A Dynamic Future for Active Quant Investing

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Recent events have illuminated the structural problems of traditional active quantitative management. During the recent global financial crisis, managers struggled with the systematic quant approach, which resulted in portfolio underperformance and unexpected losses to investors, revealing major shortcomings that have existed for years with the approach but now have become readily apparent. The standard systematic models in today's quant community are clearly ill-equipped to handle macroeconomic and investment environments that deviate substantially from typical, long-run conditions. Even though the standard models are now being refurbished to some degree, our experience suggests that a sea change, not marginal progress, is needed to accommodate the reality of markets. Unfortunately, mainstream (not all) active quant management remains focused on models that are inadequate for today's complex, adaptive markets.

Investors and financial economists have generally done a poor job of understanding and incorporating the connection between capital markets and the macroeconomy. Risk management and portfolio construction techniques must evolve to accommodate a wider array of possible outcomes, to illuminate the changing nature of our dynamic global capital markets, and to help meaningfully guide and manage our decisions. Expert investment management requires a broad and informed view across global markets. Although we are critical of certain ways that quant modeling is often used today, our experience suggests that at this important juncture, the practice of active quant portfolio management should not be abandoned altogether. Rather, we propose an eclectic approach that combines quantitative modeling with informed qualitative assessment and offers a robust technique for successful investing.

The inflection point at which we now find ourselves calls for a sharp refocusing on effective approaches and tossing aside ineffective *dilequant* methods.[1] A more constructive way forward is within our grasp. Success requires a move toward a dynamic, top-down (macro-driven) approach that is capable of capturing shifts in global risk-and-return expectations across an array of asset classes and market environments.

This article stems from our previous work at the intersection of investment management and complex adaptive markets (Li [2007], Sullivan [2008, 2009a, 2009b, 2010], and Sullivan, Peterson, and Waltenbaugh [2010]). Expanding our focus beyond quantitative inputs to emphasize empirically driven judgment, we examine portfolio construction that optimizes the strength of signals by quantifying and qualifying macro-oriented insights combined with solid, bottom-up

security selection. Although data are lacking, the active quant community does not appear to be pursuing our suggested, macro-driven approach.

ACTIVE ALPHA

Especially in recent years, the development of modern portfolio theory has provided the backdrop for the widespread acceptance of the techniques of active quants and the rise in their popularity. Like all successful investors, successful active quants make decisions on the basis of informed theory and keen historical insight, thus fostering market efficiency and sustainability. Although the active quant approach is difficult to ascertain, its primary component is a systematic, structured investment process that involves the large-scale collection of relevant current and historical information summarized in a meaningful, nonarbitrary way for use in making decisions about the future.[2] Active quant management is typified by the structured, system-driven approaches of Grinold and Kahn [2000].

In essence, active quants seek superior performance through the gathering and distilling of complex historical information in a systematic fashion.[3] Quants are so called because of their intense focus on "quantifying" unique alpha insights—those not already priced into the market. This quantifying is accomplished via formulaic empirical factor models applied across a wide array of assets in a hunt for statistically significant deviations from historical trends. The basic idea is successful forecasting driven by identifying signals (skill) and applying that skill as often as possible per year (breadth).

In their purest form, active quant factor models attempt to systematically capture recurring deviations from the general equilibrium CAPM market model. Active quants view the traditional CAPM, as driven by the single market factor, an oversimplification of the realities of markets. Active quants thus seek to generalize the traditional CAPM with skillful exposures to additional tradable factors. Though there exists no predetermined set of factors, many strategies and factors do exist. Examples of such insights include the various documented behavioral biases exhibited by investors. Collectively, this set of factors forms the driving force behind abnormal returns and can span a wide range of likely alpha sources. We can easily understand how investors view the culture of active portfolio management as a valuable and disciplined process for extracting alpha. By our very nature, we humans love structure. It is elegant in its intuitive appeal and implementation.

