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Editor

## Disentangling Size and Value

The finance community has published thousands of articles and doctoral dissertations exploring the size effect, the value effect, the momentum effect, and various combinations and permutations of the three—now often referred to as the “Fama–French factors.” In the long run, small-cap stocks typically beat large-cap stocks and high-book-to-price stocks beat low-B/P stocks. Strong-momentum stocks, the weakest of the three effects, typically beat weak-momentum stocks in the very long run (e.g., 10 years).

The problem is that size is typically defined by market capitalization. But capitalization is a product of the size of a company—typically measured as sales, earnings, or book value—multiplied by, respectively, the company’s price-to-sales ratio (P/S), price-to-earnings ratio (P/E), or price-to-book ratio (P/B). So, market capitalization is a tangled combination of size and growth.

In measuring the value factor, the typical approach compares high-B/P (book value to price) stocks with low-B/P stocks (or a related valuation ratio), after a universe of stocks has first been selected based on capitalization. Again, the size factor and the value factor are tangled together.

Even momentum is based on whether a stock has recently performed well or badly *relative to* the cap-weighted market as a whole, with the strong performers and weak performers often then assembled into cap-weighted portfolios.

Researchers have explored a whole raft of “market anomalies” that are frequently defined and tested on a cap-weighted basis after first stripping out the impact of these three primary “anomalies” (or at least the size and value effects). When the analyses of these other market anomalies are cap weighted, and perhaps also partitioned by value versus growth, size and “style” become interconnected in ways that can make it difficult to measure the true importance of these anomalies.

Some have challenged the industry’s reliance on cap-weighted models. Berk (1997) observed that the size and value measures are strongly interconnected, that the true size effect is only a small fraction as powerful as it is generally perceived to be, and that the remaining (modest) size effect is largely a function of the higher risk of small-cap companies. Some in the behavioral finance community have advanced the hypothesis that most risk factors, and many so-called anomalies, proxy for a single risk factor that reflects investor preference for “admired” stocks and aversion to “perceived risk,” both of which are correlated with size, growth–value, and momentum.<sup>1</sup>

Some of these papers have garnered less visibility than they may deserve, perhaps because they challenged efficient market orthodoxy. But even generally accepted orthodoxy deserves scrutiny. In this issue of the *FAJ*, Harry Markowitz shows that if share prices are efficient—i.e., have a true fair value that is symmetrical and unbiased around the current price—the market portfolio must be mean–variance *inefficient* except in the trivial case in which all the underlying assumptions of the capital asset pricing model are accepted as correct.<sup>2</sup> Reciprocally, if the market portfolio is efficient, then the pricing mechanism for individual assets must be biased and inefficient.

## How Big Is the Size Effect, Really?

How does a stock get “large” in market capitalization? One way is to be the stock of a big company (as long as it’s not traded at steeply discounted valuation ratios). The other is to be a small company sporting a lofty valuation multiple. Three of the four largest-cap companies today, General Electric Company, Citigroup, and Exxon Mobil Corporation, are examples of very big companies. At the top of the bubble in February of 2000, Cisco Systems was an example of a small company with lofty valuation.

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Accordingly, in our assessment of the size effect, we aren't measuring big versus small stocks; we're measuring mostly big, mostly growth stocks versus mostly small, mostly value stocks. Indeed, it's a bit worse than this. On the small end of the spectrum, because we're typically screening the small stocks for market capitalization, the low-multiple small value companies can drop off our radar screens altogether.

Assuming our style measures are tangling the traditional measure of size together with the traditional measure of value, what happens if we disentangle them? Consider **Table 1**.<sup>3</sup> Panel A of Table 1 shows the relative performance of the smallest versus largest companies, with size first defined as market capitalization, then as book value, and finally as sales. Panel B shows that the "small-stock effect" is roughly one-third as powerful (on a log scale) when size is measured as sales as it is when size is based on capitalization. In other words, two-thirds of the return associated with the size effect is evidently attributable to the P/S component of market capitalization—a *value* effect—whereas only one-third is a true size effect. Berk observed that this more modest size effect is warranted: Most small companies are fundamentally riskier than most large companies.

**Table 1. Proceeds of \$1.00 Invested by Size Deciles and Size Variable; Small-to-Large Ratios, 1967–1987**

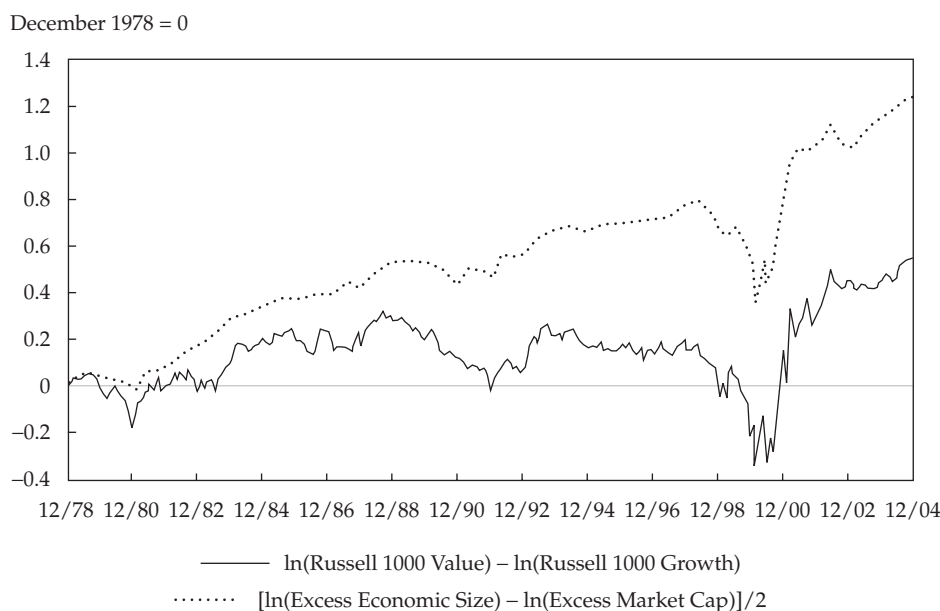
Size Decile	Capitalization	Book Value	Sales
<i>A. Performance by deciles</i>			
Largest decile	\$ 7.30	\$ 9.95	\$10.17
Large, Deciles 8–9 combined	9.21	11.93	13.05
Deciles 4–7 combined	11.71	12.99	13.10
Small, Deciles 2–3 combined	20.28	15.79	16.46
Smallest decile	40.51	22.99	18.44
<i>B. Small-to-large ratios</i>			
ln(Smallest/Largest)	1.71	0.84	0.60
ln(Small/Large)	0.79	0.28	0.23

