The Small Cap Falsehood

By Michael Edesess
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The supposed outperformance of small cap stocks is a foundational precept on which many respected asset managers have staked their expertise over the years – foremost among them, Dimensional Fund Advisors (DFA), the famed fund company that has gained a near-religious following since they popularized small cap indexing three decades ago. A growing body of research, however, shows no such advantage for the last 30 years and, now, a new study seems to have proven that the supposed small-cap advantage may have never existed in the first place.

The paper, which appeared in September in *Financial Advisor Magazine*, was written by Gary A. Miller and Scott A. MacKillop of Wyoming-based Frontier Asset Management, and it began with this startling claim:

> "The results show that, in the 1936-1975 period, the common stock of small firms had, on average, higher risk-adjusted returns than the common stock of larger firms." That one sentence, which appeared in a paper by Rolf Banz published in the Journal of Financial Economics in 1981, is the foundation for the investment truism, "Small stocks beat large stocks." As it turns out, Banz was wrong.

And MacKillop and Miller are right, as my own analysis confirms. As we shall see, not only was Banz wrong but so, later, were Eugene Fama and Kenneth French, as well as a number of others who have asserted expertise on this subject.

The "science" of investing

The truism that small caps beat large stocks has been one of the foremost reasons advanced to explain the success of DFA, the firm that first created and marketed small-stock index funds. I hadn't looked at DFA's website in a while, so I decided to check it out.

The first thing I saw was a prominent photo of Nobel laureate Robert C. Merton, identifying him as "Resident Scientist." A link on the page invites you to take a tour of the website. I clicked it. The second sentence on the next page says, "Over the years, we have translated financial science into real world investment solutions." Reading further, I found that the word "science," especially in the combination "financial science," is all over the site.

Hogwash. Finance is not a science. Investment experts who serve a tour of duty in a financial firm, no matter how many Nobel prizes they have won, are not scientists.

How little they are scientists we shall soon see. But first, a bit of history.

The origins of DFA

In the early 1970s the idea of passive investing and indexing began to take hold among financial academicians and in-the-know institutional investors, because a growing body of literature showed that active investing added nothing to performance – and subtracted its fees.

The first institutional index fund, a Samsonite Corporation pension fund with only $6 million invested, was managed by Wells Fargo. The managers found it too difficult to include all stocks in a value-weighted index fund – some of them would have had only a few dollars or even pennies invested in them – so they decided to index the Standard & Poors 500 stocks. The idea of indexing to the S&P 500 stuck – so much so that many people today still think that indexing means to hold a value-weighted portfolio of the S&P 500. In the early 1970s, several managers began to manage S&P 500 index funds, including Vanguard.

But that wasn't exactly what the academics called for. Rather, theory dictated that the most efficient portfolio should hold *all* stocks, not just the large ones in the S&P.

Enter the small cap fund. A sensible argument, made by the DFA founders, for buying a small cap index fund, was that as an enlightened investor – who knows that the most efficient portfolio is the most diversified one – you're not fully diversified if you only hold the S&P 500. In order to approximate the full stock market portfolio that investment theory implies is optimal, you need to add a small cap index fund.

It didn't hurt that a graph– using Banz's data – showed that the growth of wealth invested in small caps from 1936-1975 would have been much greater than the growth of an investment in the S&P. So you had two reasons, perhaps three, to invest in a small cap index fund: diversification, better returns, and savings on fees, which would be lower in a small cap index fund than in an actively managed one.

What happens when your company grows into a behemoth

I highly recommend journalist Joe Nocera's 1995 book, A Piece of the Action: How the Middle Class Joined the Money Class. It shows how America's middle class started piling on debt as early as the late 1950s; but it also provides some interesting history of financial firms that are now very large, like Bank of America and Merrill Lynch. Whatever you may think of these firms now, they started with the best of intentions, and on the highest moral ground – like Google – but that didn't guarantee that they would stay there. Those two banks grew rapidly, and the same reasons they both approached the brink of failure in 2008 could threaten the success of DFA as well.