A distinct advantage touted by active quant practitioners is that the process leads to a highly disciplined investment approach. That is, a rigorous, variable-centric approach, which follows a logical, hypothesis-oriented decision process, is largely uninhibited by the various cognitive lapses in judgment exemplified by the average investor. Furthermore, computer models have the superior ability of rapidly processing vast amounts of information. Given the dynamic complexity of markets and the many assets at play, active quant modeling is undoubtedly a useful aid in the ongoing search for alpha. These various quant attributes can be turned into a competitive advantage when applied in the right circumstances. Before discussing this way forward, let us briefly turn our attention to the ways that quant models frequently trip us up in our search for performance.

ACTIVE ALPHA SHORTCOMINGS

Any discussion of the challenges of successful active portfolio management must begin with the fact that alpha sources are very rare, even rarer than commonly supposed. To see why, let us consider persistent alpha capture, which, as noted by Jarrow [2010], requires two conditions: 1) The activities of arbitrageurs do not eliminate market mispricing and 2) the alpha source is continually funded in a structural way, knowingly or not, thereby allowing arbitrageurs to reap profits. Of course, such market conditions occasionally exist, but given these two rather stringent conditions, alpha is certainly not present in abundance.[4] For this and other reasons discussed later, active alpha is more elusive than many believe.

Now that we know our biggest challenge is finding active alpha, let us briefly consider the various ways in which the process-driven active quant approach, as it is sometimes applied today, can hinder success. Key obstacles can be found in the model development process—the systematic sourcing and implementing of the active signals. These issues combine to give active quant investors a false sense of skill.

The most pernicious issue concerns the inability of static active quant models to effectively capture change or the unexpected. The future direction of markets—like the path of a bird just released in flight—is highly uncertain. Although computer speed and mathematical

models are a powerful combination in ferreting out vast amounts of information and recurring patterns, effectively automating human nature remains elusive. As recent events have demonstrated, markets seem to mock the structured, disciplined approach of models. They abruptly jump from one equilibrium point to another, giving yield to fat tails and rendering the commonly used static structural models impotent. Consider how, during the global financial crisis, governments around the world implemented a flood of unconventional policies at lightning speed. These shocks quickly introduced a variety of new elements that influenced financial markets in unprecedented ways. No single model can contain all the information necessary to capture the uncertain path of outcomes and their attendant consequences. A more dynamic approach, accompanied by empirical judgment, is needed.

Unfortunately, many active approaches have been oversimplified; for example, many such approaches are based on the assumptions of normal distribution and stationarity. That is, they assume that market prices will behave as they generally have in the recent past with the hope that the strategy can be adjusted just before markets start to change direction. Over a series of market cycles, little or no value is added by such approaches—indeed, negative value add is most often the result after fees.[5]

Of course, history serves as an important guide to understanding the interconnectedness of markets and the range of possible outcomes. In reality, market linkages, even those established over long horizons, are dynamic, subject to the ebbs and flows of markets. Models that are "overfitted" on the basis of historical dynamics can be severely hampered by the structural changes and sudden stops that financial markets frequently experience.[6] These changes can significantly alter—temporarily or even permanently—the relationships established by a model.

Active quant managers attempt to deal with overfitting in a variety of ways, some of which may be useful and effective tools in the search for alpha (e.g., regime switching and extreme value theory), but other methods are downright problematic (e.g., winsorization, which essentially ignores extreme events and volatile markets). Perhaps well-established relationships will revert to their old ways following a particular event, or maybe the newly established structural relationships will become dominant. In any case, uncertainty cannot be removed from the equation. Factors are stochastic and time-varying processes; they are inadequate representations of the reality of complex, adaptive, and unpredictable markets.

Put another way, static active alpha factors are built to perform well over time, on average. Success thus depends on the future mimicking history in a structured, persistent way. But history repeats itself only in broad tendencies. Perhaps driven, in part, by "physics envy," many active quants treat factors as factual and permanent, when they should be viewed as merely temporary, as suggested by the social nature of markets. Guided by the free will of agents, markets and the economy adapt responsively over time. Using the same overfitted model parameter weightings through all macroeconomic cycles will likely not work well. In short, static alpha factors fitted with historical data may prove to be false factors when applied to future horizons.

