

David and Goliath: *Who Wins the Quantitative Battle?*

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The story of David and Goliath and their epic battle is one of the most durable stories of the Old Testament, cited as the quintessential improbable victory of an underdog over an odds-on favorite.

But as Gladwell [2013] reminds us in his book *David and Goliath*, “the problem with that version of the events is that almost everything about it is wrong.” Fact is, the ancient armies of biblical times depended on corps of well-trained slingers of stones. The best of the slingers were able to hit a bird in midflight (or so it was said). Not only did David, a simple shepherd boy, develop those remarkable skills, but without armor he could move around freely when his battle with Goliath began.

Although Goliath is a giant (height: six cubits and a span), he is carrying a sword and a spear and is weighed down with a bronze helmet and a coat of mail the weight of 5,000 bronze shekels. When Goliath commands David, “come to me,” David runs toward him and lets his missile fly. Within a split second, the stone sinks into the Philistine’s forehead. Down he goes. David grabs his sword and lops off his head. End of story.

But, no, David and Goliath is *not*, in Gladwell’s telling, a “battle won miraculously by an underdog who should not have won at all” [2013]. Quite the reverse. David had the advantage of speed and weaponry.

Indeed, Gladwell cites one historian’s conclusion: “Goliath had as much chance against David as any bronze-age warrior with a sword would have had against an opponent armed with a 0.45 automatic pistol” [2013].

What the heck does this classic ancient battle have to do with quantitative investing? As I see it, the plain and simple, well-armed, lightly dressed, unencumbered shepherd is the classic index fund—a portfolio holding all 500 stocks in the S&P 500 Index. The David approach to investing, then, is to “buy a diversified portfolio of stocks operated at rock-bottom costs, and hold it forever.” The index fund relies on simple arithmetic, a mathematical tautology that could be calculated by a second grader: *gross return in the stock market, minus the frictional costs of investing, equals the net return shared by all investors as a group*. Taking the lion’s share of those costs out of the equation is the key to successful long-term investing.

In contrast, many (most?) Goliaths of academia and quantitative investing believe the contrary: the application of multiple complex equations—the language of science and technology, of engineering and mathematics (yes, STEM), developed with computers processing “big data,” and trading stocks at the speed of light—makes our Goliaths far stronger and more powerful than we indexing Davids. The question posed in my title is essentially, “who wins?”—the *arithmetic* quants or the *algorithmic* quants.

ARITHMETIC QUANTS AND ALGORITHMIC QUANTS

The armor of the algorithmic quants—the managers of hedge funds and other aggressive pools of capital—is expensive. It costs money, and lots of it. But even if a manager succeeds in consistently outpacing the risk-adjusted returns of the S&P 500—no mean task—high fees place a heavy burden on the returns that are actually delivered to clients. The arithmetic quants typically earn the returns on the S&P 500 by holding its stocks—and charge almost nothing for doing so. Let's compare the costs of these rivals in the battle to provide optimal returns:

- Hedge funds (so-called—actually concentrated investment accounts that offer a wide variety of strategies) manage about \$2.8 trillion of assets, at a cost equal to at least 3% of assets per year (300 basis points, an informed guess), generating some \$84 billion in annual fees. Goliath runs a profitable business!
- Vanguard, the prototypical David, supervises about the same amount of assets (\$3 trillion), of which index funds represent \$2 trillion. The costs of supervising these index portfolios come to about \$400 million annually, or 0.02% per year (two basis points)—less than 1/100th of the hedge fund rate. Administering the index funds and handling the accounts of some 15 million index shareholders cost another \$1.2 billion, adding 0.06% (six basis points) to bring the aggregate expense ratio to 8 basis points.

Arithmetic investing, then, has a huge advantage in costs over algorithmic investing, both in dollars (\$83 billion *per year!*) and ratios (292 basis points). These two approaches to money management are polar opposites. The pool of assets managed by the algorithmic quants is run by (largely) brilliant managers, many with PhDs, and most with a complex quantitative approach that relies on multiple equations. They are academic to a fault. Their brilliance dazzles even the vast corps of our universities' financial engineers, who emulate them. They assume extra-market risks and typically demand—and receive—very high compensation for their work (2% of assets and 20% of returns ain't hay!).

At the other extreme, of course, are the Vanguard index funds. They have no manager in the conventional sense.

Their math is arithmetic, not calculus. They assume only market risk, neither more nor less, and the fees they charge are too small to be believed. And so the battle is joined. The heavily armed and armored hedge-fund Goliaths versus the simple unencumbered index fund David. Who will better serve the long-term investor?

MUTUAL FUNDS—CAUGHT IN THE MIDDLE

Caught in the middle of the battle between the complex and the simple is America's largest single financial institution, the \$16 trillion mutual fund industry. Fees for its actively managed equity funds are high—125 basis points on an unweighted basis, 85 basis points when weighted by each fund's assets. Their managers tend to lag the market by the amount of their costs—not only their expense ratios, but their portfolio turnover costs, opportunity costs (the drag of cash positions), and sales loads and distribution fees. If you estimate the all-in annual cost of investing in equity mutual funds at 200 to 300 basis points, you won't be far off the mark.

