

Quantitative Methods:

A brief review of the use of quantitative tools in finance and a successful model applied to international equities

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INTRODUCTION

If you think of success in quantitative investing as simply an arms race for more computing power, you have missed the essence of the art. And it truly is an art; having the fastest processors and best programmers are meaningless unless you combine them with creativity and insights that form the bedrock of any great investment process. While technology has made quantitative investing possible, we assert the same gifts and skills that made Benjamin Graham and Warren Buffet great investors are required when utilizing quantitative tools—good intuition, strong knowledge of the markets and the economic backdrop, and on-going hard work.

The ‘quant meltdown’ of 2007–2009 put increased, and warranted, scrutiny on the value of quantitative methods in the financial industry. On the sell-side, quantitative models of the major brokerage houses failed to protect them from unforeseen risks that bankrupted one of the most revered names on the street, Lehman Brothers, forced many to convert to commercial banks to benefit from the largess of the government’s stimulus packages, and left many others hobbled (and hopefully humbled). The “Flash Crash” of May 2010, when the stock market fell about 6% in five minutes and recovered essentially all of that

continued on page 2

continued from page 1

value within the next 20 minutes, led to further finger pointing as to the cause of the crisis. Much of the blame has been placed in the lap of “quants” who took advantage of anomalies that, only a few years ago would have been too minute to exploit. For buy-side firms, the impact was no less severe. A similarity in practices led to at least two notable coordinated failures—periods when managers employing quantitative techniques in managing pools of money failed in general unison. The first was in August 2007, when a broad sell-off in the equity markets was exacerbated by coordinated selling by quant firms. The second was in the spring of 2009, when stock market participants’ appetite for risk came back with a vengeance, leading to the so called “junk rally” where the most beaten-down securities performed best, regardless of underlying quality. Most quantitative managers failed to beat their benchmarks in this rally since few had variables that would capture market leadership among the lowest quality securities.

The focus of this paper is to gain an understanding of who quants are and what they do, to highlight the goals of quantitative equity management, and to emphasize the attributes of a solid quantitative process specifically as applied to our management of international equities.

WHO ARE QUANTS?

The “quantification” of finance began more than 50 years ago with the publication of Harry Markowitz’s pioneering papers on portfolio optimization. Prior to that, portfolio managers were primarily “gum shoes”, performing intensive bottom-up analysis of the companies under consideration while attempting to analyze companies based on their relative expensiveness and growth potential. Without desktop computers, or even calculators, much of the analysis was destined to be more qualitative in form. Even the work of Harry Markowitz was mostly theoretical until the 1970s, when computing power began to allow managers to numerically solve the theoretical problems generated over the previous generation. Quickly, brokerage houses realized the quantification of risk gave them an edge, especially in the fixed income arena. The “rocket scientists” of Wall Street sought to engineer ever-finer models to describe interest rates and their movements; this exercise of the next 25 years led to the creation of an alphabet soup of “structured products” (CMOs, CMBSs, REMICs, re-REMICs, CDOs, CDO²s). Group-think set in, models across Wall Street became more and more similar, with the risk further heightened by increasing leverage entrusted to these divisions. Instead of engaging in their primary role—the floating of debt and equity for firms in need of capital—most of the profits the investment banks generated during the decade of the 2000s came from “proprietary trading” by their quants.

Over this same 25-year time-frame, rival buy-side firms recognized the potential advantages of utilizing quantitative tools. Firms such as BARRA, Axioma, and Northfield created software to assist managers in assessing their sources of risk and the feasible trade-offs. And here we get to a critical distinction among investment managers who call themselves quants. The starting point of quantitative investment management is to utilize the tools described above to assess and manage the risk of potential portfolios. While this is critical to true quantitative management, we believe it is not sufficient. Quantitative management should go beyond a method of merely putting together portfolio constituents. It should use quantitative tools as the core of one’s “alpha process”—the techniques by which constituent investments are selected.