Somehow, from the marketing success of the small cap fund, and subsequently its value funds, DFA acquired a reputation for being in the forefront of "scientific investing." This owes, in large part, to a widely cited 1992 article by Fama and French, who were DFA board members at the time – and still are. The article purported to document the historical small cap effect that is now coming under such doubt.

What DFA actually did was to develop a passive trading approach. This succeeded beyond their wildest dreams, managing to glean for them enough basis points so that they slightly beat their own indexes, even after fees.

That modest success, however, would hardly be enough to support a grand strategy of marketing the firm as being in the forefront of "science." For that narrative to take root, DFA's prominent directors with academic credentials, like Fama and French, and their widely cited papers filled with impressive-seeming mathematical contortions were a crucial element.

The Miller/MacKillop thesis

The Banz paper claimed that small caps not only grew faster than the S&P 500 over the 1936-1975 period but that they beat it on a risk-adjusted basis too. This became known as the "small cap effect." It was reaffirmed in the 1992 Fama-French paper.

It is now widely known, however, that after the Banz paper was published in 1981, and after DFA introduced its small cap fund, the small cap effect went the way of what I call the Schwert rule: "After they are documented and analyzed in the academic literature, anomalies often seem to disappear, reverse, or attenuate."

Miller and MacKillop, who believe in the Schwert rule, set out to perform another check on the small cap effect in the post-1981 period to corroborate the results of other studies. Their research did corroborate those studies – including recent investigations by Fama and French themselves – by finding no small cap alpha in that period.

Out of curiosity, and having the data at hand, they then checked out the small cap effect over the whole period 1926-2010 – and found none.

This piqued their curiosity further, so they tried reinvestigating only the period, 1936-1975, of the Banz paper, as well as the whole pre-Banz period for which data were available, 1926-1981.

Lo and behold: contrary to the findings of Banz, and of Fama and French, they found no small cap effect – there was simply no superior risk-adjusted small cap performance in those periods whatsoever.

The methodological differences

To explain the differences between their results and those of their famed predecessors, Miller and MacKillop point to several possible factors. For one thing, the portfolios they use to represent small caps and large stocks are not the same as those used by Banz or by Fama and French. Moreover, the data in the CRSP database has been revised since those earlier studies, and MacKillop and Miller use "annualized" returns, while the others used monthly returns.

Unfortunately, their use of the term "annualized" is a misnomer, muddying the important underlying explanation.

What Miller and MacKillop actually do is to use log-returns instead of ordinary monthly returns. The log-return – sometimes called the continuously-compounded return or continuous return – is the natural logarithm of one plus the ordinary return. Hence, if the monthly return is 6.18%, the log-return – the continuously-compounded return – is the natural logarithm of 1.0618, or 6.00%. If a 6.00% return were compounded continuously (i.e., every split nanosecond) for a month, then the monthly return you would actually get is 6.18%.

What is wrong with Banz and Fama and French

I taught statistics to business students for three years while I was in graduate school. One of the things you try to teach students is to remember the assumptions behind the statistical methodologies. For regression analysis, a key assumption is that the underlying distributions of the random variables are normal.

Unfortunately, most people just ignore the assumptions altogether. This is too often the case in the financial field. Specifically, monthly returns are obviously not going to fit a normal distribution, because they are not symmetrical – they are limited to -100% on the downside, while they are unlimited on the upside. The log-return distribution may be symmetrical, but not the distribution of the returns themselves. Miller and MacKillop do the appropriate thing by transforming all returns to log-returns so as to better fit the assumptions of the regression method. The others, as far as I can discern, do not.

Can this change in the methodology alone account for Miller and MacKillop's different results?

Yes it can.