What's more, most active equity mutual funds today have taken on a "closet indexing" character. The 10-year return of the S&P 500 Index explains 96% of the return earned by funds in Morningstar's large-cap blend style box (R -squared = 0.9552). Further, and much more than parenthetically, the vast majority of these managers must deal with a profound conflict of interest—the outside ownership of fund managers. Forty of the fifty largest fund firms are owned by financial conglomerates and/or public shareholders. That conflict of interest between fund shareholders and management company shareholders—separate enterprises under virtually identical management control, and therefore with two conflicting sets of fiduciary responsibilities—is, finally, unacceptable. Neither hedge fund fish nor index fund fowl, actively managed mutual funds, with their flawed nature and structure, mark an industry that is ripe for disruption.

BACKGROUND

My first article for the Institute for Quantitative Finance (the Q-Group) was presented in 1984, 32 years ago, only a few years after the introduction of the first personal computers that were already changing our profession. My title was "Statistics and Suicide" (Bogle [1984]). I concluded with a caution about

excessive reliance on data at the expense of judgment. The closing quotation warned against assuming that “what can’t be easily measured isn’t very important... or doesn’t really exist. This is suicide.” (Hence, the title.)

My next article was “The Search for the Holy Grail” (Bogle [1998]) of market-beating long-run returns. I described the task during the late 20th century as “frustrating.” So far in the 21st century, such returns seem even more out of reach. Yet, the holy grail of investing remains just as it was in 1998: “to realize the highest portion of the return provided by each class of financial assets in which you invest—*recognizing* (for investors as a group) *that portion will be less than 100%*” (italics in original).

Since my 1998 article, the mutual fund industry has boomed—stock and bond fund assets have risen three-fold plus, from \$3.8 trillion to \$13.8 trillion. The assets of actively managed equity mutual funds have risen 2.5 times to \$9.6 trillion. But index fund assets have risen 16 times to \$4.2 trillion—six times as fast. The indexed share of equity fund assets has risen from 9% to 36%. This remarkable trend is but the beginning of the disruption the fund industry faces.

THE CREATION OF VANGUARD AND THE FIRST INDEX MUTUAL FUND

The creation of Vanguard and the formation of the world’s first index mutual fund represent twin halves of a concept that is reshaping the mutual fund industry. On September 24, 1974, a new mutual fund firm was incorporated. Its name: The Vanguard Group. We described it as “the Vanguard Experiment,” because the firm adopted a corporate structure without precedent in the fund business.

The new organization would be the first (and to this day, only) *mutual* mutual fund organization—run not by an external management company seeking to earn high profits for its own shareholders, but by the funds themselves, and ultimately by the fund shareholders. The firm would operate the funds on an “at-cost” basis. It sought to serve only its owners and to become the world’s lowest-cost provider of mutual fund services.

It took a near miracle for Vanguard to come into existence. Its creation was the result of a compromise solution for an ugly fight for control of Wellington Management Company. The firm’s once-promising

merger with a group of speculative investment managers of the “go-go era” of 1964–1968 (Thorndike, Doran, Paine, and Lewis) had turned to acrimony and failure as the 1972–1974 bear market took hold; the performance of the funds, then supervised by the new money managers, was catastrophic. But it was Wellington Management’s CEO (your author) who was fired in January 1974. I was not amused by the outcome. I had lost my job. My career in the industry that I loved was seemingly over.

My next move required a strong dose of determination. Despite the loss of my job at the *management company*, I continued to serve as chairman and CEO of the *mutual funds*—Wellington Fund and its sister funds. I decided to take a long shot: to persuade the directors—who were largely independent of the management company board—to “mutualize” the entire firm. That proposal quickly died, but the board reached a compromise. I would continue to lead the funds, a partial mutualization in which they would be responsible solely for their administration. My former partners would continue to control the investment management and marketing functions, which Vanguard would be barred from undertaking. (They were also awarded the Wellington name. I was furious.)

ESCAPING THE SHACKLES

On May 1, 1975, the new contracts lowering the advisory fees that our funds paid to the management company became effective. But I was not so dumb as to think I could build a great new firm without controlling the kinds of funds that we would offer, their performance objectives, and their marketing and distribution. What could we do to escape those shackles? The index fund! At the initial fall meeting of the Vanguard board of directors in September 1975, I presented the first strategic move for the new firm: a recommendation that Vanguard start the world’s first index fund, modeled on the S&P 500. Because it required no management (or so I argued to the board), it didn’t violate our agreement not to engage in investment management. Indexing was an idea that had first crossed my mind back in 1951 at Princeton University. In my senior thesis, “The Economic Role of the Investment Company” (Bogle [2015]), I wrote that mutual funds “may make no claim to superiority over the market averages.” That deeply planted early idea returned to my mind when

“Challenge to Judgment,” by Nobel laureate professor Paul A. Samuelson, was published in the first issue of *The Journal of Portfolio Management* on September 30, 1974.

