D E Shaw & Co

Programmed Obsolescence:

The Generic Paradigm in Quantitative Equity Investing and Why It's in Trouble

Abstract

Over the past forty years or so, actively managed quantitative equity strategies have become a growing presence within the asset management industry, with numerous competing firms offering a relatively standardized set of products. The vast majority of managers in the benchmark-relative quantitative equity space, which has the largest pool of quant equity assets, relies on what this paper terms the "generic paradigm": valuation and momentum alpha forecasts, highly standardized and often commercially available risk models, and mean-variance portfolio optimization tools. This paper argues that each element in this generic approach to quantitative equity management has become vulnerable to competitive pressures and changes in the nature of global equity trading. As a result, the performance of quant equity strategies in the benchmark-relative space has suffered over the past three years, and generic quant managers are likely to face considerable challenges in attracting additional assets going forward. Managers that eschew the generic approach by deploying more diversified sources of alpha, proprietary risk tools, and innovative approaches to dynamic portfolio optimization are likely to fare better, but to the extent they do, it will likely be on a far smaller scale in terms of aggregate assets under management.

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Quantitative approaches to active equity investing emerged in the late 1960s as advances in computing power, software, and electronic communications increasingly facilitated systematic trading. Then, as now, the goal was relatively straightforward: use quantitative techniques and automated systems to objectively evaluate a broad universe of stocks in the context of expected risk and return and to build and manage portfolios more efficiently and dispassionately than traditional, subjective methods. As with other systematic investment disciplines, quant equity trading was pioneered by a handful of innovators and refined by a larger number of practitioners. Over the past forty years or so, actively managed quantitative equity strategies have become a growing presence within the asset management industry, with numerous competing firms offering a relatively standardized set of products.

And yet the core techniques and tools that drive a majority of quant equity strategies (and many of the firms that deploy them)—described in this paper as the "generic paradigm"—are now in a state of crisis. Over the past three years, the performance of the median active quant equity benchmark-relative product has deteriorated considerably, and assets under management invested in these products have fallen off to a corresponding degree. This paper traces the origins of this predicament. It highlights how a number of firms, particularly some that managed a disproportionate share of capital allocated to quantitative equity strategies, used widely shared value and momentum alpha signals and third-party optimization and risk management tools, and discusses how that generic approach adversely affected those firms' growth and performance over time.

It seems likely that actively managed quantitative strategies will become a smaller and less concentrated segment of the asset management industry in the near- to medium-term, as performance for the universe of managers is likely to remain inconsistent at best and investors continue to take their money elsewhere. However, the performance of several firms that do not subscribe to the generic paradigm may buck this trend. Over the longer term, it's likely that firms that have developed, or are capable of developing, unique models and proprietary methods—those that don't follow the generic paradigm—will be able to compete for market share. On an optimistic note, we believe a number of quant equity managers have made significant strides in this direction.

1. The Generic Paradigm

Quantitative approaches to investment management generally, and active equity investing in particular, can be differentiated across a number of dimensions. However, all active quant equity processes rely on at least three core elements: alpha models, risk models, and optimization software. The bulk of assets in the active quantitative space is currently overseen by managers using broadly similar (and in some cases literally identical) techniques in these areas, and that generic paradigm, more than anything else, has precipitated the current crisis of confidence in the industry. Let's briefly examine each element.

- Alpha signals are dominated by valuation forecasts as well as investment models based on momentum and analyst earnings revisions. These factors are used to generate expected alphas for each stock at a particular point in time. The forecasts are then generally combined to generate an aggregate price forecast or alpha for a given stock.
- Risk is typically measured using a variant of arbitrage pricing theory ("APT"), which assumes that the risk of each stock can be broken down into exposures to various common risk factors and an idiosyncratic or residual risk. In addition to sharing a common conceptual framework, many managers obtain their suite of risk models from a relatively small number of vendors such as MSCI Barra and Northfield Information Services, and, as a result, they employ the same definitions of risk and constrain their portfolios to similar potential opportunity sets.
- Managers typically construct portfolios using some form of mean-variance optimization. Commercially available portfolio construction software marketed by firms such as Axioma, Barra, or Northfield relies on the mean-variance methodology, and thus that optimization framework dominates the industry.

Given that the generic quant equity manager relies on "off-the-rack" solutions to handle risk modeling and portfolio optimization, firms will naturally try to differentiate themselves by the quality of their alpha signals, and thus will expend much energy on this leg of the process. Unfortunately, because the apparent alpha being sourced is so often harvested from the same broad factors, differentiation is quite difficult. We will explore the implications of that in more detail later in the paper.

We should note here that in addition to "pure" quantitative approaches to equity investing, which is the exclusive focus of this paper, managers that utilize "fundamental" stock-picking approaches have increasingly relied on elements of the generic paradigm, including using valuation factors to narrow or "screen" large universes of stocks to identify those that warrant greater attention. In addition, such fundamental managers have also used third-party risk models to better understand other exposures that may result from their bottom-up investment approach.

At this stage, let's clarify two important points. First, the generic paradigm is so common that it's often viewed as synonymous with the totality of quant equity investing. For example, after classifying quantitative equity investing as a form of what he calls "scientific investing," BlackRock's Ronald Kahn (2010) suggests that, in fairness, quant equity investing "has come to mean something much more narrow: optimizing portfolios with forecast returns proportional to a few well-known publicly available financial ratios—book-to-price, earnings-to-price, price momentum, and analyst estimate revisions."

