

PERPETUAL

Motion

BY SUSAN TRAMMELL, CFA

A NEW STUDY LOOKS AT TRENDS IN EQUITY PORTFOLIO MODELING

Until computing power became cheap and information became ubiquitous, building an equity portfolio was largely a manual task. Now, quantitative modeling is a staple in risk management, return forecasting, portfolio construction, and optimization. However, the degree to which quant methods are employed varies widely across asset management firms.

In September 2006, The Intertek Group, a European-based financial information technology research and consulting firm, and Frank Fabozzi, CFA, adjunct professor of finance at Yale University School of Management, released the results of a 38-firm survey that studied trends in equity portfolio modeling.

ASSETS UNDER QUANTITATIVE MANAGEMENT

The survey participants who reported that they are using quantitative methods to manage equity assets cover a wide spectrum:

- 29 percent report that they had more than 75 percent of their equity assets being managed quantitatively.
- 58 percent report that they have some equities under quantitative management, although the share of equity assets managed quantitatively was frequently less than 25 percent.
- 13 percent of those surveyed state that they have no assets under quantitative management.

The term “quantitative management” requires some examination. It could mean that a shop is using something as basic as regression analysis in its valuation process or that it is applying quant methodologies to portfolio construction, or even running a fully automated fund. When firms take a more traditional approach to asset management, quantitative tools are typically used to build quant screens for stock selection or for risk measurement and management. One survey respondent predicted that, “In the near future, portfolio construction will be done almost exclusively with quantitative methods.”

Flows into quantitative funds have been spurred by the extension of quant techniques to new investment strategies. These have enabled firms to increase their range of equity products managed quantitatively. Two-thirds (66 percent) of the respondents who had only a portion of their equities under quant management increased the percentage over the 2004–05 period, while the rest remained either 100 percent quantitatively managed (18 percent of the surveyed firms) or the percentage under quant management had remained stable. The portion declined at only one firm.

USING QUANTITATIVE ANALYSIS TO FIND ALPHA SOURCES

One of the most documented sources of abnormal excess returns among both practitioners and academics is in the area of stock valuations. Financial statement analysis attempts to identify stocks that are cheap, either on an historical basis or compared with their industry groupings. Typically, stocks that are cheaper on most valuation metrics tend to outperform over time.

When everyone has access to the same information, however, how can a portfolio manager gain an edge on the competition?

“What we’re trying to do as quant investors is to scientifically pull out the salient pieces of that valuation process and then encapsulate it within a process which is scientific, disciplined, structured and repeatable,” says John Marsland, CFA, senior portfolio manager and quantitative analyst with Schroder Investment Management’s Quantitative Equity Products (QEP).

Quant managers consider the process to be dependable because it is not emotional. Instead, it relies solely on algorithms that model quantitative information. A traditional equity portfolio manager also models financial data but gives weight to qualitative factors about a company, as well. This limits the traditional equity analyst to researching a relatively small number of stocks, whereas portfolios containing more than a hundred or so stocks become difficult to manage in a traditional manner.

Using a quantitative process to identify undervalued stocks, on the other hand, enables a manager to look at the whole investment universe in one go. That is where much of the alpha, or incremental return, comes from. QEP team’s North American investment universe, for example, contains more than 3,000 stocks, and positions are held in more than 300 of those. Its global universe has more than 15,000 stocks, and global portfolios tend to have more than 500 positions. “Breadth is one of the most important aspects of a quant portfolio,” says Marsland. “Your skill is fairly uniform across all markets and all stocks, so you should be able to optimize your risk-return across larger portfolios.”

Marsland is part of a 12-person team dedicated to Schroder’s quantitatively run equity portfolios. The team was set up in 1996 and spent four years researching their strategies before starting to run their first global equity fund in 2000. The QEP team is now the brains behind US\$4.7 billion of global and U.S. equity products. The funds’ investment mandates run the gamut from enhanced-indexing strategies to long-only portfolios with few investment constraints. Marsland points out that these relatively unconstrained long-only portfolios actually have lower-than-market volatility. The global core enhanced-index strategy is in its seventh year of outperformance.