In his article, Dr. Samuelson reported finding no “brute evidence” that fund managers could systematically outperform “on a repeatable, sustained basis” the returns of the S&P 500 Index. He made the case that someone, somewhere, must start such an index fund. His challenge struck me like a bolt of lightning. It was only a week after Vanguard began that I read his article—an amazing coincidence. Dr. Samuelson’s JPM article would give me the credibility I needed to persuade the board to approve the creation of the world’s first index mutual fund.

EXHIBIT A: THE SAMUELSON PAPER

Given the strife preceding Vanguard’s birth, I knew that my objectivity would be questioned by the board. So I marked Dr. Samuelson’s article “EXHIBIT A” in my presentation, placed even ahead of the data that validated my proposal. That second exhibit presented my proof that indexing had worked in the past. I tabulated the annual returns for each equity mutual fund between 1945 and 1975 and then calculated the simple average, comparing it to the S&P 500. The S&P 500 Index won by 1.6 percentage points per year, 11.3% to 9.7%, hard statistical evidence—“brute evidence”—of the superiority of the index over active funds, confirming the tentative conclusion that I reached in my thesis 24 years earlier. Without nearly as much controversy as I had expected, the board approved my proposal by unanimous vote.

Winning the board’s approval turned out to be the easy part. The tough part was raising the initial capital for the index fund. I wore out a lot of shoe leather walking up and down Wall Street, trying to find underwriters to manage our initial public offering (IPO). At last, I recruited the Street’s then-four-largest retail brokers, led by Dean Witter. They expected to raise \$150 million in the initial offering.

Wrong! The IPO was a flop: \$11.3 million. The underwriters suggested that we accept the failure and return the investors’ money. But I wouldn’t hear of it. After all, the world’s first index mutual fund was ours, and it could now begin. On August 31, 1976, it did. Its subsequent reception was, well, underwhelming. It was called “Bogle’s Folly,” and a poster was circulated

around Wall Street reading, “Help Stamp Out Index Funds. INDEX FUNDS ARE UNAMERICAN.” In part because of that dismal reception, acceptance by the public of the index fund was close to zero. During the first five years, it drew total new capital of a mere \$17 million from investors. Nearly a decade elapsed until the second index fund was formed (in 1984, by Wells Fargo)—and it was not until the mid-1990s that index funds began to gain the traction with investors that they have enjoyed ever since.

WHY VANGUARD?

In retrospect, we became the index pioneer because, while every mutual fund sponsor had the *opportunity* to be the creator, only Vanguard had both the *opportunity* and the *motive*. Actually, we had two interlinked motives: our drive to be the industry’s low-cost provider and our need for a transformative innovation that would help to assure the success of our “experiment.” And so it proved to be. In mid-2016, our index fund assets totaled \$2.2 trillion, almost three-quarters of the \$3 trillion stock and bond fund assets under our management. (Vanguard also managed \$180 billion in money market funds.)

Looking back, I confess to amazement at our ability to surmount the roadblocks that faced the small, new fund firm, which would suffer net cash outflows for 83 consecutive months. Without the Vanguard *structure* and the index fund *strategy*, our survival would have been unlikely. But if the mark of a good idea is that others emulate it, both our structure and our index fund flunked the test. Dr. Samuelson was almost alone in his recognition of that link between structure and strategy. In 1993, just before both Vanguard and the index fund at last began to gain momentum in the marketplace, here’s what he wrote in the foreword to my first book: “John Bogle has changed a basic industry in the optimal direction. Of very few can this be said” (Samuelson [2015]).

Without Vanguard, the creation of the index fund likely would have been delayed by another decade or two, and the mutual structure has yet to be copied. Yet today, this combination of mutuality and indexing is the force that is reshaping the mutual fund industry—indeed, a force reshaping the entire world of finance. Victor Hugo got it right: “No army can resist the power of an idea whose time has come.”

EMH AND CMH

Now I'd like to take this opportunity to give the lie to the conventional belief that the "efficient markets hypothesis" (EMH) was the inspiration for my creation of the index mutual fund. The history of the EMH can be traced back at least as far as the late nineteenth century, when a young French mathematician named Louis Bachelier was studying at the University of Paris. In 1892, he spent time observing the chaotic trading at the Bourse, imagining the Bourse as a casino where the traders play an elaborate game of chance.¹ At the Sorbonne, he worked with the great physicist and mathematician Henri Poincare and earned his doctorate.

Bachelier completed his dissertation in 1900. He concluded that "market prices reflect the true value of the things being traded, because they incorporate all available information" (Weatherall [2013])—essentially what we now call the EMH, imperfect as it has proven to be. His work did not impress his readers, and he failed to earn the highest distinction—a prerequisite to continuing his work at one of France's elite universities. His career had effectively ended.