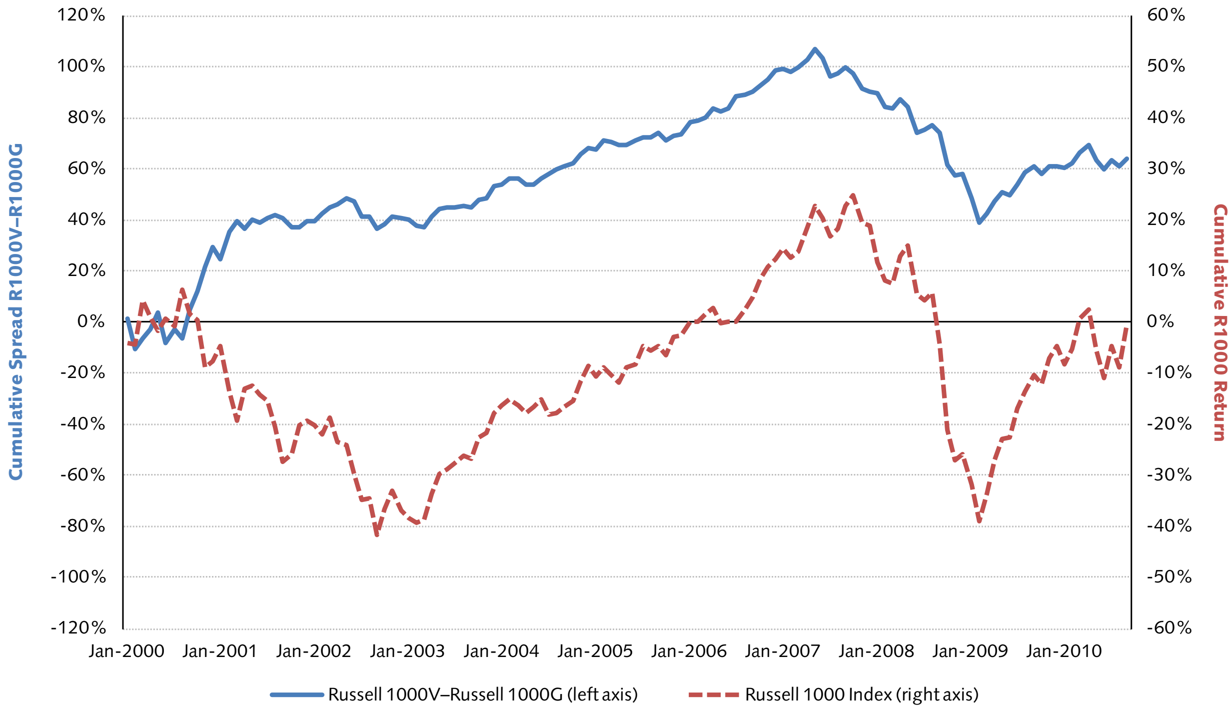
Second, that perception is incorrect: the generic paradigm is not universal. A number of quant equity managers (including the D. E. Shaw group) do not rely on the generic paradigm. These firms, which currently represent a modest slice of the industry's assets under management, have developed approaches to quantitative equity investing that consciously seek to avoid the common elements outlined above.

2. Recent Performance and Changes in Assets under Management in the Quant Equity Space

For the generic quant paradigm, the first decade of the new millennium was the best of times followed by the worst of times. In this section, we explain why the worst of times seems likely to persist.

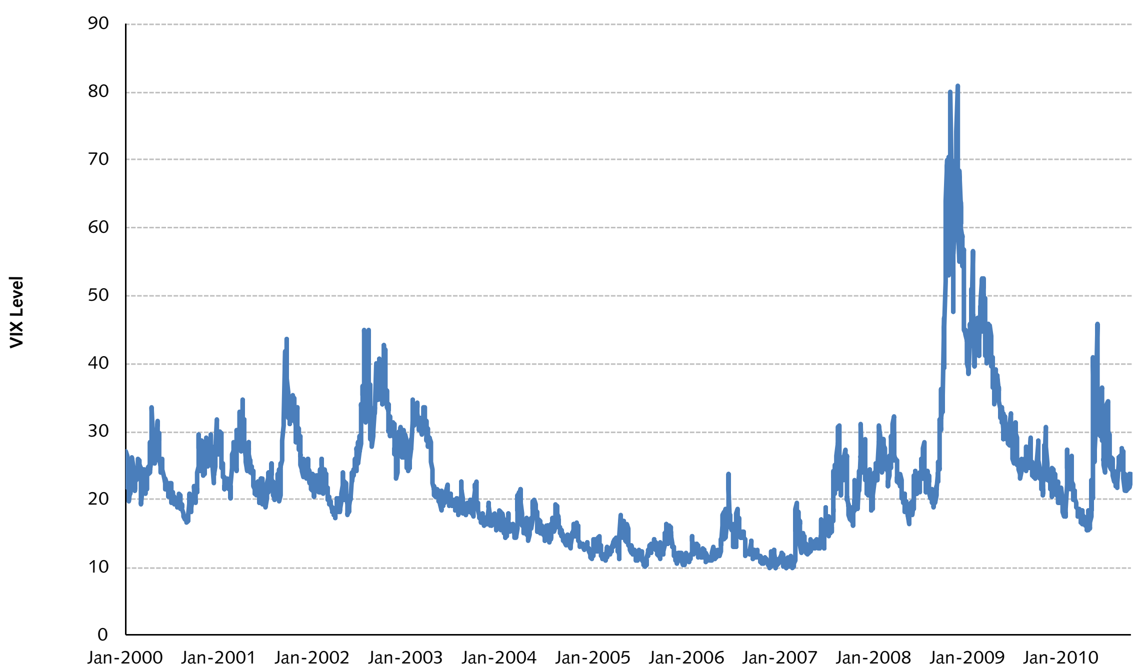
Figure 1 shows the cumulative excess return spread between the Russell 1000® Value Index and the Russell 1000® Growth Index from 2000 through the third quarter of 2010, along with the cumulative return of the Russell 1000® Index over the same period.[1] The first thing to note is that value consistently outperformed growth from about the middle of 2000 until the middle of 2007.