There is considerable rigor behind the strategies developed by quant managers such as the QEP team. “A proper, scientific insight across the market,” as Marsland calls it, has the power to forecast over subsequent periods. The quant factor is modeled, backtested, and simulated. The portfolio manager tempers the model’s output to take into account issues, such as corporate actions, that are not part of the model’s construction.

Quant managers are always refining their models, and Marsland says he does not know anyone who is not actively researching their strategies. These are described to clients, particularly investment consultants, who are not shy about delving into the details of a process. Obviously, there is an element of intellectual property that a quant shop manager would not want to lay out for a competitor.

“It’s perfectly possible to explain and see what goes on inside our models,” Marsland says. “You’re trying to build a systematic process that is repeatable so that you can consistently produce return [alpha] in different market regimes. I would argue that the client has much more visibility into what the quant manager is doing than he does about a traditional manager, whose process is not able to be written down or explained to such an extent.”

STUDY PARAMETERS

Slightly more than half of this group had taken part in an earlier Intertek study: *Trends in Quantitative Methods in Asset Management—2003 Update*. Asset managers were asked to respond in writing to the survey; interviews were also conducted with many of the participants. Not all the managers have a quant-driven investment process, and none of them manage hedge funds. The study included 23 asset managers whose home market is Europe and 15 whose home market is North America.

Equities under management ranged from US\$6.5 billion to US\$1.0 trillion and totaled US\$4.3 trillion for all participant firms. Although many managers outside the sample group have fewer assets under management than the smallest survey participant, the findings are still applicable to them.

“The size of the firms really doesn’t become as important as you think,” says Fabozzi. “If you look at the history of successful shops, some have grown out of purely theoretical research done by a few academics. Those who think they have found a money-making strategy that they can sell may start applying their research. Rather than hiring a team of analysts, they already have the technical know-how. What they need is support staffs for dealing with regulatory and compliance issues.”

Sergio Focardi of The Intertek Group agrees: “Even a small firm can start a path that leads to a quantitative investment process. For example, they can hire someone to develop a stock-ranking application to be used as a decision support system. The only real obstacle is cultural: ‘Do I want to do this or not? Am I afraid that quant methods will eat my lunch?’” Adds Fabozzi: “Delving more into cultural issues would have been interesting, but that’s really hard to do.”

To obtain a copy of the survey results, see “Management Reports” on The Intertek Group website (www.theintertekgroup.com).

THE ROLE OF QUANT MODELING

As managers report the positive results obtained with quantitative management, quant modeling is being applied to a greater number of activities. It is no longer limited to passively managed index and enhanced-indexed funds or to a subordinate role as an *ex ante* decision support tool to assist traditional equity fund managers in their decision-making process. Today, quant methods are widely being used to find new sources of alpha, increase information ratios (the risk-adjusted return of a fund over its benchmark), and limit drawdowns by implementing strategies to hold losses within a predefined limit.

In addition, computers are now running funds without human intervention at a greater number of equity management firms:

- 55 percent of respondents report that at least part of their equity assets are now being managed automatically with quant methods;
- 8 percent plan to automate at least a portion of their equity portfolios within the next 12 months.

MOTIVATIONS AND HINDRANCES

Survey participants rated the factors that contribute to the wider use of quantitative methods in equity portfolio management. In order of importance, they are

- positive results obtained with these methods (half the participants rated this the single most important factor),
- availability of desktop computational power,
- more and better data,
- availability of third-party analytical software and visualization tools,
- contribution to risk control,
- enabling a transparent and more scalable investment process, and
- nudging from a corporate parent or institutional investors, who require a more repeatable process.

Factors holding back a wider use of quant methods are in-house culture, cost of the IT infrastructure, cost of data and of qualified staff, complexity of the modeling process, and lack of consistent success for the models.

