubble bursts or deflates.

In the case of the S&P 500 effect, you would have had to anticipate in the early 1980s that, for example, indexing would cause a wave of S&P 500 investing without regard to the merits of the underlying stocks. You would expect this trend to continue as long as there is a net inflow of funds into S&P 500 index funds. When there is move away from S&P 500 index funds — into either extended index funds or active management — the effect should reverse.

To take full advantage of this anomaly, the astute investment manager will have to act at two critical points:

before the trend is established, and when it has reached its zenith. This could be a profitable investment theme. But, like all opportunities for profit, it carries its own danger. You may have the wrong cause. What if the trend is from foreign buying and not, as you had supposed, from S&P 500 indexing? You may be in for a surprise. You may anticipate the continued growth of S&P 500 indexing for another five years. At the same time, foreign investors may conclude that their stock investments of 1986-87 were disastrous and that it's time to liquidate their holdings. You would be on the wrong side of the fence.

In the long run, you are safer betting against the anomaly. It seems that S&P 500 stocks are currently overvalued with respect to non-S&P 500 stocks. If you believe that the difference in value will eventually be smoothed out (i.e. there is no reason for a permanent mis-valuation of the S&P 500 stocks), then a bet against the anomaly will eventually bear fruit.

You will be relieved of the task of finding a cause for the anomaly and making a timing decision. The anomaly should disappear over the long haul, but, as Keynes recognized, the long haul may cover a large stretch of road.

## A Broader Phenomena

The S&P 500 anomaly that we have described in this paper is similar to a more general class of phenomena. At BARRA, we have been tracking the performance of securities that have been proscribed due to corporate activity in South Africa. If a significant group of investors refuses to hold these securities, then we would expect their prices to fall relative to other securities.

The South Africa free securities are akin to S&P 500 securities. Likewise, the securities with activities in South Africa would be akin to non-S&P 500 stocks. In the 1970s, there was some positive value associated with doing business in South Africa. (Since we do this in a controlled fashion, we are careful to separate the gold stock returns from the South African activity returns). In the 1980s, there has been no significant value added or lost due to South African activities.

Apparently, the divestment movement has yet to have a measurable impact in the marketplace.

BARRA has also looked at the effect of international indexing. In the past five years, there has been a growth in international indexing by U.S.-based institutional investors. Many of these use the Morgan Stanley Capital International (MSCI) indices as a benchmark. A check of returns to Japanese stocks reveals that MSCI membership in Japan has been valuable over the last three years. Exhibit VIII shows the returns due to MSCI membership in Japan.

As you can see, there was no particular advantage to MSCI membership until the mid-1980s. Since then, however, there has been an advantage of approximately 2.6% per year.

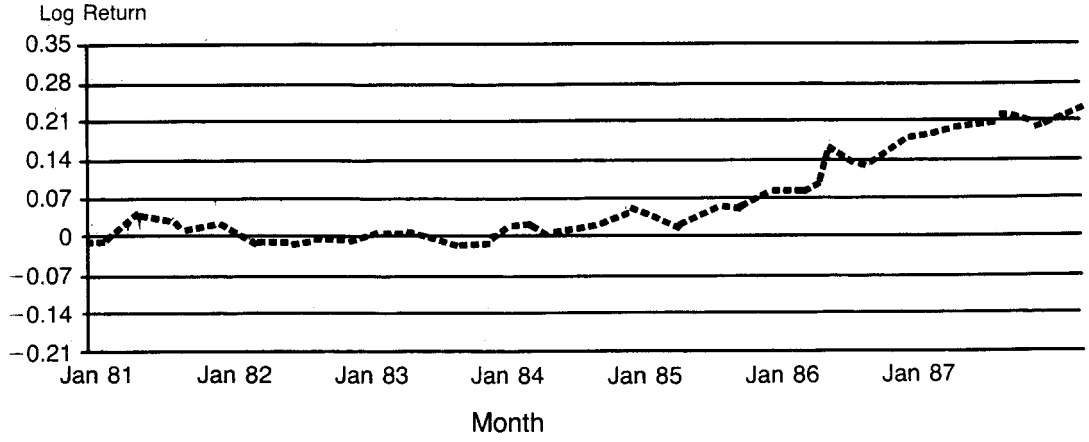
## Conclusion

Over the decade of the 1980's, there has been significant value to S&P 500 membership. Stocks in the S&P 500 performed about 3.9% per year better than similar stocks outside of the S&P 500. The performance in 1987 was 6% better.

The anomaly is difficult to see when you compare the raw returns of S&P 500 vs. non-S&P 500 stocks; it stands out more clearly when you control for differences between the two universes in terms of capitalization, industry concentration and so forth.

Price insensitive buyers — indexers, foreign buyers, or money managers evaluated against the S&P 500 — appear to be the cause.

**EXHIBIT VIII**
MSCIP Japanese Index Factor
Cumulative Logarithmic Returns
January 1981-December 1987




The phenomena is not limited to the S&P 500. We find that similar anomalies occur in other markets (Japan) and at other times (remember the "Nifty Fifty"). Astute investment managers can take advantage of these phenomena by anticipating their arrival, riding them up and getting out before the bubble bursts.

[1]See Harris and Gurel, "Prince and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressure" Journal of Finance, Vol XLI, #4, September 1986. Also see Arnott and Vincent "S&P 500 Additions and Deletions: A Market Anomaly", Journal of Portfolio Management, Fall, 1986. These studies focus on the short term effects of membership changes; i.e. what happens to a security when it is included in the S&P 500. They find that prices rise after inclusion and fall after deletion. The duration of the price change is about one month. Our research focuses on the returns associated with membership over long periods of time, rather than with changes in status over the short haul.

[2] The sample period was selected to start in January 1973 because our third test uses the BARRA risk model which dates from January 1973.

[3] Capital Asset Pricing Model; see William Sharpe's text, Investments, McGraw Hill, third edition, 1985.

[4] The FRMSU (Fundamental Risk Management Service Universe) is a value weighted portfolio of about 7000 equities traded in the US.

[5] Using a general least-squares regression.

[6] These include SIZE (capitalization), YIELD, BOOK to PRICE, EARNINGS to PRICE, SUCCESS (a momentum measure), VIM (a risk measure), and 6 others measure liquidity, cylicals, growth, financial leverage, foreign income, and labor intensity.

[7] This estimate is most likely biased toward the high side because of multi-collinearity with SIZE, the factor that BARRA uses to capture a firm's capitalization and total assets. When we added the S&P 500 membership factor to our estimation the returns on the other BARRA factors did not change in any significant manner. The exception was SIZE, whose return of about -1.44% per year (i.e. net of other effects, smaller firms have done better than larger firms in the 80's) decreased to -3.00% per year. If we credit most of this decrease to the S&P 500 membership factor, then that would reduce our estimate by about 1% per year. It should be noted that the same multi-collinearity problem was present in the 1970s and we found no significant positive or negative returns associated with S&P 500 membership.

[8] Get out your dog-eared copy of Samuelson's, Economics.