

Memo to: Oaktree Clients
From: Howard Marks
Re: Investing Without People

Over the last twelve months I've devoted three memos to discussing macro developments, market outlook, and recommendations for investor behavior. These are important topics, but usually not the ones that interest me most; I prefer to discuss things that are likely to affect the functioning of markets for years to come. Since little in the environment has changed from what I described in those three memos, I feel I now have the liberty to turn to some bigger-picture issues.

This memo covers three ways in which securities markets seem to be moving toward reducing the role of people: (a) index investing and other forms of passive investing, (b) quantitative and algorithmic investing, and (c) artificial intelligence and machine learning.

Before diving in, I want to state loud and clear that I don't claim to be an expert on these subjects. I've watched the first for decades; I've recently learned a little about the second; and I'm trying to catch up regarding the third. On the other hand, since many of the "experts" in these fields are involved in them, I think they may be biased favorably toward them as potential successors to traditional active investing. What follow are just my opinions; as always you should make of them what you wish.

Passive Investing and ETFs

I've told this story many times, but I want to repeat it here to lay a foundation for what follows. I arrived at the University of Chicago Graduate School of Business (not yet the Booth School) just over 50 years ago, in September 1967. The "Chicago school" of finance and investment theory – largely developed there in the early '60s – had just begun to be taught. It was methodically constructed on theoretical underpinnings, as well as on a healthy dose of skepticism regarding what investors had been doing previously.

One of the major foundational components was the "Efficient Market Hypothesis" and its conclusion that "you can't beat the market." First there was the logical argument: it seemed obvious that collectively all investors have to do average before fees and expenses, and thus below average after. And then there was the empirical evidence that for decades most mutual funds had performed behind stock indices like the Standard & Poor's 500.

My professors' response in the late 1960s was simple, albeit hypothetical and fanciful: why not just buy shares in every company in an index? Doing so would allow investors to avoid the mistakes most people made, as well as the vast majority of the fees and costs associated with their efforts. And at least they would be assured of performing in line with the index, not behind it. As far as I know, no one invested that way at the time and there were no publicly available vehicles for doing so: no "index funds" and no "passive investing." I don't think the terms even existed. But the

logic was clear and convincing, per the following citation from Wikipedia (with apologies to Richard Masson, my conscience regarding sources, for relying on it):

In 1973, Burton Malkiel wrote *A Random Walk Down Wall Street*, which presented academic findings for the lay public. It was becoming well known in the lay financial press that most mutual funds were not beating the market indices. Malkiel wrote:

What we need is a no-load, minimum management-fee mutual fund that simply buys the hundreds of stocks making up the broad stock-market averages and does no trading from security to security in an attempt to catch the winners. **Whenever below-average performance on the part of any mutual fund is noticed, fund spokesmen are quick to point out “You can’t buy the averages.” It’s time the public could.**

. . . there is no greater service [the New York Stock Exchange] could provide than to sponsor such a fund and run it on a nonprofit basis. . . . Such a fund is much needed, and if the New York Stock Exchange (which, incidentally has considered such a fund) is unwilling to do it, I hope some other institution will. (Emphasis added)

The first index fund appeared around that time. Again according to Wikipedia, the registration statement for the Qualidex Fund, designed to track the Dow Jones Industrial Average, became effective in 1972. I have no reason to believe it attracted many investors.

But then Jack Bogle formed the Vanguard Group in 1974, and Vanguard’s First Index Investment Trust went operational on the last day of 1975.

At the time, it was heavily derided by competitors as being “un-American” and the fund itself was seen as “Bogle’s folly.” Fidelity Investments Chairman Edward Johnson was quoted as saying that he “[couldn’t] believe that the great mass of investors are going to be satisfied with receiving just average returns.” Bogle’s fund was later renamed the Vanguard 500 Index Fund, which tracks the Standard & Poor’s 500 Index. It started with comparatively meager assets of \$11 million but crossed the \$100 billion milestone in November 1999. (Wikipedia)

The merits of index investing are obvious: vastly reduced management fees, minimal trading and related market impact and expenses, and the avoidance of human error. **Thus index investing is a “can’t lose” strategy: you can’t fail to keep up with the index. Of course it’s also a “can’t win” strategy, since you also can’t beat the index (the two tend to go together).**

Index or passive investing got off to a relatively slow start. In the early years, I feel it was treated as a bit of an oddity or sideline: perhaps a candidate to take the place of one or two of an institutional investor’s active managers. As they did with many potential alternatives to traditional stock and bond investing – such as emerging market stocks, private equity, venture capital, high yield bonds, distressed debt, timber and precious metals – some institutions put a smattering of capital into index funds, but rarely enough to meaningfully alter the performance of their overall portfolios. Few

institutions if any made passive investing a substantial part of their portfolios: thus it added a little spice but wasn't a main dish.