Fabozzi takes a philosophical view of the criticism that quant modeling performance has been inconsistent. “Some people have made the same complaint about traditional shops,” he says. “Historically, most empirical tests have been with respect to traditional approaches to equity management. So, most of what you read about the inability to beat the market has really fallen on tests of traditional [investment approaches].”

PHENOMENA BEING MODELED

The four most widely modeled phenomena are momentum and/or reversals, trends (i.e. long-term averages), the impact

THE NEW SKILL SET FOR ACTIVELY MANAGED EQUITY PORTFOLIOS

The growing interest in quantitatively managed assets signals new opportunities for portfolio managers, analysts, and programmers with higher-level math skills and a combination of other talents.

According to several participants in the 2006 Fabozzi/Intertek Asset Management survey, quant firms are looking for portfolio managers who have more than stock-picking ability. Fifty-five percent (55 percent) of the respondents reported that the profile of the equity portfolio manager at their firm is more math oriented than two years ago. Nearly half of these respondents also mentioned that an understanding of economics, finance, and accounting are widely considered to be a requisite.

“There has been a major change in the portfolio manager skill set over the last five years,” says Sergio Focardi, an Intertek principal. “You need people who combine an understanding of the markets and of the economy with a knowledge of statistics and, increasingly, computer programming and accounting skills.” The need for accounting knowledge may actually relate to the ability to scrub financial data.

According to Focardi, non-quant managers who want to introduce a systematic investment process into their firms need three things. First, they need people who understand the models at a conceptual level, which requires familiarity not only with the financial markets but the econometrics of probability, stochastic processes, and other modeling concepts. Second, managers must know how to interact with developers. And third, they need to manage the introduction of quant techniques to their non-quant managers.

Focardi advises such firms to create a separate quant team that starts out with simple, achievable goals. Initially, this could mean using quantitative methodologies to measure the risk of portfolios chosen with non-quant methods. The next step would be to persuade managers to incorporate quantitative analysis into their process, such as running regressions over factors.

The appearance of robust software tools has greatly reduced the portfolio manager’s need for programming skill, at least at an application level. That is because it is

now possible to buy the building blocks of an application, such as a Monte Carlo simulator. The real need is in knowing how to assemble the modules. “When you try to model the market, it’s a real lesson in humility,” Focardi says.

At the other end of the spectrum from nascent quant users are the asset managers who are developing proprietary algorithms for their derivatives business. With individual investors increasingly demanding downside protection from the market and institutional investors seeking to benchmark their liabilities, derivatives are becoming more important to active equity managers. Creating new derivatives contracts, whether as part of a retail structured product or as a custom offering, requires the innate ability to work with complex mathematics.

Perhaps for this reason, the past several years have seen an explosion of financial engineering (FE) academic study. FE graduate programs are often the fastest-growing divisions at many leading universities in North America, Europe, and Asia. For example, the University of Chicago offers a one-year program that teaches the theory and practice of quantitative finance, including derivatives, pricing, hedging, statistical arbitrage, and computational finance. Nanyang Technological University of Singapore offers a one-year program in the financial applications of calculus, statistics, and computing.

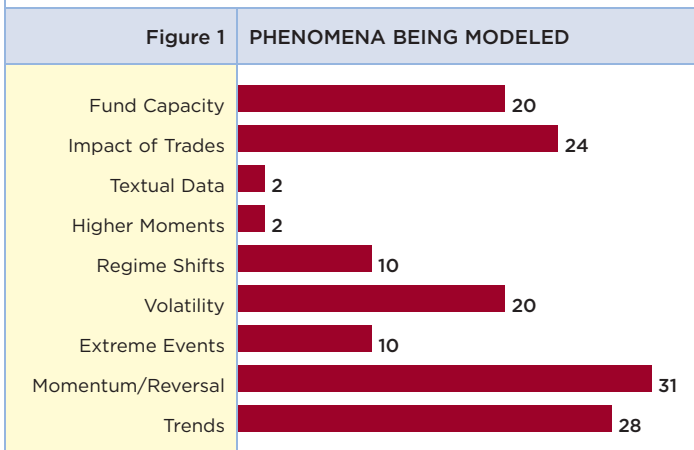
Focardi points out that the skills needed for an equity portfolio manager are not the same as those for a financial engineer. FEs are primarily concerned with modeling the complexity of contracts, be it for derivatives or guaranteed/total return funds. Portfolio managers, on the other hand, must be able to relate information to what is happening in the real world.