Another not so subtle point is that we cannot know the true general equilibrium model that describes market returns. Models miss the richness of complex, adaptive markets. As stated earlier, although CAPM is a solid theory, it is viewed as naive by modern investment managers and thus possesses limited applicability. The well-known Fama–French size and style factors represent a constructive step forward in generalizing the CAPM. But variables are always missing from any model that attempts to capture the interactions in capital markets. Even the best statistical models make simplifying (or hidden) assumptions and can incorporate only a small number of variables, thus obscuring the variables' implications.

Even if we could accurately define the true market model, model builders can describe only those aspects of financial markets that are measurable or can be reasonably proxied (e.g., the value metric can be measured in many reasonable ways). Some desirable inputs, however, cannot be reasonably measured or proxied. Consider the modeling of the accrual anomaly associated with earnings gimmickry. Effective arbitrage of the impact of any accrual-related earnings management requires an estimate of those accruals for which management exercises discretion (normal accruals are difficult to manipulate). Only imperfect proxies exist for discretionary accruals, however, and any inputs are measured with error. Li [2010], for instance, showed that discretionary accruals are just one aspect of earnings gimmickry. He demonstrated how additional earnings management activities regularly used by managers can also be used to predict

performance. In sum, forecast error that is related to the modeling process emanates from many sources: omitted or mismeasured variables, misspecification, overfitting, and obscured or wrong proxies or factors. In our experience, these errors have led to costly, unintentional bets for some investors.

The empirical weakness of common quant models is evidenced by weak explanatory power (low R^2s), accompanied by significant idiosyncratic volatility. Residual risk imposes real uncertainty, and it is a primary factor in limiting both effective arbitrage and the extraction of alpha. In turn, investors seeking to profit from various anomalies must bear greater uncertainty in outcomes than was previously understood (Pontiff [1996, 2006] and Li and Sullivan [2010, 2011a, 2011b]). This uncertainty comes in the form of high idiosyncratic risk and transaction costs, which raises costs and hinders the profitable arbitrage of seemingly anomalous effects. The foregoing leads us to conclude that active quant models frequently possess biases in what modelers believe to be true about the relationships established via the modeling process.

Moreover, as alpha opportunities become known, overcrowding occurs.[7] As noted by Lo [2004], markets are not only complex but also adaptive. Such crowding into the trade has decreased (or eliminated) the persistence of the well-known alpha opportunities and may even result in a sudden reversal of well-established relationships (e.g., large caps outperforming small caps for an extended period). For instance, note that the equity market flare-up in early August 2007 was deemed to be driven, in large part, by a sudden downdraft of concentrated equity holdings common to many quant equity funds (Kandhani and Lo [2007]). Increased trading commonality also suggests a rise in market vulnerability as evidenced by increased systematic risk in recent years (Xiong and Sullivan [2011]).

The aforementioned issues also present major challenges to the business of implementing the often dense and opaque quant models. Even though quants may embrace Einstein's advice to make everything as simple as possible but no simpler, highly structured models geared to complex, dynamic markets are necessarily complex themselves. Although investment personnel can grasp a model's key insights, the difficulty in gaining a full, working knowledge seems to increase with the square of the number of inputs. Operational managers are thus challenged to ensure that all segments of the firm fully understand the implications of any model put into practice. For success, one must know what risks both the firm and its clients face in the investment process—and how to manage those risks effectively—as well as what changes are needed to improve (or worse, fix) a model that is not producing.

For all these reasons, one may fairly say that these challenges create a high degree of uncertainty for typical quant performance. Static models make little sense in a world where risk premiums, correlations, and volatility change dramatically from year to year.