I performed a test to answer this question. Anyone who wishes to may replicate the analysis. Here are the details. I started by generating 1,000 sequences of 1,020 random monthly small cap and large stock returns (1,020 = 12 months x 85 years). In this process,

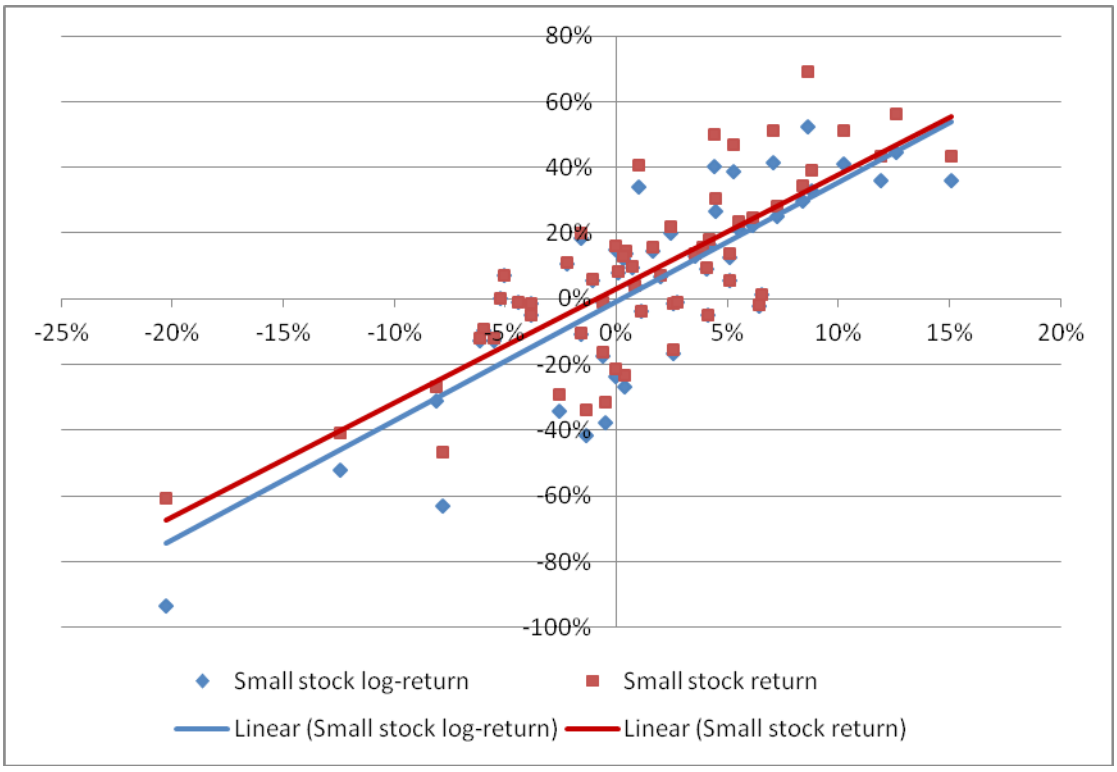
I assumed that the expected annual risk premium (premium log-return) of large stocks was 6% with a standard deviation of 20%, and that the premium of small caps had a standard deviation of 35% and that its beta with large stocks was 1.5. This implies that small caps' expected premium was 9% (1.5 times 6%).

When I ran regressions on the resulting log-returns, the alphas averaged zero – as expected, because the data were designed that way.

But when I regressed the ordinary monthly returns, the average alpha came out about 0.25%, which annualizes to about 3% a year. This implies that Banz's findings – and those of Fama and French as well – are spurious, the result of failing to transform the data so that they fit the assumptions of regression analysis.

Their error can be more easily understood by looking at Chart 1. The assumptions for beta and the standard deviation of small caps have been exaggerated, and the number of years of monthly data has been altered to make the visual effect clearer.

Chart 1.



The squares represent the ordinary returns, while the diamonds represent the corresponding log-returns. Note the upward skew of the ordinary returns relative to the log-returns at high and low values. The result is that the regression line for the log-returns

goes through the origin (alpha = 0) while the regression line for the ordinary returns has a positive alpha.

It is surprising that this most basic requirement – that it must be possible to reasonably assume that the underlying variables approximately fit a normal distribution – has been neglected in such widely quoted academic studies. Unfortunately, this is often the state of science in the world of finance.

That should put the nail in the coffin of the small cap effect. It's quite possible that it calls into question the value effect as well.

When you see the word "science" used in the financial field, always smell a rat.

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