But that was not the end of the story. In a seminal moment in quantitative history, Paul Samuelson came across Bachelier's dissertation in the MIT library in the early 1950s, published with the title "Theory of Speculation." It became required reading in Samuelson's MIT class, and part of the economics canon. The conclusion of the thesis: "*The mathematical expectation of the speculator is zero.*"

Well, No. The mathematical expectation of the speculator is not zero. *It is zero less transaction costs.* Just as in the casino, where the mathematical expectation of the gambler is zero, less the "take" of the house. When he ignored the inevitable friction of transaction costs, Bachelier was hardly the first mathematician to make simplifying assumptions about his model. Nor, to state the obvious, was he the last. But such oversimplification can—and did—create a flawed conclusion.²

THE QUANTITATIVE SCHOOL OR THE PRAGMATIC SCHOOL?

In 1965, Eugene Fama of the University of Chicago wrote "The Behavior of Stock-Market Prices." This article solidified his role as a leader in the EMH movement and ultimately led to his winning the Nobel Prize

in economic sciences in 2013. But as I was preparing to create the first index mutual fund in 1975, I knew *nothing* of the work on efficient markets being done in Chicago. I had never heard of the EMH, nor of Professor Fama. ("Shame on Bogle," you may be thinking.) What I have called the *Quantitative School* of indexing was led by brilliant masters of mathematics, of algebra and calculus and simultaneous equations—such as James Vertin, William Fouse, and John (Mac) McQuown at Wells Fargo, and William Sharpe at Stanford.

Their work, had I been aware of it, would have been way over my head. No, I was part of the *Pragmatic School* of indexing, supported by two great pillars: (1) the *principle* that, for investors as a group, gross market return minus cost equals net market return, and (2) the *evidence*, brute evidence, that the investment returns earned by fund managers lag the S&P 500 returns with remarkable consistency. In a curious paradox, in his 1974 JPM article, Paul Samuelson—the consummate algorithmic quantifier—turned instead to the evidence provided by pragmatic arithmetic.

In my 1975 comparison of S&P 500 returns with equity fund returns over the previous three decades, I assembled just such brute evidence. It helped pave the way for the formation of that first index fund. Coincidentally, that 1.6 percentage points per year by which the funds had lagged the S&P 500 exactly matched the 1.6 percentage points per year gap during the most recent three decades (1985–2015).³ *The past proved to be prologue.* Since Dr. Samuelson made his demand in 1974, brute evidence has validated the implicit shortfall of fund returns to the S&P 500 (or to other more finely tuned indexes), a conclusion confirmed in countless studies and articles.

The EMH is now part of the algorithmic canon. But while markets are *usually* highly efficient (on both a macro and a micro basis), they experience exceptions—periodic aberrations that are often unpredictable and extreme. On the other hand, my own arithmetic model relies solely on the *Cost Matters Hypothesis* (CMH): Investors as a group earn the stock market's return *less the frictional costs of investing.* This arithmetic fact is insurmountable and prevails under *all* circumstances, without exception. (I've been using my CMH acronym as a contrast to the EMH acronym for more than two decades. Its acceptance, alas, has been even *less* enthusiastic than the disappointing early acceptance in the marketplace of our first index mutual fund.)

PASSIVE INDEXING AND ACTIVE MANAGEMENT TODAY

Despite the remarkable success of passive indexing in the mutual fund field—and especially at Vanguard—the traditional, original concept is in the process of radical change. Some \$2 trillion of today's \$4 trillion invested in index mutual funds has remained true to the spirit of the traditional S&P 500 index fund that Vanguard formed all those years ago—market-cap weighting, maximum diversification, minimum cost, and utter simplicity, designed for investors to hold *forever*. The other \$2 trillion is represented by the exchange-traded index fund, the ETF.

Through the ETF, indexing has become the darling not only of mutual fund sponsors, but of money managers, marketers, and financial promoters who have jumped on the index bandwagon. There are now 1,871 ETFs, offering an incredible variety of investment options, tied to almost as many indexes. Most of today's ETFs offer less diversification, higher costs, increased complexity, and sometimes even high leverage. In contrast to TIFs—traditional index funds based on Vanguard's original concept and held largely by “owners” (long-term holders)—ETFs are more heavily used by “renters” (short-term holders). (Like the CMH/EMH acronyms that I introduced earlier, these contrasting acronyms—TIF/ETF—have failed to capture the imagination of the trade.)

Twelve years ago, I spoke about what was coming. A speech that I gave in Washington, DC, in 2004 carried the impossibly long title, “CONVERGENCE! The Great Paradox: Just as Active Fund Management Becomes More and More Like Passive Indexing, So Passive Indexing Becomes More and More Like Active Fund Management” (Bogle [2011]).

The ETF is the major force driving this change in which passive indexing morphs into active management. The impact of ETFs goes far beyond the fund industry to the very nature of today's stock market. In recent years, the dollar volume of trading in ETFs has represented more than one-third of the dollar volume of trading in the U.S. stock market. Every day, just like clockwork, the “Spider” (State Street Global's Standard and Poor's Depository Receipts, the first and largest ETF) is the most widely traded stock in the world.