“When you receive all those numbers, you have to be able to interpret the data,” Focardi says. “You need a sound conceptual understanding of the modeling exercise and must be able to correctly interpret the results of the exercise. This requires a sound understanding of basic statistical concepts.”

THE ART OF MARKETING QUANT FUNDS TO PRIVATE CLIENTS

of trades, and fund capacity. Momentum and reversals are, respectively, trends and inversion of trends at specific time horizons. Trends being modeled fall into the areas of traditional, such as consistent growth; technical, such as price; and behavioral, such as patterns in analyst earnings estimates to produce a sentiment/growth model component in forecasting returns. Modeling the impact of trades elicited the following post-survey remark from one participant: “With the advent of modern trading techniques, trading costs in commission terms can be very low. Algorithms can be designed to execute computerized trades that have very low market impact. What you’re really looking for is whether or not you have the reason to trade in terms of a model that can give you a source of alpha.”

Figure 1 shows how many of the 38 survey participants are modeling a given phenomenon. Attempts to use textual data to forecast equity prices are limited to only the largest players, and only two firms reported that they are modeling higher moments (the shape of the distribution around the mean).



MODELING METHODOLOGIES BEING USED

Regression analysis and momentum modeling continue to be the most popular quant techniques, as shown in Figure 2. These methods were used by 100 percent and 78 percent, respectively, of the sample group. Regression on factors and on company-specific predictors is the mainstay of return modeling. All respondents, including those with no equities under quantitative management, report using these models. A few sources also stated that they are giving more weight to momentum/reversal models. Some respondents mentioned, however, that performance based on these strategies can be erratic, because changes in the momentum/reversal horizon can change profits to losses.

Just under half of the survey respondents (47 percent) model cash flows. Several attributed better performance of valuation models to the use of discounted cash flow models. The biggest change in return forecasting from the 2003 Intertek study is the greater use of behavioral modeling, as reported by 44 percent of participants.

How do you market a quant fund to private clients without once using the word “quant”? Ask H el ene Harasty, CFA, head of quantitative asset management and research for Lombard Odier Darier Hentsch & Cie. Harasty’s group manages fully automated equity and fixed-income portfolios.

“Private clients do not form a homogenous group. They go from the elderly rich man to the PhD in finance. But generally speaking, as soon as you mention the word ‘quant,’ private clients think of the word ‘math,’” she says. As a result, individual investors become intimidated by the idea of investing in quantitatively managed funds or put up a mental block. Other terms to be generally avoided are “backtest,” “tracking error,” and “information ratio.”

“Don’t use jargon,” Harasty advises, “but always explain your strategy. No client will buy a black box. When we market our quant strategies to our high-net-worth clients, we use simple words and give examples of stocks that are familiar to them.”

It is important to Harasty that clients understand that no strategy outperforms at all times. There will be periods when a quant fund will underperform its benchmark. When this happens, clients are shown that instances of underperformance in the past are compatible with the fund’s long-run track record of outperformance.

“Clients understand that the fund gives them exposure to the market, so it will go up and down with the market. We show them that the smallest alpha year after year really adds up in terms of wealth,” she says.