The empirical evidence of assets continuing to flow to passive management suggests that many active managers are still falling short of the indices. There have been lots of years in the last dozen in which the shortfall has been pronounced, and I'm not aware of many that were the reverse. As a result, the trend toward passive investing has steadily gained momentum (e.g., the Vanguard 500 Index Fund now stands at \$410 billion). According to data from Morningstar, roughly similar amounts went into active and passive equity mutual funds from 2005 through 2011, but the flows into passive funds accelerated in 2012, while the inflows to active funds began to decline and, in 2015, turned into outflows. According to the *Los Angeles Times*, April 9, 2017:

Conventional U.S. stock mutual funds that invest passively now hold \$1.9 trillion in assets, triple what they had in 2007. Add in the \$1.7 trillion in U.S. equity exchange-traded funds, another type of index portfolio, and the total in passive funds accounts for 42% of all U.S. stock fund assets — up dramatically from 24% in 2010 and just 12% in 2000.

These figures apply mostly to “retail” investments, leaving out institutional portfolios where passive investing also has grown dramatically. Rather than being an exotic add-on with a few percent of a portfolio's assets, passive investing is now mainstream among institutions, perhaps often accounting for 20% or so of total assets.

Given the *L.A. Times* quote above, I want now to introduce ETFs, or exchange-traded funds. In the 1990s, money managers came up with a new way to offer participation in the markets, in competition with index mutual funds. Whereas investors can only invest in or redeem from mutual funds at the close of trading each day, when the daily closing net asset value (or NAV) is calculated, ETFs can be bought or sold like company shares anytime exchanges are open. The ability to transact much more freely has attracted a lot of attention to ETFs. And while index ETFs gave this new field its start and still represent the vast bulk of ETFs, there are many other types these days.

In the late 20th century, “index investing” and “passive investing” were synonymous: vehicles designed to passively emulate market indices. But now there's a difference. Today this is called index investing. Passive investing has grown to include not just index funds and index ETFs, but also “smart-beta” ETFs that invest according to portfolio construction rules. Think of them as actively designed, rules-based vehicles. Once the rules are set, they're followed without discretion. As I wrote a year ago:

[To grow their businesses], ETF sponsors have been turning to “smarter,” not-exactly-passive vehicles. Thus ETFs have been organized to meet (or create) demand for funds in specialized areas such as various stock categories (value or growth), stock characteristics (low volatility or high quality), types of companies, or geographies. There are ETFs for people who want growth, value, high quality, low volatility and momentum. Going to the extreme, investors can now choose from funds that invest passively in companies that have gender-diverse senior management, practice “biblically responsible investing,” or focus on medical marijuana, solutions to obesity, serving millennials, and whiskey and spirits.

But what does “passive” mean when a vehicle’s focus is defined so narrowly? **Each deviation from the broad indices introduces definitional issues and non-passive, discretionary decisions.** Passive funds that emphasize stocks reflecting specific factors are called “smart-beta funds,” but who can say the people setting their selection rules are any smarter than the active managers who are so disrespected these days? Steven Bregman of Horizon Kinetics calls this “semantic investing,” meaning stocks are chosen on the basis of labels, not quantitative analysis. [For example, he points out that because it’s so big and liquid, Exxon Mobil is included in both growth and value ETFs.] There are no absolute standards for which stocks represent many of the characteristics listed above. (“[There They Go Again . . . Again](#)” July 2017)

According to Wikipedia, “as of January 2014, there were over 1,500 ETFs traded in the U.S. . . .” That compares with 3,599 stocks in the Wilshire 5000 Total Market Index (per *Barron’s*). To me, the number and variety of ETFs serves as a reminder of the financial industry’s customary eagerness to accommodate people’s desire in good times to “get action” in the markets. And how else should we view the levered ETFs that have been designed to appreciate or depreciate by a multiple of what an index does?

That’s the background. Now I’m going to turn to the implications of passive investing and its increasing popularity. **The first question is, “Is passive investing wise?”**

In passive investing, no one at the fund is studying companies, assessing their potential, or thinking about what stock price is justified. And no one’s making active decisions as to whether particular stocks should be included in a portfolio and, if so, how they should be weighted. They’re just emulating the index.

Is it a good idea to invest with absolutely no regard for company fundamentals, security prices or portfolio weightings? Certainly not. But passive investing dispenses with this concern by counting on active investors to perform those functions. The key lies in remembering why it is that the Efficient Market Hypothesis says active management can’t work, and thus why it expects everyone (good or bad luck aside) to just end up with a return that’s fair for the risk borne . . . no more and no less. I touched on this in “[There They Go Again . . . Again](#),” which will be the source for the next three citations:

. . . the wisdom of passive investing stems from the belief that the efforts of active investors cause assets to be fairly priced – that’s why there are no bargains to find.