During the volatile first quarter of 2016, trading in ETFs rose to new heights, virtually equaling the trading in individual stocks. The dollar volume of trading in the

100 largest ETFs was \$4.34 trillion, while the volume in the 100 largest individual stocks was \$4.46 trillion. Given the far smaller market capitalization of these ETFs (\$1.5 trillion versus \$13 trillion), the annualized turnover of ETFs was 1100%, while the annualized turnover of stocks was 140%. Because excessive trading is the enemy of the investor, this trend troubles me deeply. Indeed, when Nathan Most, creator of the ETF, proposed to me in 1992 that we join forces and offer Vanguard's original S&P 500 Index Fund as the medium for his creation, I declined his offer, upholding the buy-and-hold principle on which our index fund was founded. I do not regret my decision.⁴

“SMART BETA”?

Today, about one-half of all ETF shares are held by banks and other financial institutions that trade them with a fury. The other half are held by individuals, in part by investors who tend to hold them because of their convenience, flexibility, and lower expense ratios than active funds. But, likely in larger part, they are held by those who have a short-term focus and confidence that they can out-trade their fellow speculators.

For those individual investors, “smart beta”—the promise of ETFs to capitalize on market sectors (“factors”) that are expected to enhance returns—has great momentum. Most observers seem to believe that this trend began a decade ago with the focus on “fundamentals” by the RAFI 1000 ETF and, a year later, the first WisdomTree ETF, which focused on a portfolio of stocks weighted by their dividend payouts rather than their market capitalizations.

The fanfare for this new (well, as it turned out, not really new) strategy was a bit over the top. Writing in the *Wall Street Journal* in July 2006, WisdomTree's Jeremy Siegel compared his variation on indexing to Copernicus and his “simple, sun-centered solar system,” which effectively destroyed the earth-centered Ptolemaic view of the universe. To the contrary, it is the traditional index fund that represents the Copernican approach to the simple, sun-centered financial system, not its off-center satellites.

NEW BRUTE EVIDENCE

RAFI 1000 and WisdomTree—at least so far—haven't destroyed anything. Since their inception through March 2016 (ten and nine years ago,

respectively), both have failed to capitalize on the “new paradigm” that Dr. Siegel described. RAFI 1000 has eked out a return margin of 50 basis points over Vanguard’s S&P 500 Index Fund (7.8% versus 7.3%), but only by assuming about 15% more risk (a standard deviation of 17.4% versus 15%). Result: Sharpe ratio of 0.38 for RAFI, lagging the 0.40 Sharpe ratio for the S&P 500.

WisdomTree Dividend had a slightly lower return than the S&P 500 with slightly lower risk: Sharpe Ratio 0.39 versus 0.41. Of course! When a portfolio holds essentially the same stocks as the index but weights them differently—and carries a higher expense ratio—aren’t those shortfalls in risk-adjusted return pretty much what we should have expected? *It is not that these funds have failed; it is simply that they have not succeeded.* No matter. The silly idea of “smart beta” (Dr. Sharpe says that the term “makes me sick”) is now the fad of the day.

Morningstar changes the term “smart beta” to “strategic beta”—a far more appropriate description for index funds that depart from the simple TIF all-market-cap-weighted model. This major provider of mutual fund data now counts 624 strategic beta funds—largely funds that favor various “factors,” essentially separate segments of the total stock market that demonstrate different investment characteristics.

So it is that investors can now speculate on almost any imaginable factor that fund managers and marketing entrepreneurs can conjure up, and trade one factor for another whenever the spirit moves them. (ETFs make it easy!) Among the factors: growth stocks and value stocks, large- and small-cap, and momentum. But trading among such factors is all too likely to be a loser’s game for investors. *That’s precisely what the long-unrecognized history of strategic beta tells us.*

THE FIRST FACTOR FUNDS

I know that history firsthand. Morningstar credits me with starting the *first* strategic beta funds. Way back in November 1992, we created two new funds, Vanguard Growth Index Fund and Vanguard Value Index Fund, dividing the stocks of S&P 500 into these two factors. Today, they hold assets of \$51 billion and \$40 billion, respectively, not only the oldest but by far the two largest of all strategic beta funds. *But strategic beta had absolutely nothing to do with my reasoning.*

In their inaugural annual report, I clearly stated the objective of these funds: to allow investors to own

a growth index (lower taxable yield, greater volatility) during the accumulation phase of their lives—their working years—and to move to a value index fund (higher yield, lower volatility) during the distribution phase, once they retire.

From their inception, I expressed my conviction that the returns of the two portfolios would converge in the long run and provide similar returns. (regression toward the mean [RTM] strikes again!) I warned investors “to stick to your objectives, rather than endeavoring (fruitlessly, I believe) to switch among these [two] market segments in the search for higher returns” (1994 Annual Report). “Such market timing is all too likely to be self-defeating” (1995 Annual Report).