Figure 1: Difference between Russell 1000 Value Index and Russell 1000 Growth Index Cumulative Returns and Cumulative Return of Russell 1000 Index, January 1, 2000–September 30, 2010[2]



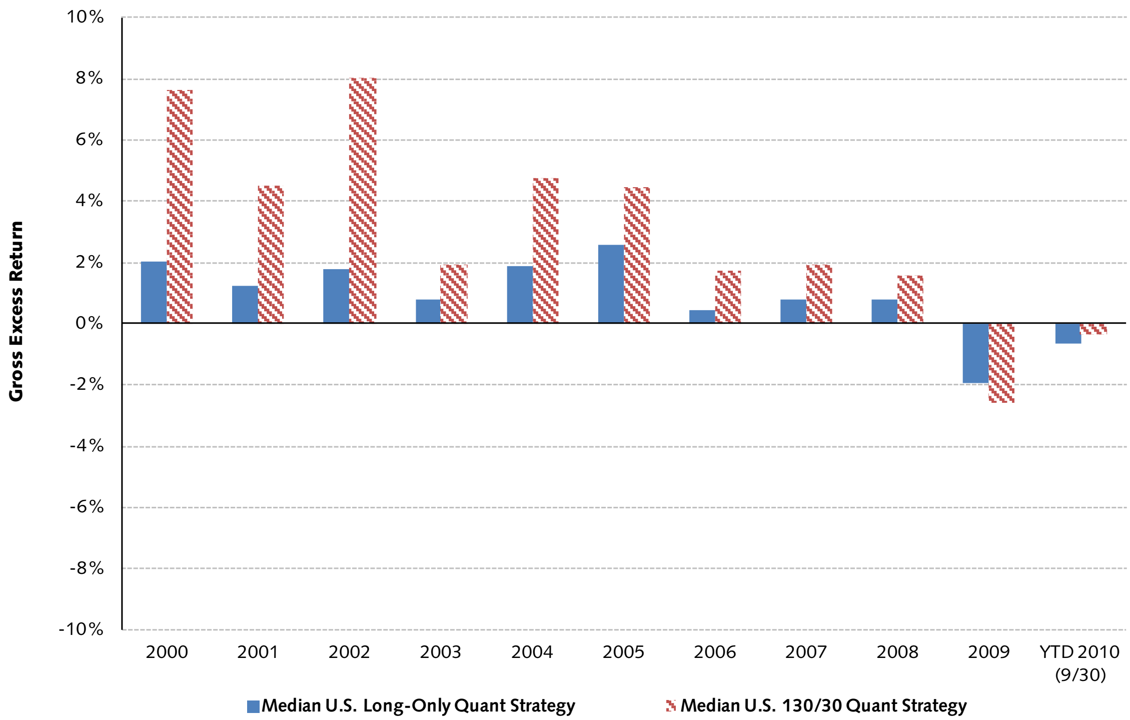
After surging ahead of growth in June 2000 as the tech bubble burst, value continued to outperform, albeit at a more moderate pace, between 2002 and 2007. In addition, over roughly the same period, U.S. stock market volatility declined considerably. As illustrated in *Figure 2* below, after reaching approximately 45 in early August 2002, the VIX Index fell below 20 by mid-2003 and stayed between 10 and 15 for much of the period between mid-2003 and mid-2007.

Figure 2: VIX Index, January 1 2000–September 30, 2010[3]



The tailwind generated by value's outperformance, and smooth waters resulting from declining levels of volatility, contributed to the success of quantitative equity managers within the generic paradigm which, as discussed earlier, depends largely on a value tilt as a source of active return. Although value has tended to outperform growth over the long term, this period of sustained outperformance was unusual in duration and in large part explains how actively managed quantitative products outperformed their benchmarks for much of the decade, as illustrated in *Figure 3* below.