### How Big Is the Value Effect, Really?

If capitalization derives some of its efficacy from the value effect, is the value effect more powerful than it seems? Emphatically *yes*.

Suppose we define the value effect classically as a cap-weighted index of the "value" (defined for the moment as high-B/P) stocks against a cap-weighted index of the "growth" (low-B/P) stocks.<sup>4</sup> The solid line in **Figure 1** shows the performance of the Russell indexes defined in this way—the log of the Russell 1000 Value Total Return Index less the log of the Russell 1000 Growth Total Return Index.

**Figure 1. Assessing the Value Effect: Cap-Weighted Indexes vs. Pure Value, 1979–2004**



The jagged rise of the line to 0.55 divided by the 26-year span that's covered in Figure 1 implies a 2.1 percentage point premium for the value investor over the return for the growth investor. This premium is an important potential source of profits; indeed, it exceeds the risk premium of stocks relative to bonds over the 1979–2004 period. But the gain is a hard-earned roller-coaster ride, with 10.4 percent annual volatility in the return difference.

Now, let's try to define a purer measure of growth versus value, one unadulterated by capitalization effects. Suppose we define company size by the size of the company in the economy. For the "capitalization scale," we measure a company's size as its current percentage of total market capitalization. For the "economic scale," we measure a company's size as its current percentage of the total economy. To do so, we use sales, cash flow, book value, and dividend distributions and then average these percentage weightings.<sup>5</sup>

Suppose we take the simple difference between those two measures of size. If a company is larger on the market-cap scale than it is on the economic scale, we count it as a growth stock *but only to the extent that its capitalization exceeds its economic size*. In other words, if a company is 2 percent of market capitalization and 1.5 percent of the economy, we count only the 0.5 percent difference. We might call this a portfolio of "Excess Market Cap." Reciprocally, if it is a larger share of the economy than of stock market capitalization, we count it as a value stock *but only to the extent that its economic size exceeds its capitalization*, creating an "Excess Economic Size" portfolio.

If we construct a growth portfolio and a value portfolio in this fashion and measure the difference between them, we will have portfolios comprising deeper growth and deeper value stocks than in the conventional framework, where borderline companies are dropped into one or the other basket.

Therefore, to approximately match the monthly volatility of the conventional growth-versus-value comparison, we apply a 50 percent multiplier to the return differential. The result, as shown by the dotted line in Figure 1, is remarkable: Volatility for this redefined "value-versus-growth" measure falls from 10.4 percent to 9.2 percent, and annual value added soars from 2.1 percentage points to 4.7 percentage points. Reconstituted in this fashion, the value effect is nearly three times more powerful than it is commonly thought to be.<sup>6</sup>

## Implications

Our industry has been seduced by the elegance of the theoretical models on which we rely. Because theory tells us that the market-clearing portfolio is a mean–variance efficient portfolio, we fail to look at other notions of efficiency, as Markowitz has done. And we fail to consider ways other than market capitalization to gauge size.

We have a tendency to reject alternatives as theoretically unsound, even though most of us acknowledge that theory, even at its best, is based on simplifying assumptions that are not always accurate. For this reason, theory merely *approximates* reality. The result, as the performance measurement industry has matured, is that habit conditions us to measure the impact of our size and value bets in a way that tangles the two effects together rather than allowing us to measure them separately.

When we separate the size effect from the value-versus-growth effect, we find that size as measured by market capitalization is far less powerful than is generally believed. And, reciprocally, the value effect—because some of its efficacy has been siphoned off by the mislabeled size effect—is far more powerful and more consistent than is generally believed.

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## Notes

1. For example, Shefrin and Statman (1994); Clarke and Statman (1994); Shefrin and Statman (1995). As a 20-something novice author, I even chipped in a take on this issue (Arnott 1988; first published in 1983).
2. That is, no taxes, no difference between borrowing and lending rates, a well-defined risk-free rate, no differences among investor risk tolerances, a willingness to leverage without limit, and so forth.
3. Table 1 is adapted from Berk's 1997 paper. In this adaptation, I combined some of the middle deciles because it matters little whether Deciles 5 and 6, for instance, are monotonic. Table 1 also shows the ratio differences of the smallest relative to the largest and of the small (Deciles 2–3) relative to the large (Deciles 8–9).
4. Although it makes little difference whether we use earnings/price, book/price, or sales/price to distinguish value from growth, much of the investment world has gravitated toward using B/P.
5. This method, explored in Arnott, Hsu, and Moore (2005), is certainly not the only way to measure economic size. The important issue is that the measure of economic size, in order for this exercise to strip away any value-versus-growth bias, should be valuation indifferent.
6. The *t*-statistic rises from 1.2 to 3.1 as we move from a conventional definition of value versus growth to the alternative approach.

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