IGNORING THE LESSONS OF HISTORY

Over their now 23-year history, the returns of these two factor funds have indeed converged: annual return for Growth Index, 9.0%; for Value Index, 9.1%. Our growth and value index funds have outpaced their respective peers by 160 basis points annually (large-cap growth funds) and by 120 basis points (large-cap value funds). (Their low expense ratios—9 basis points for Admiral and ETF shares, 23 basis points for Investor shares—accounted for most of that advantage.)⁵ That’s the good news.

The bad news is that, despite my warnings, market timing has been rife among the investors in these two index funds. To their sorrow, such investors learned the meaning of “self-defeating.” Since the funds’ inception in 1992, investors who bought and held earned an annual rate of return of about 9% on both the growth and value portfolios, yet the annual return that the average fund investor actually earned (IRR) was only about 6%. Simply put, the annual returns earned by long-term holders were a remarkable 50% higher (!) than the returns of the investors who chased performance. *O tempora! O mores!*

But forewarned was *not* forearmed. It’s clear that the sponsors of today’s high-powered versions of those two pioneering (as it turned out) Vanguard strategic beta funds have ignored these lessons of history. To be sure, with 624 such funds, a few may well produce higher returns than the S&P 500 on a risk-adjusted basis over the long run. But for smart beta fund investors as a group, the search for the holy grail is all too likely to be in vain.

I’m guessing that not a single one of these latter-day strategic beta managers is aware of the historically huge gap between a factor fund’s reported return

(time weighted) and the returns earned by its shareholders (dollar weighted). Why would they want to know? Isn't ignorance bliss? Why mention a negative? Especially in a mutual fund industry that has come to favor marketing and asset gathering over professional investment management. But in the long run, managers that promise the moon and then fail to deliver it to investors will find their reputations damaged.

CHALLENGES TO HEDGE FUNDS, TODAY'S GOLIATHS

Now, let's think about the challenges that lie ahead, first for today's Goliaths, and then for our simple shepherd David. From that first A.W. Jones hedge fund—it was actually *hedged*—back in 1949 (\$100,000 in initial assets), a whole new and powerful hedge fund industry segment has emerged. Leave aside that, for the vast majority of today's hedge funds, hedging is only part of their menu. The entrées, if you will, are dominated by concentrated investment portfolios that are typically focused on stock picking, price discovery, momentum, factor bets, and opportunistic trading.

At first, the hedge fund industry's growth in assets was electrifying (\$120 billion in 1997, \$2.1 trillion in 2007). Then, the market crash of 2007–2009 took hedge fund assets back to \$1.4 trillion in 2008, with a recovery to \$2.8 trillion currently. That pattern reflects in part the solid relative returns earned by hedge funds initially, and the lagging returns that followed.

Between 1990 and 2008, the average hedge fund (HFRI) earned an annualized return of 11.8%, compared to just 7.2% for the S&P 500 and 7.3% for a 60/40 stock/bond balanced index. Then the reverse happened. Absolute returns tumbled, and relative returns plummeted. From 2009 through February 2016, the annualized returns were as follows: hedge funds, 5.3%; S&P 500, 13.5%; balanced index, 10.1%. One might ask, could the era of hedge fund growth be ending?

Surely, their investors are not amused by this decline in the performance of most hedge funds, particularly given the extraordinary levels of compensation that they pay to their managers. As the *New York Times* [2016] reported, the compensation paid to the 25 largest hedge fund managers in 2015 *averaged* \$520 million, with the highest-paid manager earning \$1.7 billion. Wow! (At least to this David.) That 5,000-shekel coat of mail that the hedge fund Goliath wears may slow him

down and impede his mobility, but it supports a nice standard of living.

In my experience, as assets of a particular fund or style or class grow and competition for performance increases, declining relative returns are to be expected. More and more brilliant, energetic, STEM-educated individuals enter the hedge fund field, seeking to prove themselves and earn such extraordinary compensation. Then, in theory at least, price discovery becomes more challenging; spreads between stock prices and intrinsic values narrow, and strategies that have won in the past become more popular and draw increasing assets. Result: *factor returns ultimately revert to the market mean.* (Warning: AQR's Cliff Asness believes passionately that the value/momentum combination will *not* be subject to RTM. He is far smarter and more experienced in this area than am I. But, based in part on the results of those original Vanguard growth and value index funds, I stand my ground: RTM is inevitable.)

MORE CONCERNS

As I appraise the hedge fund cohort, these erratic patterns of asset growth and relative investment returns reflect but the beginning of my concerns. Hedge funds do not perform “as a group,” and the variations around the mean are huge. Consistent winners are few. With some 10,000 hedge funds now in existence, the selection risk assumed by investors is huge. During the past five years, returns of individual hedge funds have ranged from –91.1% to 157.3%, a spread of almost 250 percentage points between the best and the worst performing funds.

Failure rates are astonishing. Hedge Fund Research reports that 8,912 hedge funds have been liquidated over the past 10 years alone. Meanwhile, smart new entrants have joined the fray (10,199 new hedge funds were launched during that period), more likely than not to compete away some of the alleged advantages in particular strategies and structures. To repeat: RTM is inevitable.