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All investment managers use factors—price-to-earnings, return-on-equity, etc.—to select their constituent investments; quantitative managers simply employ factors more intensively and with greater rigor. It should be understood therefore that there is no such thing as a pure fundamentalist or a pure quant; it is a spectrum and no manager inhabits the absolute endpoints.

WHAT IS THE GOAL OF QUANTITATIVE INVESTMENT MANAGEMENT – SEVEN DIFFERENTIATORS

The goal of quants in the asset management field is no different than for more fundamentally-driven practitioners—to deliver superior investment returns to their clients.

There are many excellent fundamental managers who have terrific track records and who can share the thinking that goes behind investment decisions. Quants take this a step farther—they try to differentiate themselves by having a process that:

1. Can be explained and even described by computer code.
2. By its rigorous implementation may be less susceptible to cognitive errors that are endemic to human decision-making.
3. Is highly-scalable. Much more data can be considered and analyzed than by traditional “gray-matter” approaches.

4. Is therefore “back-testable”.
5. Can be tested “out-of-sample.” Once you understand the process, you can ask important questions such as, “Did this particular factor work for you in this time period?”
6. Exploits the advantages inherent within the “law of large numbers”. Quants tend to have more diversified portfolios that allow for more explicit focus on desirable factors and the ability to neutralize unintended portfolio exposures.
7. Is repeatable.

The culmination of these seven pieces is that well-designed quantitative methods can do what a good fundamentalist does—produce above-average results—but ideally with greater consistency than by intuition and qualitative assessments alone.

WHAT HAPPENED TO QUANTS IN 2007–2009?

As discussed above, both from a risk management and an alpha generation perspective, analytical tools used by quants and data employed by them had grown greatly homogenized. From the alpha generation-perspective, many managers were essentially fine-tuning the same information with little to distinguish them. From the risk management side, an over-reliance on quantitative models for risk control may have dominated many managers “alpha” inputs, therefore generating even more similarity among portfolios across the industry and a heightened risk of coordinated failure. The result of this was the high correlation of failure among quants in this period. When the subprime crisis swept through global equity markets, much of the “rationality” built into financial models failed to capture the movements of markets driven by fear (“black swans”) in what turned out to be the greatest recession since the Great Depression.

WHAT ARE THE CHARACTERISTICS OF A GOOD QUANTITATIVE PROCESS?

In our estimation, there are seven primary elements required to maintain a quantitative process with the potential to successfully fulfill the goal of top-tier performance while minimizing the risk of “melting down” in conjunction with other

quantitative strategies. Let’s look at each and see how they can be viewed by an investor in international equity:

1. Begin with intuition

Number crunching is useless in isolation of sound theory. One must also have a deep understanding of economic variables and their relationship to the global markets as well as insights into why behaviors can change over time.

A factor that shows validity in back-testing but has no foundation in political, economic, behavioral, or financial realities is likely to be specious. It is equally unlikely to have utility in forecasting in the future. While a “data miner” may find a relationship between the winner of the Super Bowl each year and the direction of the Spanish stock market over the next year, the result, while surprising, is due to chance and cannot be the foundation of an investment strategy.

When building a quantitative model, an understanding of the current environment is undeniably critical. But in our view taking that snapshot in isolation of longer-term fluctuations in the markets and an appreciation of the demographic, social, and political landscape yields almost no useful information. As John Maynard Keynes wrote of the importance of understanding the scope of global change, “The great events of history are often due to secular changes in the growth of population and other fundamental economic causes, which, escaping by their gradual character the notice of contemporary observers, are attributed to the follies of statesmen or the fanaticism of atheists.”¹

Our primary job is as global thinkers. Our secondary one is translating that understanding into a quantitative process.

2. Focus on limited-term forecasting

As difficult as it is to predict with any certainty the results one day forward, it is equally difficult over long time-frames (e.g., one-year).