And where do the weightings of the stocks in indices come from? From the prices assigned to stocks by active investors. **In short, in the world view that gave rise to index and passive investing, active investors do the heavy lifting of security analysis and pricing, and passive investors freeload by holding portfolios determined entirely by the active investors’ decisions.** There’s no such thing as a capitalization weighting to emulate in the absence of active investors’ efforts.

The irony is that it’s active investors – so derided by the passive investing crowd – who set the prices that index investors pay for stocks and bonds, and thus who establish the market

capitalizations that determine the index weightings of securities that index funds emulate. If active investors are so devoid of insight, does it really make sense for passive investors to follow their dictates?

And what happens if active investors quit doing that job? **Thus the second question is, “What are the implications of passive investing for active investing?”** If widespread active investing makes it impossible for active investing to succeed (by making markets too efficient and security prices too fair, per the Efficient Market Hypothesis), will the increasing prevalence of passive investing make active investing once again potentially profitable?

. . . what happens when the majority of equity investment comes to be managed passively? Then prices will be freer to diverge from “fair,” and bargains (and over-pricings) should become more commonplace. This won’t assure success for active managers, but certainly it will satisfy a necessary condition for their efforts to be effective.

How much of the investing that takes place has to be passive for price discovery to be insufficient to keep prices aligned with fair values? No one knows the answer to that. Right now about 40% of all equity mutual fund capital is invested passively, and the figure may be moving in that direction among institutions. That’s probably not enough; most money is still managed actively, meaning a lot of price discovery is still taking place. Certainly 100% passive investing would suffice: **can you picture a world in which nobody’s studying companies or assessing their stocks’ fair value? I’d gladly be the only investor working in that world.** But where between 40% and 100% will prices begin to diverge enough from intrinsic values for active investing to be worthwhile? That’s the question. I don’t know, but we may find out . . . to the benefit of active investing.

The third key question is: **“Does passive and index investing distort stock prices?”** This is an interesting question, answerable on several levels.

The first level concerns the relative prices of the stocks in a capitalization-weighted index. People often ask whether inflows of capital into index funds cause the prices of the heaviest-weighted stocks in the index to rise relative to the rest. I think the answer is “no.” Suppose the market capitalizations of the stocks in a given index total \$1 trillion. Suppose further that the capitalization of one popular stock in the index – perhaps one of the FAANGs – is \$80 billion (8% of the total) and that of a smaller, less-adored one is \$10 billion (1%). That means for every \$100,000 in an index fund, \$8,000 is in the former stock and \$1,000 is in the latter. It further means that for every additional \$100 that’s invested in the index, \$8 will go into the former and \$1 into the latter. Thus the buying in the two stocks occasioned by inflows shouldn’t alter their relative pricing, since it represents the same percentage of their respective capitalizations.

But that’s not the end of the story. The second level of analysis concerns stocks that are part of the indices versus those that aren’t. Clearly with passive investing on the rise, more capital will flow into index constituents than into other stocks, and capital may flow out of the stocks that aren’t in indices in order to flow into those that are. It seems obvious that this can cause the stocks in the indices to appreciate relative to non-index stocks for reasons other than fundamental ones.

The third level concerns stocks in smart-beta funds. The more a stock is held in non-index passive vehicles receiving inflows (*ceteris paribus*, or everything else being equal), the more likely it is to appreciate relative to one that's not. And stocks like Amazon that are held in a large number of smart-beta funds of a variety of types are likely to appreciate relative to stocks that are held in none or just a few.

What all the above means is that for a stock to be added to index or smart-beta funds is an artificial form of increased popularity, and it's relative popularity that determines the relative prices of stocks in the short run.

The large positions occupied by the top recent performers – with their swollen market caps – mean that as ETFs attract capital, they have to buy large amounts of these stocks, further fueling their rise. **Thus, in the current up-cycle, over-weighted, liquid, large-cap stocks have benefitted from forced buying on the part of passive vehicles, which don't have the option to refrain from buying a stock just because its overpriced.**

Like the tech stocks in 2000, this seeming perpetual-motion machine is unlikely to work forever. If funds ever flow out of equities and thus ETFs, what has been disproportionately bought will have to be disproportionately sold. **It's not clear where index funds and ETFs will find buyers for their over-weighted, highly appreciated holdings if they have to sell in a crunch. In this way, appreciation that was driven by passive buying is likely to eventually turn out to be rotational, not perpetual.**

The vast growth of ETFs and their popularity has coincided with the market rally that began roughly nine years ago. Thus we haven't had a meaningful chance to see how they function on the downside. Might the inclusion and overweighting in ETFs of market darlings – a source of demand that may have driven up their prices – be a source of stronger-than-average selling pressure on the darlings during a retreat? Might it push down their prices more and cause investors to turn increasingly against them and against the ETFs that hold them? **We won't know until it happens, but it's not hard to imagine the popularity that fueled the growth of ETFs in good times working to their disadvantage in bad times.**

Question number four: **“Can the process of investing in indices be improved relative to simply buying the stocks in proportion to their market capitalizations, as the indices are constituted?”** For many years my California-based friend Rob Arnott of Research Affiliates has argued for passive investing on the basis of fundamentally based indices as opposed to market-weighted indices. Rob is one of the real thinkers in our field, and I won't try to recount his entire argument or do it justice.