I also warn about reliance on the past history of various factors—retrospectives “on paper only”—as a guide to the future. Among the literally hundreds of journal articles that have presented “smart beta” results and other creative and complex formulas designed to win the performance game, almost all ignore the significant real-world implementation costs of these strategies—largely, the fiscal drag of advisory fees, portfolio turnover, taxes, and other costs. Also ignored is the documented gap

between backtested returns and the returns that actually follow. These realities could easily undermine the credibility of the data produced that are intended to show the hypothetical value of quantitative investing. At a minimum, full and clear disclosure is called for.

Of course, the high fees charged by hedge funds are part of this issue. Is “2 and 20” etched in stone?⁶ Will price competition finally prevail? Will the marketplace demand lower fee rates? Will investors demand fees based solely on the investment returns actually achieved? What about a base fee of zero, but an incentive fee equal to say, 10% to 20% of the amount by which the fund exceeds its mutually agreed-upon benchmark? Then, hedge fund managers would “make money the old-fashioned way; they’d earn it.”

Way back in 1976, Benjamin Graham suggested this very approach to fees on equity mutual funds. When asked if institutional clients should be content with the market’s returns, Graham said, “Yes. Not only that, but I think they should *require* approximately such results over, say, a moving five-year average period as a condition for paying standard management fees to advisers” (italics added) (Ellis [1976]). One day, maybe sooner than we imagine, the institutional clients of the Goliaths will demand new approaches to compensating their hedge fund managers.

CHALLENGES TO THE TRADITIONAL INDEX FUND, TODAY’S DAVID

Until a few years ago, TIFs had been subject to few serious challenges. They have become the staple of most college courses in finance and investments. They have earned returns that were almost exactly what was predicted, outpacing (by roughly the amount of their all-in cost advantage) their managed peers—large-cap, mid-cap, and small-cap mutual funds, sorted by growth, blended, and value categories (Morningstar’s “tic-tac-toe” box). Index funds have also won, overwhelmingly, the contest for cash flows from investors, largely at the expense of their actively managed counterparts.

Today, investors are seeing the light. Index funds have achieved remarkable momentum in the marketplace. Since 2007, \$1.5 trillion of net cash flow has poured *into* index equity funds, while \$500 billion has poured *out* of active funds—a \$2 trillion swing in the preferences of equity investors, the likes of which I have never before seen during my 65 years in this field.

With the Department of Labor’s forthcoming fiduciary duty standard requiring brokers and investment advisers for retirement plan investors to put first the interests of their clients, that momentum will surely accelerate. The acceleration will be even faster when the SEC finally requires—as it must, and as it will—that the fiduciary standard also be applied to investment advice for non-retirement plan accounts.

Nonetheless, there is now a serious intellectual challenge to traditional indexing. When as distinguished an academic and investor as Professor Andrew Lo [2016] of MIT describes the S&P 500 as “a very specific and limiting way of constructing an index, an artifact of its financial and technological era,” only a fool would fail to take notice.

But what can really be wrong with broad, market-cap-weighted indexes such as the S&P 500? They produce essentially the returns of the total U.S. stock market and, because of their low costs, they virtually guarantee that their investors will earn higher returns than their fellow investors as a group. They also substantially eliminate the “behavioral drag” that investors incur when they engage in counterproductive trading among funds. I see no reason why such indexes will become an artifact. They represent the ultimate benchmark.

Dr. Lo supports his case by noting the rise of what he calls “strategy indexes,” such as life-cycle and target-date funds. But rather than being a departure from our index strategy, Vanguard’s life-cycle and target-date funds serve to reinforce our conviction about the merits of traditional indexing. Way back in 1994, when I created Vanguard’s four LifeStrategy Funds, *all were index based*, the precursors to our index-based Target Retirement Funds, created in 2003. Both sets of funds featured the Total Stock Market Index and the Total Bond Market Index, with a small allocation to non-U.S. stocks (later increased, along with the addition of non-U.S. bonds). Both are indeed *index funds*, even though they are not “static.”

I’m also skeptical about a new wave of “dynamic” indexes designed to reflect, in Dr. Lo’s words, “the new reality of technology-leveraged investing” (Lo [2016]). His warnings about backtesting and “potential pitfalls” are well taken. But it will take a long time before even a core of consumers will have “the education and experience to properly assess these risks and use these indexes responsibly” (Lo [2016]).⁷ Further, my own experience has made me skeptical of adding the word *dynamic* to any tried-and-true strategy. (It’s a long story!)