As mentioned earlier, the rigorous decision-making process of active quants has value under certain circumstances, but when misused or overused, it can be detrimental. Models are merely a guide for quality decision making in the face of uncertainty. They interpolate and extrapolate the world, but by no means offer *the* correct interpretation of reality. Therefore, those depending on quant models have a responsibility to be keenly aware of the limits, boundaries, and risks of quant techniques and to know when to turn away and seek input elsewhere. This task becomes more challenging as finance grows increasingly complex.

The shortcomings of active alpha offer a compelling reason to dispense with ineffective approaches to active quantitative management and refocus attention on the ways that modeling can be effective. In this way, quants can gain a competitive edge while supporting client goals.

THE FUTURE OF ACTIVE INVESTING

Active portfolio management is at an inflection point. The recent market turbulence has reinforced the notion that active managers are not worth their high fees. The active quant community has seemingly suffered more than most. Adding to these troubles, investors are increasingly turning to passive and semi-passive, low-cost index funds. We predict that such index strategies (in particular, in the form of exchange-traded funds) will continue to absorb market share in the coming years, especially from the active quant side, because such strategies in practice today are easily replicated in a growing roster of fund offerings.

These issues have certainly not gone unnoticed by the active quant community, which continues to try to improve the effectiveness and efficiency of traditional quant models, mostly through active signal innovation.

EXHIBIT 1
Macro Risk Factors

Inflation
Credit
Country
Currency
Size/Style Rotation
Liquidity
Momentum
Volatility
Economic Growth

Although likely to meet with some success, this additive approach, in our view, does not go far enough. As discussed earlier, adhering to a set of fixed factor weights (established as the average of various market cycles) will lead to unacceptable performance periods. Designing flexible models with an eye toward quantifying big-picture issues warrants considerably more attention; see Exhibit 1. Model construction should thus emphasize empirically based evidence that includes specifications to appropriate risks and the nimbleness to cope with market turbulence. Models should work well in circumstances that matter.

The myriad of challenges facing the active quant community, notwithstanding, we foresee a dynamic future for active quant investing. This (not altogether) novel breed of active quant asset management will exhibit an interdisciplinary culture focused on extending and updating (not abandoning) the existing core competencies held by the typical active quant firm. In light of the challenges to achieving investment success, the need for an agile top-down active asset management approach that integrates both quantitative and fundamental insights is clear. Managers should take risks if the returns appear to represent fair compensation. At any given time, some asset classes may offer an acceptable or even generous compensation while others may offer an unacceptable trade-off. The idea is to take full advantage of time-varying risk premiums, driven, in large part, by investors' cycling between risk aversion and risk adoration.

On this last point, capturing risk premiums cannot be accomplished with overfitted static models developed via back testing. A forward-looking orientation will emphasize an eclectic framework with the flexibility to capture the top-down risk dynamics of markets. In practice, this approach means broadening the inputs to include global macroeconomic views, which will play a more prominent role in asset management. The prevailing framework thus switches from static to dynamic asset allocation and takes into account time-varying macroeconomic forecasts that are overridden by qualitative judgment, as necessary. With such skill comes the ability to recognize when a new structural cycle has begun.

In other words, successful macrofactor timing requires the transmission of informed, empirically based judgment into the portfolio. Moving away from a narrow focus (e.g., on the convergence to the norm of company-specific factors) and toward broader macrofactors can be achieved only through a more qualitative approach. The weak *statistical* significance of many macrovariables may give pause to some in adopting macrovariables into the formal model framework, but given the frequent turbulent systemic events affecting markets, such insights may indeed be highly *economically* significant. They should certainly not be ignored. A judgment-oriented approach based on empirical evidence will enable investors to better guide risk taking and thus help clients succeed over the long haul. Obtaining a statistically significant, but economically insignificant, alpha when the total portfolio is substantially down does little to help investors achieve their goals.[8]

Dynamic global asset allocation will necessarily be complemented with a rigorous, bottom-up assessment of assets, as always. In this connection, an innovative strategy may well set aside parsimony in favor of a looser, more qualitative approach—for example, one that mixes fundamental with active quant investing and that integrates bottom-up stock selection with top-down global macroinvesting. Such a rich, integrated process that explores the full range of possibilities could offer the best chance of performance success—say, in recognizing when a new world order is upon us. Active investment managers could turn macro-driven market cycles into a competitive advantage—admittedly a delicate task, calling for a competency in dynamic global asset allocation.