Suffice it to say, however, that a given company with a given amount of earnings will have a greater market capitalization the higher its price/earnings ratio is . . . that is, the more it's loved. **Thus, everything else being equal (there's that *ceteris paribus* again), the heavier-weighted stocks in an index are likely to be the more highly priced ones.** Do you want to put more of your index-investing money into the more expensive stocks or the ones that are cheaper? I'd rather do the latter. Thus it makes sense to invest in the index stocks in proportion to something like their earnings, not their market caps.

Question number five: **“Is there anything innately wrong with ETFs and their popularity?”**

ETFs are just another vehicle for buying stocks and bonds. They’re neither good nor bad *per se*. But there is a way in which I worry about ETFs’ impact, and it has to do with the expectations of the people who invest in them.

My thinking goes back to the reason ETFs gained popularity in the first place: the ability to buy or sell them anytime the market is open. I’d bet a lot of the people who make use of ETFs do so for the simple reason that they think they’re “more liquid.” There are a couple of problems with this.

First, as I wrote in “[Liquidity](#)” (March 2015), the fact that something is able to be sold legally, or the fact that there’s a market for it, can be very different from the fact that it can always be sold at a price that’s intrinsically fair or close to the last price at which it sold. If bad news or a downturn in investor psychology causes the market to drop, invariably there’ll be a price at which an ETF holder can sell, but it may not be a “good execution.” **The price received may represent a discount from the value of the underlying assets, or it may be less than it would have been if the market were functioning on an even keel.**

If you withdraw from a mutual fund, you’ll get the price at which the underlying stocks or bonds closed that day, the net asset value or NAV. But the price you get when you sell an ETF – like any security on an exchange – will only be what a buyer is willing to pay for it, and I suspect that in chaos, that price could be less than the NAV of the underlying securities. Mechanisms are in place that their designers say should prevent the ETF price from materially diverging from the underlying NAV. But we won’t know if “should” is the same as “will” until the mechanisms are tested in a serious market break.

Some people may have invested in ETFs in the mistaken belief that they’re inherently more liquid than their underlying assets. For example, high yield bond ETFs have been very popular, probably because it’s far easier to buy an ETF than to assemble a portfolio of individual bonds. But what’s the probability that in a crisis, a high yield bond ETF will prove more liquid than the underlying bonds (which themselves are likely to become quite illiquid)? The weakness lies in the assumption that a vehicle can provide more liquidity than is provided by its underlying assets. **There’s nothing wrong with the fact that ETFs may prove illiquid. The problem will arise if the people who invested in them did so with the expectation of liquidity that isn’t there when they need it.**

In March I noticed a Bloomberg story about the \$900 million BTS Tactical Fixed Income Fund managed by Matt Pastis, which on February 9 went from “almost entirely in junk bonds” to fully in cash:

[BTS] employs no credit analysts to study the fundamentals of bonds. Pastis is a market timer, trying to suss out whether the whole high-yield asset class is going to rise or fall in value. He watches trend and momentum measures, such as the moving average of the price of exchange-traded funds that track the junk bond market. When not in junk, BTS is either in Treasuries or cash.

Trading completely in and out of the market is simple for BTS because the fund doesn’t directly hold the bonds. Instead, it has the unusual strategy for a fund of

investing almost entirely via ETFs. In late January, before it sold, BTS had about 95% of its assets in the two largest junk-bonds ETFs.

Leaving aside the question of whether a manager can add value by predicting the short-run direction of a market – about which I would be highly skeptical – **I think one of these days, this investor may want to execute a trade that wouldn't be doable in the “real” high yield bond market, and he'll find that it can't be done via ETFs either.** In short, building a strategy around the assumption that ETFs can always be counted on to quickly get you into or out of an illiquid market at a fair price seems unrealistic to me. The truth on this will become clear when the tide goes out.

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Passive/index investing got its start because of a view that the stock market would grind on as it always had, with active investors setting “proper” prices for securities. That would enable passive investors to participate in the markets – assembling portfolios that mimic the indices and “free-riding” on the work and price discovery performed by active investors – without picking up their share of the analytical tab.

But that misses the reality behind George Soros's Theory of Reflexivity: that the actions of market participants change the market. Nothing in a market always continues, independent and unchanged. A market is nothing more than the people in it and the decisions they make, and the behavior of those people shapes the market. When people invest more in certain stocks than others, the prices of those stocks rise in relative terms. And when everyone decides to refrain from performing the functions of analysis, price discovery and capital allocation, the appropriateness of market prices can go out the window (as a result of passive investing, just as it does in a mindless boom or bust). **The bottom line is that the wisdom of investing passively depends, ironically, on some people investing actively. When active investing is dismissed totally and all active efforts cease, passive investing will become imprudent and opportunities for superior returns from active investing will reemerge.** At least that's the way I see it.