But perhaps I'm destined to be counted among those whom Dr. Lo describes as "Luddites" fighting off any change in the status quo. We shall see

LESS IMPRESSIVE CHALLENGES

Harsh criticism of S&P 500 indexing also comes from William Ackman [2015]. In the 2015 Annual Report of Pershing Square Capital Management (whose hedge fund lagged the S&P 500 by 21.9 percentage points for the year), he writes, "Index funds have very low fees and have outpaced the average manager *in recent years*" (italics added). But that statement is far too limiting. The S&P 500 has outpaced the average actively managed equity fund by an average annual rate of 1.6 percentage points *over the past 70 years*. Mr. Ackman also errs when he repeats the canard that index funds are "forced to buy more [of a stock] as stock prices rise." Not so. When a stock rises in price, the value of the index fund's investment in it rises by precisely the same amount.⁸

Another challenge to the S&P 500 Index comes from Marc Reinganum, chief quantitative strategist of State Street Global Advisors. Here's what he said in *Practical Applications*, about his recent article published by *The Journal of Portfolio Management*:

The market-cap-weighted approach was propelled by performance-chasing and theory... grounded on the assumption that... the cap-weighted portfolio would be optimal for all investors... [But] different investors have different requirements. (Scott [2015])

Years earlier, however, Benjamin Graham described this argument as:

only a convenient cliché or alibi to justify the mediocre record of the past... I see no reason why [investors] should be content with results inferior to those of an index fund or pay standard fees for inferior results. (Ellis [1976])

Finally (perhaps a cheap shot on my part), when they conclude that the S&P 500 Index is so flawed, I would ask, "what do these Goliaths who criticize cap-weighted indexes know that Warren Buffett doesn't know?" Mr. Buffett has been endorsing the S&P 500 Index Fund for decades, and the trust he has established

for his wife will have 90% of its assets invested in a low-cost S&P 500 index fund. (He suggests Vanguard's). He's also winning, by a huge margin of 43 percentage points, his million-dollar bet that the Vanguard 500 Index Fund will outperform a preselected list of five hedge funds over a 10-year period, which has only 18 months to go.

The challenge to traditional index funds by strategic beta funds is also likely to lapse, because they ultimately fail to fulfill their promise of superior returns. Finally, my David-like confidence is unshaken that *simple arithmetic is the king*: the optimal way for investors to capture their fair share of whatever returns the nation's corporations (and the world's) can generate via the dividend yields and earnings growth that, over the long run, are reflected in their stock prices. *Yes, there may prove to be a few money managers and investment strategies that will provide better returns for investors than those achieved by the low-cost, all-market index fund, but the number of managers and strategies that will provide worse returns is infinite.*

CONCLUSION AND REPRISE

Let me close by returning to my opening story. When he took down Goliath, David impressed Saul, Israel's first king. The king became a sort of mentor to the young shepherd and offered him his daughter's hand in marriage. David later became the commander of Israel's armies and then the second king of Israel, serving for 32 years.

And yes, that young shepherd who became king is the same David who wrote the *Book of Psalms*. Okay, he had some shocking moral lapses along the way. (Remember his extra-marital affair with Bathsheba? Remember his sending her husband Uriah to a certain death?) But God not only forgave him (or so First Samuel tells us), but described David as "a man after my own heart." I do not have the temerity to assert that the index fund is the strategy that has won God's own heart. But maybe, just maybe, the traditional index fund has done just that. Who among us can really be sure?

ENDNOTES

This essay is an edited version of the keynote speech delivered to the 50th anniversary seminar of the Institute for Quantitative Finance in Washington, D.C., on April 18, 2016. The opinions expressed in this essay do not necessarily represent the views of Vanguard's present management.

¹I am indebted to James Owen Weatherall, physicist, philosopher, and mathematician at the University of California for telling Bachelier's story in his book, *The Physics of Wall Street* (Weatherall [2013]). This volume is remarkable both in its insights and its readability.

²The vast majority of articles I have read on quantitative investment strategies in FAJ and JPM also fail to account for managers' fees and implementation costs.

³Average annual returns 1945–1975: large-cap-dominated average equity funds 9.7%, S&P 500 Index 11.3%; 1985–2015: average large-cap fund 9.6%, S&P 500 Index 11.2% (cited in Bogle [2016]).

⁴Vanguard's management decided to enter the ETF arena and introduced its first "VIPER" (now "Vanguard ETFs") on May 24, 2001. The firm offers a list of 70 ETFs, including broad-market stock and bond ETFs, various size and style segments, and broad industry sectors. Turnover among the Vanguard ETFs is significantly below the turnover of its peers. ETFs now account for \$500 billion of Vanguard's \$2 trillion of indexed assets.

⁵Early on, I thought about changing the benchmark for the growth and value index funds from S&P to Russell, but ultimately decided to stand pat. For the record, since the introduction of our two funds in late 1992, S&P Growth Index annual returns: 9.1%, Russell 8.3%; Value Index returns: S&P 8.9%, Russell 9.6%. (My successors at Vanguard changed the indexes to MSCI in 2003, and to CRSP in 2013.) The Fama–French data, which include both large- and small-cap stocks, show that value returns were significantly higher than growth over the same period—11.0% versus 7.7%.

⁶I heard Jim Simons of Renaissance Technologies say that his biggest mistake was charging 2 and 20 rather than 4 and 40. The *Institutional Investor* audience laughed.

⁷Note please, the "consumer experience" cited earlier with respect to our Growth and Value Index Funds.

⁸That said, I found Mr. Ackman's critique of index fund policies on corporate governance issues to be penetrating and worth carefully considering.

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