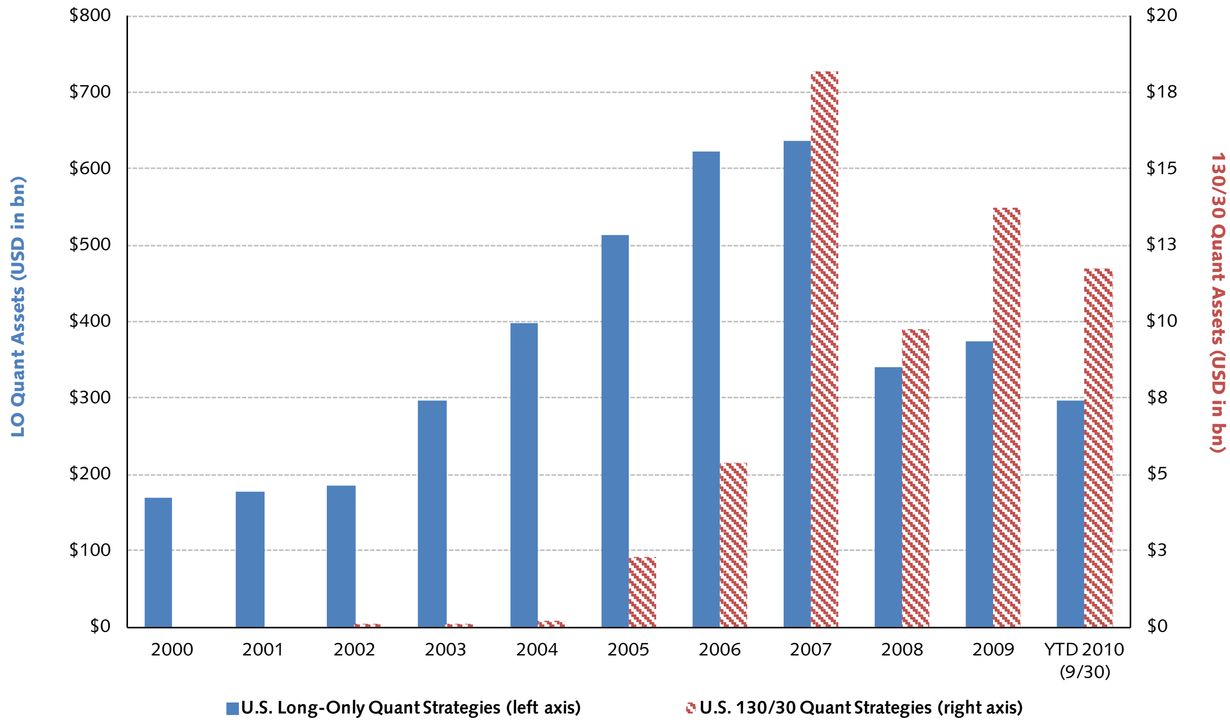
Figure 3: Excess Returns of Long-Only and 130/30 U.S. Quantitative Equity Strategies, 2000–2010[4]



This outperformance was especially pronounced in so-called "130/30" strategies. Such strategies provide for 30% gross shorting, effectively allowing for the financing of an additional 30% in long exposure for a cumulative net exposure of 100% (*i.e.*, identical market exposure to that of a traditional long-only configuration, but with, in theory at least, more latitude for a stock picker to add value through security selection). The success of these 130/30 strategies may be credited to the levered effects of exposure to value over this period.

Figure 4 shows year-end assets under management ("AUM") in U.S. quantitative equity strategies from 2000 through 2009 and at the end of the third quarter in 2010. Actively managed, benchmark-relative strategies using the generic paradigm benefitted from remarkable growth in AUM from 2002 through 2007 because any manager deploying that approach outperformed, and, as is ever the case, such performance tends to attract new inflows.

Figure 4: Assets under Management in U.S. Quantitative Equity Strategies, 2000–2010[5]



These inflows also had an ancillary impact on the relative effectiveness of the alpha models utilized by generic quant managers because those managers' dependence on similar alpha sources means they hold similar positions. The U.S. stock market is highly liquid, but as the assets managed by any individual firm grow, so naturally does the proportion of average daily volume represented by a given trade across all of a firm's portfolios. The time required to establish a position of a given percentage size without generating significant market impact also increases as AUM increases. For example, if every quantitative equity manager held 2% of its portfolio in the stock of 3M Company at the end of 2001, it would have represented 27.2% of dollar average daily volume. By the end of 2006, that same 2% position in the quant equity universe would have grown to 85.2% of dollar average daily volume because the large increase in the AUM invested in quant equities vastly outstripped the modest growth in the average dollar volume of the market as a whole over the same period. To put it simply, the huge increase in quant equity AUM meant that larger managers were increasingly cannibalizing each other's capacity and thereby greatly constraining how they could deploy those assets.

This had an important implication for performance given that many quantitative equity managers were increasingly dependent on higher-capacity, longer-term, and slower-to-change alpha signals. The concentration of assets in longer-term sources of alpha, whether existing "generic" value or momentum factors or "new" variations on those signals, became problematic. This was exacerbated as industry-wide AUM grew and became concentrated in a few dominant quant equity firms, particularly those that had built large passive equity management businesses and now saw many of their investors migrate to enhanced index and other risk-controlled strategies. These firms, properly cognizant of their size, became dependent to a greater extent on longer-term expected returns because their portfolios were simply too large to efficiently take advantage of other, shorter-term effects, making them captives to their models. This would have obvious implications if those factors became less reliable predictors of future returns, as they most assuredly did from the middle of 2007 through to early 2010. The watershed moment, of course, occurred in the summer of 2007, when a liquidity crisis and subsequent deleveraging in equity names widely traded by quantitative managers precipitated a sudden fall in the returns of their portfolios.