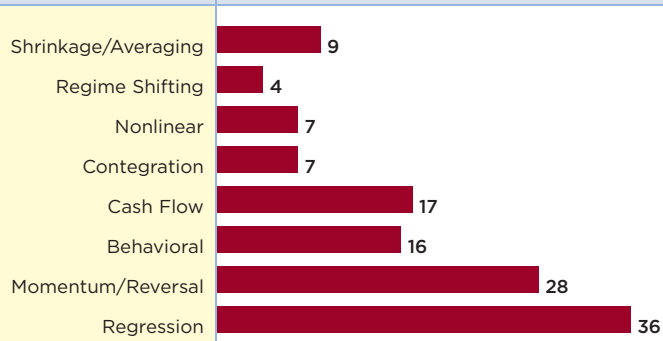
Every client situation is different, but the individual buyer of a quant fund is typically someone with a medium- to long-term investment horizon of at least three to five years. As quant funds usually present good risk-adjusted returns, they are likely to ideally form the core of the private client’s portfolio.

“The challenge is to convince the client that a particular quant fund fits their needs but without using sophisticated language or discussing the technicalities of the strategy,” Harasty explains. “Remember that the client and his portfolio manager have already formed a relationship of trust.”

Modeling methodologies used less frequently are model averaging and model shrinkage, which diversify model risk by averaging forecasts; cointegration, an econometric technique for testing the statistical significance of the correlation between certain variables so as to avoid spurious correlations; regime shifting, when a trend changes direction; and several nonlinear methodologies.

The bottom line is that regression on factors and on company-specific predictors remains the bread-and-butter of return modeling. While there continues to be considerable interest in nonlinear methods, the scarcity of requisite in-house skills, lack of an economic explanation, the danger of overfitting, and client reluctance were cited as the main factors limiting their adoption.

Figure 2 METHODOLOGIES USED IN PRODUCTION



MODELING WITH HIGH-FREQUENCY DATA

Fourteen percent (14 percent) of respondents use high-frequency data (HFD) to identify profit opportunities and improve forecasts; another 8 percent said they planned to use HFD within the next 12 months. HFD in equity portfolio management may be defined as the data on each buy/sell execution. For example, the average number of daily transactions of an average stock in the S&P 500 is 2,000, so HFD offers a 2,000-fold increase in data points versus the traditional use of closing prices.

The advantages of using HFD have been demonstrated in areas such as volatility, where HFD allows a high-precision measurement. Drawbacks of using HFD are an unattractive noise-to-signal ratio and investor resistance to HFD-based strategies.

PERFORMANCE ISSUES

Members of the sample group cited the problem of the persistence of model performance. A source at a quant firm remarked, “When, over several months, performance is better in backtesting than in the real world, one has to evaluate the need to change the model.”

One survey participant offered a post-survey observation: “We have a huge research team that constantly looks after our [proprietary quant] model and analyzes the results and changes in the marketplace, such as the volatility decline in

2003. When the signals are not strong enough anymore, we modify the model.”

Adds Fabozzi, “You have to determine when your models are not appropriate in the existing environment. You wouldn’t expect that there will be a model for all seasons. That’s where the good shops continue to develop and test new strategies, and they drop the old strategies.”

RISK AND RISK MODELING

All participants use quantitative tools to measure risk. Many firms compute several risk measures, although they then face the challenge of melding the views into a coherent risk measurement. The most widely used measures of risk are variance (97 percent), value at risk (or VAR, 67 percent), conditional VAR (11 percent), and extreme value theory (or EVT, 6 percent).

To a certain extent, risk has been redefined. Until recently, an investment firm’s risk was typically considered to be tracking error relative to a benchmark. Now, the mass affluent want protection against market risk. Firms offering total-return/absolute-return products are effectively absorbing market risk, which is hedged through replicating option strategies similar to those adopted by investment banks.

Institutional investors are also increasingly concerned about covering future liabilities. Asset managers who want to win broader mandates with institutions will have to adopt some form of stochastic multistage optimization, requiring resources that many have yet to acquire.

OPTIMIZATION

More than 92 percent of participants use some portfolio optimization techniques at least some of the time, opening the door to a fully automated investment process. The most widely used techniques among respondents who perform optimization are mean–variance (83 percent), utility optimization (42 percent), and robust optimization (25 percent). Only one firm mentioned that it is using stochastic optimization.