Our recommended framework is consistent with Xiong et al. [2010], who found that about 80% of total return variation is dominated by changes in the general market, with the remainder evenly split between specific asset allocation and security selection. In other words, passive asset allocation and active asset allocation together account for the bulk of return variability. Our suggested approach is also consistent with Markowitz [2005], who found that the market portfolio is not necessarily an efficient portfolio.[9]

Our top-down approach also places dynamic risk management at the fore; attention is paid to much more than market risk. Investors must also give ample attention to liquidity risk, counterparty risk, systemic risk, and the effects of leverage. This idea appears to be gaining traction. Witness the recent surge of interest in gaining a better understanding of fat tails (which imply a more frequent occurrence of extreme events), dynamic correlations, and systemic risk (see, e.g., Kritzman and Li [2010], Sullivan, Peterson, and Waltenbaugh [2010], and Xiong and Idzorek [2011]). These models provide a framework that illuminates the changing nature of risk and helps guide and manage risk decisions.

In recent years, investors have turned their attention to greater diversification of asset classes in order to generate higher returns and protect assets from market volatility. We certainly agree that a broad array of asset classes can improve portfolio efficiency and should thus be included in portfolios. This notion is consistent with Tobin [1958] and Sharpe [1964], who suggested that portfolios should be formed with a combination of the risk-free asset and the market portfolio of all risky assets. Nevertheless, many investors undertook asset allocation under the false premise that certain asset classes would yield equity-like premiums while being largely uncorrelated with the overall market. But when evaluated carefully in reality—and as many learned painfully during the global financial crisis—the uncorrelated asset class is a myth (Ennis [2009]). The lesson here is simple: Collecting a risk premium means that the investor must bear the risk—there is no free lunch in asset allocation.

Altogether, this suggests that the primary focus should be on that which plays the biggest role—the asset allocation decision, that is, the process of deciding how best to adjust asset allocation in accordance with a sensible assessment of the risk–return trade-off that the various markets are offering. Again, the decision to invest (i.e., whether to take risk) is the most important investment decision. How much market risk to take entails the two aspects of asset allocation: policy allocation to the general market, and specific asset allocation. The powerful intuition behind our approach is that proper portfolio construction is an ongoing, dynamic process, one of calibrating from the top down the set of risk and return expectations for each asset (asset class, country/region, industry, and security) against current and expected macroeconomic and investment conditions. Although challenges remain, the upside is a compelling, flexible framework, one that integrates the time-varying macropicture with microspecific analysis. Such an approach is within our grasp.

Although obstacles to implementing our suggested approach to portfolio choice undoubtedly exist, the evidence makes clear that successful investing is dominated by value-driven active asset allocation. As Bernstein [2003] deftly observed, the traditional strategic approach of fixed asset allocation is outmoded. The challenge of portfolio choice is much more than merely selecting for inclusion uncorrelated asset classes that constitute significant economic exposure and then specifying a fixed proportion of each.[10]

As Sharpe [2010] noted, the only portfolio that all investors can hold simultaneously is the market-weighted portfolio of all assets. So, holding the market portfolio is best for those without superior knowledge about the relative attractiveness of asset classes. Anything else is an active strategy. This observation plainly suggests that the traditional approach of rebalancing to prespecified weights represents an active contrarian strategy. But as we have shown, no single fixed-weight strategic asset allocation is best for all environments.[11] This discussion leads us back to our main thesis: An industry shift—an eclectic approach that adapts to the market situation, with a focus on the capacity to understand the trade-off between asset classes from a macro point of view—is needed. With skillful insight and wide breadth, algorithms can go beyond a systematic narrative of what has merely happened in the past. This approach means implementing all relevant quantifiable and qualitative factors, regardless of whether those factors can be systematically incorporated.