In sum, the stars aligned for the generic quant paradigm between 2000 and 2007, allowing almost any manager relying on that approach to generate sustained outperformance. After June 2007, the fragile nature of this outperformance became clear, with many of the dominant players having perversely become victims of their own success: managing very large pools of capital that greatly constrained their ability to find alternative, diversifying sources of alpha.

3. Diminishing Returns in Fundamental Factor Research

Generic quant equity managers have invested heavily in researching valuation and longer-term momentum effects. When a manager has a large existing exposure to a given source of alpha, areas related to that alpha source often figure prominently in that manager's research agenda. This is natural, but it can also result in a substantial misallocation of resources if the given factor is well known and already extensively researched, or simply if the core implications of that factor do not differ materially from marginal modifications made to it. This means that generic quant managers, when compared to other managers, are likely to be far less capable of adapting to the competitive landscape once their alpha sources begin to decay. It's not that generic quant managers couldn't research independent sources of alpha; rather, we believe, most have developed a worldview that valuation and momentum factors are the predominant source of market inefficiencies and thus alpha sources. When these signals struggle, some managers may allocate research resources to explore new sources of alpha but may be quick to abandon these efforts when valuation and momentum breathe signs of life once again. We believe this dynamic has played a role in the declining fortunes of managers using the generic paradigm in the past few years.

The diminishing returns to research on valuation effects are evident from research conducted by Dissanaike and Lim (2010). The authors analyze the comparative profitability of a range of valuation models of the kind often used within the generic quant paradigm. In the category of simpler financial ratios, they consider earnings, book values, cash flow, and operating cash flow; in the more complex category, they consider the residual income model (see Frankel and Lee [1998]) and Ohlson's extension of that model (see Dechow, Hutton, and Sloan [1999]). For purposes of assessing the relative predictive power of these valuation models, Dissanaike and Lim employ a very simple strategy based on performance of the three prior years. Since a variant of the Ohlson model is the top performer over a range of metrics, it's worth providing a bit more detail on that model's moving parts:

$$P_t = b_t + \alpha_1 x_t^a + \alpha_2 v_t$$

where:

$P_t =$ value at time t

$b_t =$ book value at time t

$\alpha_{1,2} =$ alpha sources

$x_t^a =$ abnormal earnings at time t

$v_t =$ information about future abnormal earnings

In short, the Ohlson model holds that changes in a company's valuation are driven by the persistence of abnormal earnings, which are themselves a function of the persistence of the abnormal accounting rate of return and the growth rate in book value.

The dataset used by Dissanaike and Lim is based on U.K. equity markets between 1965 and 2001 for some variants and 1987 to 2001 for more data-intensive variants. Their analysis of the competing models considers various stock-specific and unconditional approaches to estimating α_1 and α_2, as well as various bells and whistles applied to the residual income model. They conclude that the simplest variant of the Ohlson model, setting α_1 equal to an unconditional estimate across all stocks and $\alpha_2 = 0$, is the winner. In other words, there appears to be such a limit on the rewards to complexity that, even before considering additional degrees of freedom, simplicity wins. They also find that a simple price-to-free-cash-flow ratio model is almost as effective as the winning strategy. As they put it in their conclusion, "Our most intriguing finding is that simple cash flow multiples appear to have almost as much power in predicting future contrarian profits as the more sophisticated alternatives."

It would be interesting to see a similar analysis for other markets. Dissanaike and Lim refer to other papers that they consider supportive of their conclusions in the U.S. context, but those papers are somewhat dated. That said, these results certainly are in line with practitioner experience in working with valuation models. Almost all valuation approaches are highly correlated with price-to–free-cash-flow, and lower correlation and greater complexity are often associated with inferior performance. Furthermore, given this high degree of correlation and the fact that cash-flow ratios are widely documented in the academic literature as market inefficiencies that could be exploited as alpha forecasts, it's indeed unlikely that any two quant managers relying on valuation factor tilts as mainstays of their investment process will be anything but highly correlated.

This suggests a number of problems with the emphasis that many quant managers place on valuation factors in their alpha research. First, it's hard to see how a high allocation of researcher time to valuation models will produce meaningful alpha enhancement if Dissanaike and Lim's general argument is correct. Secondly, such research will do little to reduce the generic manager's correlation with the competitive universe of quantitative equity managers. Finally, if such a manager uses a generic risk model, then instead of improving performance, marginal changes to the valuation rankings may create a gap between the manager's new valuation measure and the more traditional variant embodied in the generic risk model. The next section takes a more detailed look at how differences between the same factors embedded in alpha models and generic risk models can distort portfolio construction.

4. Generic Risk Models: The Perils of Forecast Misalignment

The use of shared risk models by generic quant firms has exacerbated the declining risk-adjusted performance of those managers. Most quant equity managers employ a risk model that assumes that the risk of an individual stock can be decomposed into exposure to common risk factors and the idiosyncratic risk associated with each stock. Additionally, value and momentum signals, which in one form or another are the basis of generic managers' alpha models, are themselves common risk factors and as such are explicitly or implicitly integrated in the off-the-shelf risk management software purchased by those managers.