Quantitative Investing

My next topic – which, as I said, I'm just learning about (and thus I write with some trepidation) – goes by names such as quantitative, algorithmic and systematic investing. In this memo I'll use the first of those. As I understand it, quantitative investing consists of establishing a set of rules (perhaps with help from a computer) and having a computer carry them out.

There are at least two principal forms of quantitative investing. The first might be called “systematic factor investing.” The process goes like this:

- The manager conducts an examination of a period in history, which shows that superior returns were associated with certain “factors.” Factors are attributes that characterize securities, such as value, quality, size and momentum. Perhaps in a given period the stocks that did best were characterized by strong value, high quality, large capitalizations and recent

appreciation (or “momentum”). Thus the manager concludes that his portfolio should consist of stocks that rank high in those factors. (Of course those factors don’t always lead to above average returns; if things change, growth, low quality, smallness and recent under-performance might be associated with superior returns instead.)

- The manager instructs its computer to search for securities that offer the most of those factors for the money. Thus, for example, the computer might search for value based on measures including price/earnings ratio, enterprise value/EBITDA ratio, price/book ratio and price/free cash flow ratio, as well as industry-specific metrics such as the ratio of price to reserves for oil companies.
- Then the manager tells the computer in what proportion to weight the search criteria, and the computer proceeds systematically to populate the portfolio with securities that deliver the optimal mix of the factors.
- Finally, the computer is instructed to assess the attendant risk. The portfolio is optimized, constraining even the most attractive components in order to limit the representation of individual stocks and perhaps industries, as well as the risk introduced by likely correlations among the stocks. The portfolio is formulaically derived according to the rules, usually without human intervention.

The end product of this process is a portfolio that, according to the algorithm, will deliver the highest expected return with the least risk (under the assumption that the factors associated with superior returns in the past will continue to be so associated in the future, and that assets will be volatile and correlated as in the past).

The other main form of quantitative investing is “statistical arbitrage” or “stat arb.” For an example of stat arb, let’s assume an investor wants to buy 100,000 shares of XYZ, and the market for that stock is “one cent wide” at \$20.00/20.01 (perhaps 5,000 shares are bid for at \$20.00 and 8,000 shares are offered at \$20.01). The broker takes the 8,000 shares offered at \$20.01. The next offering is 6,000 shares at \$20.02, and the broker takes those. Then a seller offers 5,000 shares at \$20.03, and the broker takes those as well. This buying may move the market to \$20.03/20.04.

A quant’s computer takes note of the fact that the market has moved up and stock has been bought at progressively higher prices.

- If other stocks haven’t moved in similar fashion, the computer concludes that these events are “idiosyncratic” – related to that one stock – rather than “systematic,” or present throughout the market.
- If that stock’s price has moved up idiosyncratically and there’s no news from the company to explain it, the computer concludes the price move took place because of investor buying, not fundamental developments.
- The computer considers the price move a short-term dislocation that resulted from the broker’s efforts to fill the investor’s order.
- It also decides on the basis of the trading to date, the current market, and the status of the order book that buying for that purpose is likely to continue to take place at prices above where the stock would be in the absence of that buying.
- Thus the computer decides the quant should “short” stock (sell stock the quant doesn’t own) to the buyer who’s elevating its price, on the assumption that the quant will be able to cover

later, when the buying has stopped and the price has receded. It might be possible to sell stock today at \$20.03 or \$20.04 that can be bought back at \$20.00 or 20.01 in a few days.

- Thus the quant provides liquidity that otherwise wouldn't exist and is willing to carry positions overnight. In exchange the quant gets a couple pennies more for the stock he supplies than he'll have to pay to buy it back.

We might say that for the most part, the stat arb computer responds to disequilibria between the price of one stock and the prices of other stocks or the market as a whole, and it acts on the assumption that the relationships will revert to normal. The pennies made aren't a big deal (perhaps a 0.1% profit in the above example), and as Renaissance Technologies said in a statement to a Senate subcommittee in 2014 concerning its core Medallion fund, "The model developed by Renaissance . . . makes predictions that are profitable only slightly more often than not." But if you do it often enough and on enough leverage, stat arb can produce meaningful returns on equity.

This is like what Long-Term Capital Management did in the late 1990s, looking for statistical divergences that could be arbitrated. One of its executives described what it did as going around the world picking up nickels and dimes. But in 1998, LTCM's enormously levered portfolio encountered an improbably long period in which, rather than converging, the relationships diverged further. Mark-to-market losses caused Long-Term's lenders to require the posting of additional capital; unable to do so, the fund melted down; and securities industry leaders had to take on its portfolios. It turned out that LTCM had been picking up nickels and dimes in front of a steamroller, and the steamroller caught up with it.