For all these reasons, active quantitative investment management appears to be on the verge of important change, which is not necessarily a bad thing. At the very least, it suggests an opportunity. An approach that incorporates a nimble and dynamic global asset allocation is more likely to yield positive results for all interests (both principals and agents) over the long haul. Although ours is perhaps not an entirely novel approach, it is certainly not the currently dominant one.

CONCLUSION

Active equity management has become increasingly narrow and complex, but not necessarily wiser. As a result, investors will likely continue to embrace

passive and semi-passive low-cost index strategies and shun high-fee, hidden-beta strategies. For these reasons, we are at an important juncture in active quantitative investment management. To navigate this juncture successfully, the skills of quants can be tapped for a competitive advantage, but only in the right circumstances.

We envision a flexible and nimble investment approach, one that will more likely deliver performance success over both the intermediate term and the long haul. We see quantitative asset management turning to an eclectic framework that accommodates a wider array of possible outcomes and that copes with the frequent occurrence of extreme events (fat tails). The distinguishing feature of our technique is the recognition that investors must negotiate turbulent periods. Today's standard active quant models that use static linear methods will, by their very nature, prove inadequate in such markets. Therefore, expert models must dynamically reflect all portfolio risk exposures, not merely those represented by typical conditions and captured in static models. Qualitative judgment based on empirical evidence must meaningfully accompany any quant-driven, decision-making process.

In sum, we call on the active quant investment community to broaden its focus beyond the standard bottom-up, systematic model by incorporating a dynamic top-down (macro-driven) approach to investment management, one with the flexibility to capture shifts in risk and return expectations across an array of asset classes and market environments. Quant methods can be highly useful when accompanied by qualitative reasoning. Given the extreme events that markets frequently experience, modelers must take seriously their responsibility to engage deeply.

ENDNOTES

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[1]We borrowed this term from Mark Kritzman, who has applied it to those who merely dabble in quant methods.

[2]We use the terms *active quant*, *active alpha*, and *active portfolio management* synonymously. By quant, we mean traditional active portfolio management strategies, not other quant forms, such as statistical arbitrage or high-frequency trading.

[3]Of course, this definition is not limited to quant investors. For a brief overview of both fundamental and quant investing, including pitfalls, see Sullivan [2010].

[4]One example of persistent alpha is the value of the call option implied by a residential mortgage-backed security (RMBS), which has historically tended to be overpriced by homebuyers, thus affording RMBS buyers an arbitrage opportunity. Will this source remain viable in the future?

[5]For example, Agarwal and Naik [2004] and Mitchell and Pulvino [2001] found that many hedge fund strategies possess characteristics similar to a put option.

[6]To varying degrees, all investors rely on historical information to guide their decisions. Therefore, rigorous historical analysis is not necessarily problematic unless the user expects the future to mirror the past. The backward-looking nature of quant investing, however, should serve as a reminder of the limits of quant models.

[7]Although nuances certainly exist, quant alpha frameworks bear a striking similarity. As evidence, consider how most quants rely on the same risk and optimization models provided by a limited number of vendors, many of whom deliver data updates on the same schedule. Li [2011] offers a discussion of the optimal global equity investment framework.

[8]Several statistical issues also inhibit the effectiveness of pure top-down quant approaches. First, modeling extreme events yields very small sample sizes and thus little chance at statistical significance even when estimated over a long historical sample. Second, return modeling generally requires fixed intervals such as monthly, quarterly, or annual. Such fixed modeling intervals cannot successfully capture the turning points of market cycles. Maybe for this reason, NBER can only mark the end of a recession long after it has ended.

[9]Specifically, Markowitz [2005] suggested that the inefficiency of the market portfolio could be so substantial that it would not be arbitraged away even if some investors could borrow without limit.

[10]For further discussion on this topic, see Sullivan [2008].

[11]Of course, managers should regularly compare their asset allocations with current market proportions.

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