When a manager's risk model and alpha model contain different expressions of the same effect, common portfolio construction techniques can have unintended consequences that greatly distort the relationship between the portfolio's risk and return profiles. For example, take a hypothetical manager that uses a risk model containing a single risk factor—let's say it's a valuation factor—that is also included among the manager's alpha sources. Now consider the simple three-asset optimization shown in *Table 1* below. We assume that the valuation factor is the only risk factor for each stock. We fix the valuation risk exposure at the values shown in the *Risk Factor* column. We then consider two expected-return scenarios for separate portfolios. In the case of *Portfolio 1*, all three stocks have the same expected return as they have exposure to the risk factor. This could happen, for example, if the same factor were used for both risk control and alpha forecasting. In the case of *Portfolio 2*, however, *Stock A* and *Stock C* have expected returns that are the same as their exposure to the risk factor, but *Stock B* has a different expected return. This would happen if, for instance, the manager's valuation model was similar to but not perfectly correlated with, say, the generic valuation factor. Note that for the *Portfolio 1*, where risk factors and alpha forecasts line up perfectly, we obtain a result that, if we have lived a dull enough life, we can probably predict without the benefit of an optimizer. In other words, it seems highly intuitive that *Stock B,* with the lowest expected return, should have the lowest weight in the portfolio.

Table 1: Hypothetical Optimization Example

Stock	Portfolios 1 and 2 Stock's Exposure to Value Risk Factor	Portfolio 1 Forecast for Stock Using Value Alpha Model 1	Portfolio 1 % Weight of Stock in Portfolio Using Value Alpha Model 1	Portfolio 2 Forecast for Stock Using Value Alpha Model 2	Portfolio 2 % Weight of Stock in Portfolio Using Value Alpha Model 2
A	3.0	3.0	0.28	3.0	0.18
B	-0.5	-0.5	0.25	1.0	0.61
C	2.0	2.0	0.46	2.0	0.22

However, in the case of *Portfolio 2*, where *Stock B's* alpha forecast is imperfectly correlated with the associated risk factor, the resulting optimal portfolio greatly overweights *Stock B* despite *Stock A* and *Stock C* having substantially higher expected returns. Why this counterintuitive result in the case of *Portfolio 2*? In technical jargon, the optimizer attempts to identify orthogonalities to exploit. Plainly put, this means in this instance the optimizer, given a mandate to construct a diversified portfolio, is making a large bet on the only difference between the forecast representation and risk model representation that's available to it.

Optimizers have the significant strength—and great weakness—that they obediently do exactly what they are told, whether or not the instruction actually makes sense. Lee and Stefek (2008) provide a more complex example in which a manager uses a 12-month momentum forecast lagged by one month to overcome potentially spurious short-term price movements ("bid-ask bounce"), among other complexities, and the risk model uses 12-month momentum without a lag. In this more complicated scenario, the optimal portfolio ends up taking a big bet against stocks that outperformed in the previous month and a big bet in favor of stocks that outperformed 13 months ago because that's where the risk model and the alpha forecasts diverged. As Lee and Stefek laconically put it, "The chances are high that this is not what the portfolio manager has in mind." Indeed, it's likely quite different from what most managers actually want their process to be doing. The generic quant manager often picks multiple representations of the same basic effect (so called "factor families") and is most inclined to take positions in those names where many of the family agree. The orthogonalization effect of their optimizers works exactly in the opposite direction by forcing the portfolio to bet on the difference, rather than the overlap, between the return forecast and the risk representation of the same factor.

This is of particular relevance when assessing quant equity managers that rely on the generic paradigm because so many of them include large-scale valuation forecasts and momentum forecasts in their alpha sources and simultaneously use some variant of APT risk modeling (often using tools purchased from one of a handful of credible vendors and offering limited scope for customization) that explicitly or implicitly includes valuation and momentum factors. APT is a robust and perfectly acceptable methodology that is very specific about the *form* of the risk model. But it provides limited, if any, guidance on how to avoid and manage *overlap* between risk models and alpha models. Given this fact alone, a manager's choice of risk factors constitutes a critical component of the investment process, and arguably one that should not be outsourced as commonly and cavalierly as appears to be the case today. If the manager's alpha models include non-trivial but different exposures to factors also present in a generic risk model, such tensions can result in unwanted, and occasionally bizarre, bets driven by the search for orthogonality rather than alpha.

In short, managers using generic risk models and proprietary alpha forecasts based on common valuation and momentum signals really are caught between a rock and a hard place. On the one hand, if a manager's alpha forecasts are highly correlated with generic risk-model forecasts, it's hard to see what the manager is adding to the mix (other than a higher fee for active management), since more or less the same outcomes could be attained by plugging the generic risk factor representations (in the guise of alpha models) directly into the generic risk model. On the other hand, even if a manager's alpha forecasts are only modestly correlated with risk factors related to similar effects, the optimizer will attempt to make the bets described above, resulting in possibly perverse and unwanted portfolio exposures. Persistent success is likely to elude managers that don't pay heed to this basic feature of portfolio construction. Even if a manager's alpha forecasts have the potential to add value, their impact will be limited, and perhaps even detract from a portfolio's relative performance through inefficient portfolio construction, unless the process incorporates a complementary risk model. In our view, many managers have likely ignored this truth because off-the-shelf risk models are vastly less expensive and less difficult to develop than customized models developed in-house. We also believe that the plan sponsor and consultant community are increasingly inclined to disfavor this kind of plug-and-play approach.