Among the lessons learned in the LTCM experience were that (a) the opportunities for stat arb are limited in size, (b) the capital directed at it must likewise be limited, (c) the leverage employed must be reasonable in order for the investor to survive those periods when historic relationships and probabilities fail to hold, and (d) likewise, it's important to appropriately hedge out the market's overall directional risk.

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Quantitative investors program their computers to emulate behavior that was profitable in the past or that is expected to be profitable in the future. In other words, they set rules or formulas for their computers to live by. The key question is whether, in a competitive, dynamic and interconnected arena like investing, the route to profitability can be captured in a formula, and whether changes in the investment environment (perhaps caused by the very implementation of the formula) won't negate the formula's effectiveness.

Just the other day, I got an email from Rosalie J. Wolf, a former CIO and consultant to some of our clients' boards, asking which memo contained a quote she likes to use. It turned out to be from "[Dare to be Great](#)" (September 2006), and ironically it's extremely relevant to the question raised above:

How can we achieve superior investment results? The answer is simple: not only am I unaware of any formula that alone will lead to above average investment

performance, but I'm convinced such a formula cannot exist. According to one of my favorite sources of inspiration, the late John Kenneth Galbraith:

There is nothing reliable to be learned about making money. If there were, study would be intense and everyone with a positive IQ would be rich.

Of course there can't be a roadmap to investment success. First, the collective actions of those following the map would alter the landscape, rendering it ineffective. And second, everyone following it would achieve the same results, and people would still look longingly at the top quartile . . . the route to which would have to be found through other means.

Before going further, let me elaborate on my skepticism regarding the potential for a formula that alone will lead to above average investment performance.

First, while there are ways to invest that I think can't work, there also are exceptional people who succeed at them. I include here active trading, macro investing and quantitative investing. As for the last, Renaissance Technologies and Two Sigma enjoy excellent reputations for their performance. My mother used to say, "It's the exception that proves the rule." She meant, for example, the fact that only a tiny number of people can do something proves that most people can't. So while I wouldn't say my skepticism is always justified, I do think it's generally appropriate. By definition it doesn't make sense to think large numbers of people can arrive at formulas that produce exceptional performance.

Second, the key word is "alone." Any old formula cannot unlock the secret of investment success. **An exceptional formula, arrived at on the basis of exceptional intelligence and insight, conceivably can do the job, although maybe just for a limited time.**

It seems obvious that a formula's application and popularization eventually will bring an end to its effectiveness. Let's say (in an incredibly simplified example) your study of the market shows that small-company stocks have beaten the market over a given period, so you overweight them.

- a) Since "beating the market," "out-appreciating" and "out-performing" often are just the flip side of "becoming relatively expensive," I doubt any group of stocks can outperform for long without becoming fully- or over-priced, and thus primed for underperformance.
- b) And it seems equally clear that eventually others will detect the same "small-cap effect" and pile into it. In that case, small-cap investing will become widespread and – by definition – no longer a source of superiority.

To reiterate, George Soros's Theory of Reflexivity says the behavior of market participants alters the market. Thus no formula will be a winner forever. For me, that means the achievement of superior returns through quantitative investing requires the ability to constantly and correctly update the formula. **Since investing is dynamic, the rules relied on in quantitative investing have to be dynamic.**

According to Raj Mahajan of Goldman Sachs, my principal tutor on these matters, "The best models today will change exposures as the environment changes and as the dynamics of the factors change

(e.g., as they become cheaper or more expensive). The rules have become increasingly complex, and they are able to ‘learn’ (that is, they are ‘conditional’ or ‘contextual’) in that they understand more of the environment.” **Constant renewal – not “a formula alone” – seems to be a minimum requirement for any quants’ long-term success.**

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It seems to me that while the members of both fraternities might reject the comparison, quantitative investing has some things in common with smart-beta ETF investing:

- Both are rules-based, pursuing the attributes the managers want in their holdings.
- In both, once the rules are set, the humans (largely) take their hands off the wheel and leave implementation up to computers.

The main differences I see – and they are very substantial – are that:

- There’s much more trading in quantitative investing. Since index funds and ETFs are “passive” and thus indifferent to company fundamentals and the attractiveness of security prices, they largely buy and hold. On the other hand, quantitative investors’ computers constantly recheck their portfolios against the algorithms or rules.
- The quantitative process is much more . . . quantitative. As Steven Bregman said, smart-beta ETFs buy based on “semantics”: on how securities are labeled (without any quantitative standards for membership in groups). Quantitative investors, on the other hand, do so based on quantitative assessment of securities’ fundamentals and price.

In closing on the subject of quantitative investing, I want to mention a few issues related to timeframe (some of them suggested by my son Andrew).