At Bailard, we recognize that the long-term is simply a linkage of a series of short-terms and believe the most effective way to succeed over the long run is to focus on these shorter periods. Looking too far forward, signals become fuzzy and can be overwhelmed by the impact of nearer-term events and the opportunities and risks they generate. There is never perfect prediction—there are occasionally weaknesses in the relationship between one’s inputs and the forecasts. But in our view a focus

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¹ John Maynard Keynes, *The Economic Consequences of the Peace* (New York: Harcourt, Brace and Howe, 1920), 14-15.

on the larger, longer-term landscape and the shorter market-based factors is a critical combination in successful model-building.

For us, this means focusing on forecasts of relative country performance over a one-to three-month time frame.

3. Play in an uncrowded field

While it sounds great in theory, it is exceedingly rare to find a new area for investment. Even when it does occur, the opportunity is often fleeting as other managers quickly join in and arbitrage away the outsized profit potential of an empty playing field. Recent examples of this have been in the arena of infrastructure investment and natural resources.

For international equity investors there is very little undiscovered territory. Small capitalization is increasingly well-covered and emerging markets have become a core part of most portfolios. The next frontier is literally called the “frontier markets”. These are a tier below the accepted emerging markets in terms of liquidity, investibility, and economic development. While, in the very long run, some of these markets have the potential to grow at the rate of many of the current leading emerging markets, many will languish under endemic poverty and corruption and therefore rightfully remain below the radar screen of institutional investors. In fact, as a group our research suggests they still have far to go before meriting a sustained allocation.

4. Look at the playing field from a different perspective than the competition

If value managers all measure their investment universe by a price-to-book metric, there would be little difference in their security selection, absent other factors in their models. If instead they simply treated value as the space in which they work but, for example, examined the securities in that universe on the basis of time-varying volatilities of sector exposure or based on correlations over business cycles, they may have an inherent advantage.

Most international equity managers treat their investible universe much as their domestic counterparts—seeking to add value by focusing solely on picking the best stocks. But what of the importance of the country where a company is domiciled? How can the realities of differing political, tax, and social systems as well as a country’s natural endowment of resources and manpower not be of critical import? As distinguished historian Arnold Toynbee wrote, “Countries have characters

that are as distinctive as those of human beings”.²

The data and the intuition support this. Even in countries with similar industrial make-ups that share a common boundary, similar political systems, and even a common currency, dramatic differences in investment returns can be realized annually. In 2007, for example, Germany, France, and Belgium returned 35%, 13%, and -3%, respectively.³ Markets with very similar endowments in oil, for instance, can produce wildly different outcomes due to the style of political leadership, the business environment created, and foreigners’ willingness to engage. Here, consider two very different markets—Russia and Canada—one of which is returning to an almost feudal state under autocratic rule while the other enjoys one of the strongest currencies in the world and some of the most impressive fiscal responsibility among the world’s nations. Another contrast can be made between a pair of “BRICs” markets—India and China. One is the world’s largest democracy and has shown difficulty harnessing its full potential. The other has invented a new political/financial model: an amalgam of free markets along with a strong central government that has proven to be a boon for the entire region.

Our research has shown that, even in an age of increasing globalization, a company’s country of domicile is among the most critical and, more importantly, predictable sources of return in international equities. Twenty years ago such a perspective was much more common, but during the 1990s academicians and practitioners foresaw increasing correlations among countries’ investment returns and a lower dispersion among them as a likely outcome of the formation of the Euro-zone. While the forecast was correct, the dispersions didn’t decline as much as anticipated and the opportunity set for investors in the area has remained “fertile”. That fertility is especially gratifying for us as there are fewer “farmers” trying to plow the same fields—and thereby arbitrage away the potential value-added. Investment managers covet “information ratios”—essentially the amount of value added for a level of risk taken—and from our research there is no finer way to garner it than focusing our strategy on country allocation

5. Utilize unique factors

Beyond simply taking a different perspective, we believe finding factors that aren’t in the tool chest of one’s competi-

² Arnold Toynbee, *East to West: A Journey Round the World* (New York: Oxford University Press, 1958), 199.