ORGANIZATIONAL ISSUES

Quantitative modeling requires increased investment in processes and people. A source at one firm with a strictly quantitative approach noted, “We have doubled the number of investment professionals. Since most products are licensed per person, our IT and data costs have risen significantly. We also continue to see substantial price increases from the IT and data vendors.” Several survey participants mentioned that investments in the IT infrastructure were being driven by new regulatory requirements for risk monitoring.

A number of quant firms report a circle of success, where the good performance of existing quant strategies attracts substantial inflows, providing the platform to launch additional strategies. //

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MOMENTUM and REVERSAL

BY SERGIO FOCARDI

Momentum is often described as the persistence of returns. That is, stocks with high returns continue to have high returns, and stocks with low or negative returns continue to perform poorly. Price processes exhibit reversal if past high returns are followed by low returns, and vice versa. But momentum and reversal phenomena are more subtle than this simplistic description.

If we call “formation period” the time window in which we estimate returns, momentum and reversal phenomena entail the existence of a well-defined pattern of returns for each pair of formation and holding periods. It has been ascertained empirically that, in the United States and in Europe, stock prices exhibit reversals when both the formation and the holding periods are about one month. It also has been further shown that stock prices exhibit momentum of varying magnitude for formation

and holding periods of 3–12 months, as well as reversals when both formation and holding periods exceed three years.

This complex pattern of short-term reversals followed by medium-term momentum—followed by long-term reversals—makes momentum and reversal a theoretically puzzling phenomenon with important practical consequences. In fact, momentum strategies that consist of buying stocks with the highest returns in the past 3–12 months and selling those with the lowest returns during the same period earn returns above 100 bps per month. Short-term contrarian strategies, which sell those stocks with the highest returns and buy those stocks with the lowest returns in the past month, earn similar returns.

Several explanations have been advanced to explain momentum. Most are based on behavioral phenomena, in particular, investors’ under- or overreaction to news. These cognitive biases are not limited to investors. Analysts are also affected. In fact, analysts’ estimates can be seen to exhibit persistence. Momentum may be considered a self-sustaining phenomenon because investors’ attempts to exploit momentum should, in principle, reinforce momentum, not eliminate it.

What stock-price models can we use to explain momentum? First, consider that we cannot explain momentum through the autocorrelation of returns, given that stock returns are nearly uncorrelated. In addition, the spread of long-term expectations of returns is too small to justify the magnitude of momentum profits found empirically.

However, stock returns exhibit significant cross-autocorrelations of returns. (Cross-autocorrelation means that returns of different stocks at different time lags are correlated. For example, one can observe that large firms are price leaders with respect to small firms.) Cross-autocorrelation induces autocorrelation and thus predictability at the level of portfolios. Autocorrelation at the portfolio level can explain momentum and reversals, at least partially. However, in order to arrive at a global explanation of momentum and

reversals capable of reproducing known stylized facts, we have to admit that expected returns are time varying, perhaps in response to a broad set of factors.

The risk dimension also plays a role. Momentum phenomena are highly correlated, as demonstrated by the fact that we find significant momentum at the level of industry segmentations. It has also been demonstrated that risk adjustment at the moment of stock selection improves momentum returns.

The theoretical and empirical findings have important practical consequences: Plain vanilla strategies, such as buying winners and selling losers, are not optimal. The performance of momentum and reversal strategies can be significantly improved using factor models, risk adjustment, and optimization. Ultimately, it can be said that momentum and reversal phenomena are the empirical underpinning of more sophisticated strategies. The practical application of momentum strategies benefits from a better knowledge of the underlying econometrics. ▀

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ULTIMATELY, IT CAN BE SAID THAT MOMENTUM AND REVERSAL PHENOMENA ARE THE EMPIRICAL UNDERPINNING OF MORE SOPHISTICATED STRATEGIES. THE PRACTICAL APPLICATION OF MOMENTUM STRATEGIES BENEFITS FROM A BETTER KNOWLEDGE OF THE UNDERLYING ECONOMETRICS.