- Most quantitative investing is a matter of taking advantage of standard patterns (the factors that have been correlated with outperformance) and normal relationships (like the usual ratio of one stock’s price to another’s or to the market).
- Quants invest on the basis of historic data regarding these things. But what will happen if patterns and relationships are different in the future from those of the past?
- Is it important that most quantitative investors have operated only in periods when interest rates were declining, inflation was low and volatility was low, and when the trends in these regards were fairly stable? **Will their approaches prove dynamic enough to adjust if rates, inflation and volatility rise or become more variable? And if they do rise or become more variable, what historic data will quants use in their rule-making?**
- Likewise, is it significant that there’s limited history of investment performance in periods influenced by quants? **In other words, will increased quantitative investing influence the effectiveness of quantitative investing, and thus alter the requirements for success?**

We’ll see, but certainly it can’t be said that most quantitative investors are proven in these regards.

Artificial Intelligence and Machine Learning

Since I'm now well beyond the limits of my technological expertise, I'm going to rely on Wikipedia again to introduce a discussion of these next topics:

Artificial intelligence is intelligence demonstrated by machines, in contrast to the natural intelligence displayed by humans and other animals. In computer science AI research is defined as the study of “intelligent agents”: any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. Colloquially, the term “artificial intelligence” is applied when a machine mimics “cognitive” functions that humans associate with other human minds, such as “learning” and “problem solving.”

. . . Capabilities generally classified as AI as of 2017 include successfully understanding human speech, competing at the highest level in strategic game systems (such as chess and Go), autonomous cars, intelligent routing in content delivery network and military simulations.

. . . The traditional problems (or goals) of AI research include reasoning, knowledge representation, planning, learning, natural language processing, perception and the ability to move and manipulate objects.

In other words, artificial intelligence means the ability of machines to think. Quantitative investing consists of giving computers instructions to follow. But a computer with artificial intelligence can figure out what to do for itself. As *Investor's Business Daily* put it on May 10, “AI uses computer algorithms to replicate the human ability to learn and make predictions.”

Bernard Marr goes on in *Forbes* (December 6, 2016) to make the distinction between artificial intelligence and machine learning:

In short, the best answer is that Artificial Intelligence is the broader concept of machines being able to carry out tasks in a way that we would consider “smart.”

And Machine Learning is a current application of AI based around the idea that we should really just be able to give machines access to data and let them learn for themselves. . . .

Two important breakthroughs led to the emergence of Machine Learning as the vehicle which is driving AI development forward with the speed it currently has.

One of these was the realization – credited to Arthur Samuel in 1959 – that rather than teaching computers everything they need to know about the world and how to carry out tasks, it might be possible to teach them to learn for themselves.

The second, more recently, was the emergence of the internet, and the huge increase in the amount of digital information being generated, stored, and made available for analysis.

Once these innovations were in place, engineers realized that **rather than teaching computers and machines how to do everything, it would be far more efficient to code them to think like human beings, and then plug them into the internet to give them access to all of the information in the world.** (Emphasis added)

So, as this non-techie sees it, AI can enable machine learning whereby computers sift through huge amounts of data and discern the route to success. They don't have to be fed rules as in quantitative investing; **they figure out the rules for themselves.**

(One of the ways the best chess players become Grand Masters is by studying past chess matches, watching the moves that were made, and remembering what move was most successful in each situation, and the best response to that move. But there are obvious limits to the number of games a person can study and the number of moves that can be remembered. That's the thing: a powerful-enough computer can review every game that's ever been played, assess the consequences of every move, and decide on moves that will lead to success. Thus computers are beating Grand Masters these days, and no one's surprised anymore when they do.)

Machine learning is still in its infancy. It may be that AI and machine learning will someday permit computers to act as full participants in the markets, analyzing and reacting in real time to vast amounts of data with a level of judgment and insight equal to or better than many investors. But I doubt it will be anytime soon, and Soros's Theory of Reflexivity reminds us that all those computers are likely to affect the market environment in ways that make it harder for them to achieve success.

The Impact on Investing

It's only taken me until page fourteen to get to the issue that prompted me to start in on this memo: what these things imply for the future of our profession.

For me, the situation regarding index and passive investing is clear:

- Most people can't and don't beat the market, especially in markets that are more-efficient. On average, all portfolios' returns are average before taking costs into account.
- Active management introduces considerations such as management fees; commissions and market impact associated with trading; and the human error that often leads investors to buy and sell more at the wrong time than at the right time. These all have negative implications for net results.
- The only aspect of active management with potential to offset the above negatives is alpha, or personal skill. However, relatively few people have much of it.
- For this reason, large numbers of active managers fail to beat the market and justify their fees. **This isn't just my conclusion: if it weren't so, capital wouldn't be flowing from active funds to passive funds as it has been.**
- Regardless, for decades active managers have charged fees as if they earned them. Thus the profitability of many parts of the active investment management industry has been without reference to whether it added value for clients.