5. Secular Changes in Equity Markets: Is Conventional Mean-Variance Optimization Still the Right Tool?

The mean-variance optimization technology in place at many quantitative equity shops constitutes the third major weakness of the generic paradigm. Although it's possible to critique mean-variance optimization by citing a number of somewhat technical complications, we'll make two high-level arguments in this section. First, mean-variance portfolio optimization is inherently unstable because small changes in estimates of risk and return can result in portfolios that have remarkably different compositions. Second, mean-variance optimization lends itself to fixed-frequency optimization at relatively lengthy intervals. Global equity markets have undergone significant changes that have, for example, resulted in greatly increased market turnover when compared to a decade ago. We argue that such fixed-frequency rebalancing on a schedule measured in hours, days, or weeks has simply not kept pace with secular changes in equity trading.

At its core, mean-variance optimization involves constructing an optimal portfolio by allocating capital across multiple securities on the basis of inputs derived from the expected return and volatility of the securities and the correlations of those securities to each other and various common exposures. The output of this optimization is an efficient frontier at a single point in time, after consideration is given to a large number of potential portfolios and their associated trade-offs between risk and return. One of the fundamental challenges for a mean-variance optimization process is its sensitivity to initial conditions. Even small changes in return or risk forecasts can generate new "optimal" portfolios that radically diverge from the previous portfolio. The instability associated with traditional mean-variance optimization (which has evocatively been described as its "marble-on-a-plate" property) means that various *ad hoc* methods are used to dampen the influence of outliers and large return or risk changes on the portfolio.

In the generic quant paradigm, portfolios are typically reoptimized on a fixed frequency, whether once per month, week, or day, using forecasts that, at the risk of repetition, are dominated by value and longer-term momentum. Almost universally, the optimization involves ranking and then normalizing alpha forecasts, which are used to generate the desired tilt in the portfolio. The practical result of this fixed-frequency rebalancing process is that a trade list is generated and in turn is passed to a trading desk, potentially (at larger firms) for pooling with other orders. At the end of a day or two of work by the trade execution team, the portfolio is moved substantially in the direction of the target portfolio. As the trading desk works the list of trades required to reach the new optimal portfolio, the optimizer is left to idle, waiting for the new portfolio to take shape before re-engaging to generate the next optimal portfolio.

The optimization and trading processes featured by the generic paradigm have remained essentially the same over the past fifteen years or so, yet equity markets have not remained static over that period. Most observers would concur that equity markets have undergone significant shifts that in the past 10 or 15 years. How well has this approach to optimization and rebalancing performed in light of some of those key changes?

Chordia, Roll, and Subrahmanyam (2010) offer a good summary of some of developments in equity market trading from 1993 to 2008. One of their main conclusions is that turnover has clearly increased quite sharply in response to secular decreases in trading costs. This higher turnover has been associated with a simultaneous decrease in average trade size and strikingly large increase in the average daily number of trades. The authors also show that the decrease in average trade size and increase in number of trades have disproportionately affected those names most widely held by institutional investors. In a particularly revealing passage, they assert that "daily serial correlations on large trade imbalances have increased the most for stocks with the largest levels of institutional holdings. Since large orders are more likely to be used by institutions, this finding once again suggests that institutional trading has played a principal role in recent volume increases."

We believe these developments are likely to be bad for quant managers wedded to the generic paradigm because, as evidenced by the data compiled by Chordia, Roll, and Subrahmanyam, the greatest increase in trading has been in those stocks most heavily traded by quant managers themselves. In this context, the serial correlation of trade imbalances (decreasing trade size and increasing number of trades) suggests that this method of trading is increasingly inefficient and likely has resulted in excessive trading costs that drag down performance. On this view, a style of portfolio construction that was optimal when trade sizes were larger and the amount of money being traded in quantitative equity strategies was considerably smaller has become extremely inefficient in the current market environment. Executing trade lists for large-value portfolio rebalances routinely requires timeframes measured in multiple days, which can result in precisely the correlation of trade imbalances noted by the authors.

So far we have discussed changes in market microstructure in the context of longer-term shifts in the distribution of daily trading volume and size. There has also been a significant change in the intraday distribution of trading volume. Avramovic and Mackintosh (2008) and Avramovic (2010) have analyzed this change in some detail. The past few years have seen a substantial increase in the number of trades executed towards the close of the trading day, so that the intraday distribution of trades has moved from downward sloping with the highest point in the first half hour of trading to a more U-shaped distribution with liquidity picking up in the afternoon. Opinions differ on the likely causes of this change in the distribution of intraday trading volume, but the fact that there are now multiple periods of meaningful activity each day means that traditional managers working from monthly, weekly, or even daily trade lists move far less quickly than do markets. Achieving an optimal portfolio outcome given current market structure would seem next to impossible with a rebalancing based on a trade list generated even as frequently as once per day.

6. Conclusion

The generic paradigm that has dominated quant equity investing over the past decades is unlikely to be an enduring source of alpha for institutions on a prospective basis. The generic quant equity enterprise leans heavily on a scant few alpha factors, and its reliance on third-party risk and optimization tools introduces potentially destabilizing and counterintuitive portfolio outcomes. The most important sources of alpha in this process—valuation and momentum—are arguably more accurately conceived of as broad risk factors, and even very well-funded and intensive research efforts primarily focused on these factors are likely to yield limited benefits while possibly creating or exacerbating a destabilizing mismatch between house-built alpha models and off-the-shelf risk models seeking to capture the same factor. Given evidence that basic valuation factors perform about as well as more labor-intensive variants, it's difficult to escape the conclusion that the generic paradigm represents, at bottom, a relatively simple model in which risk factor and forecast representations are precisely identical. This approach to portfolio construction is certainly investable, and it's relatively inexpensive to implement. In essence, for those who still wish to buy it, the generic paradigm in quant equity investing has become commoditized. Managers that rely on this style of management will, in our view, face considerably long odds in their efforts to outperform.