³ All performance figures given are for the designated MSCI country total return indices (net of dividends, U.S. \$).

tors is a critical way to stay ahead of—and different from—them.

A critical, yet rarely utilized element of international equity research is measures of risk, e.g., the political, economic, and financial risk of the universe of countries considered. While some in the consulting arena use such data as an aspect of risk control, we have found that a focus on variables such as these can greatly enhance a manager's ability to discriminate among countries over the proceeding one to three months. This is especially true in the emerging markets, where the "country effect" is most pronounced and an awareness of these risk elements can greatly enhance one's decision-making power. In some cases, and in certain environments, variables can play several roles: risk-averting, risk-taking, or fine-tuning how and when to utilize other variables.

6. Combine factors intelligently—be dynamic, take advantage of behavioral biases

For us, understanding the investment markets begins with the acceptance that many of the choices investors make are not purely rational, but draw on a variety of internal influences. As Hans Morgenthau stated, "The philosophy of rationalism has misunderstood the nature of man, the nature of the social world, and the nature of reason itself. It does not see that man's nature has three dimensions: biological, rational and spiritual. By neglecting the biological impulses and spiritual aspirations of man, it misconstrues the function reason fulfills within the whole of human existence."⁴ Many quants simply put together a litany of static factors to generate security rankings. From our perspective, this leaves much of the information contained in the data unutilized.

Combining factors to create inter-relationships among them can generate much more information than utilizing factors in isolation. The understanding that rationality alone doesn't capture what drives the investment markets gives us the opportunity to exploit both the "animal instincts" and higher aspirations that also drive individual choice. We start with a simple behavioral insight. When people are anxious, they tend to "go with what they know" and seek safety. Alternatively, when they are more sanguine about the future, it takes a great deal of information to deter them from their current path and they often stick to what has worked. In selecting countries, these states of investor anxiety commonly get reflected in a bias toward value and risk when anxiety is present, and momentum when investors exhibit greater confidence.

⁴ Morgenthau, *Scientific Man vs. Power Politics* (Chicago: University of Chicago Press, 1946).

By identifying environmental variables that reflect this investor anxiety, our country allocation strategy generates "dynamic factor exposures" based on these changes in risk posture. We have found that, by utilizing such an approach, we have the opportunity to add more value over a broader array of market environments than many traditional managers.

7. Use risk controls intelligently

As discussed above, risk models were a likely contributor to the quantitative meltdown of 2007–2009. Understanding the correct role for these models can make them a tool to manage risk instead of one to enhance "group-think".

Risk models, especially the optimizers that are built into them, can exacerbate similarity among equity portfolios. Qualitative measures of risk control can be as, or more, useful than the quantitative tools. Our experience suggests that focusing on many small decisions at all times—having moderate over- and underweights in a large number of countries and having enough securities within each country portfolio to neutralize unwanted exposures—is the most critical element to portfolio risk control for an international manager. Within country baskets, for example, we have found that a bias toward sector neutrality is beneficial over the long-run, as active exposures there often add more risk than return to a portfolio. Similarly, we use our country allocation "engine"—not to cherry-pick the very best countries and create a concentrated portfolio but—to hold a minimum of 25 countries at any time and put greater emphasis on those markets that are highly ranked and while underweighting those that rank poorly.

CONCLUSION

Quantitative equity management is a very useful tool to allow the astute manager a means to more consistently express his intended "bets" while neutralizing unintended portfolio exposures. The ability to build an investment process around insight, theory, and market knowledge utilizing large amounts of data is a combination of tools available only in the past 30 years. Doing quant is meaningless. Doing quant right can be a great benefit to a strategy's investors.

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