It's important to note that the trend toward passive investing hasn't occurred because the returns there have been great. It's because the results from active management have been poor, or at least not good enough to justify the fees charged.

Now clients have wised up, and unless something changes with regard to the above, the trend toward passive investing is going to continue. What could arrest it?

- More active managers could become capable of delivering alpha (but that's not likely).
- The markets could become easier to beat (that'll probably happen from time to time).
- Fees could come down so that they're competitive with passive investment fees (but in that case it's not clear how the active management infrastructure would be supported).

Unless there are flaws in the above reasoning, the trend toward passive investing is likely to continue. **At the very least, it reduces or eliminates management fees, trading costs, overtrading and human error: not a bad combination.**

Of course, there are active investors who outperform. Not most, and not half. **But there's a minority who do earn their fees, and they should continue to be in demand.**

* * *

Moving on to quantitative investing, it's particularly interesting to assess the future. The good news about quantitative investing is that it corrects many of the shortcomings of active management:

- It can do much of what people do, generally without making "human mistakes."
- It can handle infinitely more data.
- It excludes emotion; it never buys on euphoria or sells in panic.
- It never forgets to rebalance: to sell the things that are expensive and buy the things that are cheap.

Quantitative investing makes good use of the ability of computers to handle vast amounts of data and their freedom from human error. **In short, I think computers can do more than the vast majority of investors, and do it better.**

Now for limitations. I think of quantitative investing as also a free-riding strategy: it profits from disequilibria caused by others. **The supply of "nickels and dimes" is limited to the extent of those disequilibria, and thus only a limited amount of capital can be run this way to great advantage.** There has to be a reason why the best quant firm – Renaissance Technologies – has returned all outside capital from its flagship Medallion Fund; if an investment approach is infinitely scalable, by definition it's never economic to limit the capital under management. (Of course, all "alpha strategies" are based on taking advantage of the errors of others; thus the opportunities are limited to the scale of the errors – see "[It's All a Big Mistake](#)" from June 20, 2012.)

And there are bigger-picture questions: **Can quantitative investing make superior qualitative decisions? And can it invest for the long term?**

This brings me back to one of my very favorite quotations. It's from sociologist William Bruce Cameron, although many people attribute it to Albert Einstein (I've done so in the past):

... not everything that can be counted counts, and not everything that counts can be counted.

Computers can do an unmatched job dealing with the things that can be counted: things that are quantitative and objective. But many other things – qualitative, subjective things – count for a great deal, and I doubt computers can do what the very best investors do:

- Can they sit down with a CEO and figure out whether he's the next Steve Jobs?
- Can they listen to a bunch of venture capital pitches and know which is the next Amazon?
- Can they look at several new buildings and tell which one will attract the most tenants?
- Can they predict the outcome of a bankruptcy reorganization where the parties may have motivations other than economic maximization?

Further, quantitative investing's emphasis on profiting from short-term dislocations leaves a lot more to be mined. So much of investing these days considers only the short run that I think there's great scope for superior active investors to make value-additive decisions concerning the long run. I have no reason to believe computers can make these in a superior way.

The greatest investors aren't necessarily better than others at arithmetic, accounting or finance; their main advantage is that they see merit in qualitative attributes and/or in the long run that average investors miss. And if computers miss them too, I doubt the best few percent of investors will be retired anytime soon.

Will machine learning enable computers to study the entirety of financial history, figure out what made for the most successful investments, and sense what will work in the future? I have no way of knowing, but even if so, I think that's not enough. **Computers, artificial intelligence and big data will help investors know more and make better quantitative decisions. But until computers have creativity, taste, discernment and judgment, I think there'll be a role for investors with alpha.**

(My confidence that our jobs are safe is not unlimited, however. It's interesting to note that in 2016, a group at Stanford developed a computer program that correctly distinguished between suspenseful and non-suspenseful written passages 81% of the time. The researchers got it to do this by agreeing on what features contribute to suspense and then getting the program to recognize them and learn to identify new ones.)

Importantly, the trends toward both quantitative investing and artificial intelligence presuppose the availability of vast amounts of data regarding fundamentals and prices. A great deal of such data is on hand with regard to public companies and their securities. On the other hand, many of the things Oaktree and other alternative investors are involved in are private, non-traded and relatively undocumented: things like distressed debt, direct lending, private equity, real estate and venture capital. AI/machine learning eventually will make its way into these fields, but a good bit of time is

likely to pass before it is sufficiently sophisticated and data is sufficiently available to permit computers to act autonomously.

Finally, I view this situation kind of like index investing: if the day comes when intelligent machines run all the money, won't they all (a) see everything the same, (b) reach the same conclusions, (c) design the same portfolio, and thus (d) perform the same? **What, then, will be the route to superior performance? Humans with superior insight. At least that's my hope.**

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