On a more optimistic note, if we move past the idea that quantitative equity management is coextensive with the generic quant paradigm, the future looks much more promising, though challenges for both managers and the investor and consultant communities remain. We believe that new and varied styles of quantitative equity management that address the issues described in this paper exist and will develop as the industry diagnoses and solves the ailments of the generic paradigm. And these different approaches will resemble the generic quant paradigm about as much as a Siamese cat does *Stegosaurus*.

In our view, there has never been a better or more interesting time to build innovative approaches to quantitative equity investment than the present. Natural language processing has greatly increased the ability of quants to extract signal from non-numeric data. Advances in machine learning have substantially improved systems designed to parse signal from noise. New developments in optimization theory, including approaches that allow for multiple time horizons and a dynamic reoptimization process operating throughout the trading day, have been applied by leading-edge firms and continue to greatly add value relative to the mean-variance model. Some firms also seek to add value by using some of these same techniques to make refined predictions about realized transaction costs. Quant equity strategies relying on non-commoditized techniques associated with more dynamic approaches to portfolio construction are unlikely to have the same level of capacity as the generic paradigm. But even at lower capacity levels, the field is sufficiently less crowded than the generic domain that we believe there are still meaningful growth prospects. It's also a fair bit easier to estimate a strategy's capacity when the strategy doesn't involve widely-used factors like valuation, whose capacity may be (heavily) influenced by the activity of other managers. And firms using non-generic tools and methods have strong incentives to protect and preserve their capacity.

To the extent that the future of quantitative equity management continues on a path with no dominant new paradigm, but instead a heterogeneous set of non-overlapping approaches, the jobs of plan sponsors and investment consultants in identifying and analyzing manager talent become a more difficult, but also potentially much more rewarding. Asset holders and their advisors will need to look more closely at the results of managers to see if returns are highly correlated to value, momentum, and/or other manager returns. If they're not, that's probably a good sign, but it's only a first step. Plan sponsors will then need to delve into the manager's process, and not just the alpha models, but also risk models, portfolio optimization technology, transaction cost management. In short, only a multi-faceted approach to manager due diligence will suffice because heterogeneity is central to the promise of quant equity investing going forward.

7. Notes

1. Each of the Russell 1000® Growth Index, Russell 1000® Value Index, and Russell 1000® Index (collectively, the "Russell Indexes") is a trademark/service mark of the Frank Russell Company. Russell® is a trademark of the Frank Russell Company. The Frank Russell Company is the source and copyright owner of each of the Russell Indexes.
2. Source: the Frank Russell Company, based on daily index returns.
3. Source: Yahoo! Finance, based on daily index returns.
4. Source: "Long-Only" excess return figures for the applicable period represent all quantitative products in the "All US Equity" universe of the eVestment Alliance, LLC ("eVestment") database screened for an investment focus "not equal" to long/short, benchmarked to the S&P 500 or the Russell 1000 Index, and excluding the performance of retail mutual funds and retail separately managed accounts. "130/30" excess return figures represent all quantitative products in eVestment's "Extended US Equity" universe that are benchmarked to the S&P 500 or Russell 1000 Index.
5. Source: "Long-Only" assets under management represent all quantitative products in the eVestment's "All US Equity" universe screened for an investment focus "not equal" to long/short investing as of June 30, 2010. "130/30" assets under management represent all quantitative products in eVestment's "Extended US Equity" universe.

8. References

Avramovic, Ana (2010). ETFs Go for the Close. Market Commentary. Credit Suisse Advanced Execution Services, July 8, pp. 1–3.

Avramovic, Ana, and Phil Mackintosh (2008). Intraday Rollercoaster Rides: Market Moves at Day's End. Market Commentary. Credit Suisse Advanced Execution Services, December 10, pp. 1–5.

Chordia, Tarun, Richard Roll, and Avanidhar Subrahmanyam (2010). Recent Trends in Trading Activity. Working Paper. January 14, pp. 1–56.

Dechow, Patricia M., Amy P. Hutton, and Richard G. Sloan (1999). An Empirical Assessment of the Residual Income Valuation Model. *Journal of Accounting and Economics*. Vol. 26, Nos.1–3 (January), pp. 1–34.

Dissanaike, Gishan, and Kim-Hwa Lim (2010). The Sophisticated and the Simple: The Profitability of Contrarian Strategies. *European Financial Management*. Vol. 16, No. 2 (March), pp. 229–255.

Frankel, Richard, and Charles M.C. Lee (1998). Accounting Valuation, Market Expectation and Cross-Sectional Stock Returns. *Journal of Accounting and Economics*. Vol. 25, No. 3 (June), pp. 283–319.

Kahn, Ronald N. (2010). Quantitative Equity Investing: Out of Style? BlackRock Investment Insights, Vol. 13, No. 1 (March), pp. 1–9.

Lee, Jyh-Huei, and Dan Stefek (2008). Do Risk Factors Eat Alphas? *Journal of Portfolio Management*. Vol. 34, No. 4 (Summer), pp. 12–25.