

# QUANTITATIVE EQUITY HEDGE FUNDS: REVISITING THEIR STRENGTHS

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## Executive Summary

Funds employing complex mathematical models to invest in equity markets around the globe can serve as an effective way to incorporate diversification and skill in a client’s hedge fund strategy.

Quantitative equity hedge fund strategies or “quants” are adept at structuring portfolios to profit in markets not solely focused on corporate financials. Therefore, rather than diversifying portfolios across asset classes, market capitalizations and geographies—that may be highly correlated—quantitative funds allow clients to gain exposure to other factors such as momentum, value, growth and interest rates.

Quantitative strategies use algorithms and high-powered computing to incorporate a myriad of factors that drive stock market returns into a predictive model. They can provide a source of alpha, or excess return, through their differentiated process to portfolio construction. They also offer a lower correlation to equity markets than other more fundamental long/short equity strategies, and the ability to synthesize complex data.

As shown in Exhibit 1, quantitative equity managers have shown strong absolute returns over the past 10 years and robust risk-adjusted returns. Both the pure quant and multi-quant composites<sup>1</sup> have shown strong Sharpe Ratios of 1.0 and 0.9, respectively.

In this paper, we propose that quant equity funds have an edge over more traditional fundamental managers in four specific areas:

1. Model development
2. Dispassionate decision-making
3. Optimization
4. Risk management

We believe that these categories contribute to the diversification benefit quant strategies bring to investment portfolios.

To be sure, this investing approach suffered a black eye in the summer of 2007, as quant funds experienced large drawdowns. Since then, we believe the overall market for quant equity managers has changed for the better, with a decrease in market participants, greater understanding of

common models as risk factors, and lower leverage levels.

An effective quant manager can be characterized by skillful model construction and the ability to perform in-depth research. Quant managers should also have a repeatable process that is verified through rigorous empiri-

**Exhibit 1: Risk and Return Characteristics for Quant Managers<sup>1,2</sup>**

	Compound ROR	Standard Deviation	Sharpe Ratio	Max Drawdown
Pure Quant Composite	7.3%	5.6%	1.0	-22.5%
Multi-Quant Composite	6.6%	5.3%	0.9	-11.5%
Fundamental Quant Composite	3.5%	4.3%	0.4	-17.8%
HFRI EH—Quantitative Directional	6.6%	9.6%	0.5	-31.1%
Credit Suisse Long-Short Equity Index	6.9%	8.0%	0.7	-22.0%
MSCI WORLD (Net; USD)	7.2%	16.0%	0.4	-54.0%
S&P 500 (TR)	7.3%	14.6%	0.4	-50.9%

Source: Dow Jones Credit Suisse, PerTrac, Hedge Fund Research, NEPC (June 2003 - June 2013)

<sup>1,2</sup> For composite information, please see the End Notes.

cal analysis and back tests. Finally, it is necessary for these funds to have a thoughtful way to put all the factors together to construct a forward-looking portfolio.

For this paper, we focus on those strategies used by long-term investors as an equity allocation, and that employ quantitative tools at every stage of the investment process. While our paper is focused on the benefits of these types of funds, we will also place them in the wider spectrum of quantitative strategies and articulate their respective pros and cons.

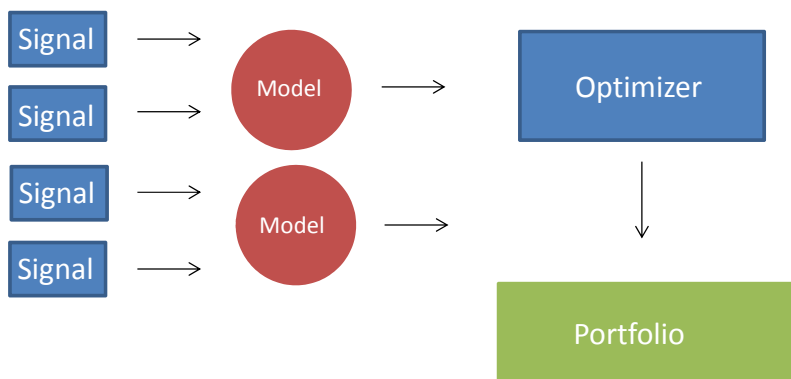
## QUANTITATIVE EQUITY FIRMS ARE DEVELOPING MODELS IN EFFORTS TO EARN OUTSIZED RETURNS, OR ALPHA, AND REDUCE RISK.

The quant approach to portfolio construction has the potential to deliver strong cumulative returns when implemented consistently. We recommend that investors consider quantitative equity hedge fund strategies for their portfolio. We think investors should be able to find the right quant fit for their portfolio, given the range of approaches that fall under the quantitative umbrella.

### The Nuts and Bolts of Quant Strategies

Investors have numerous ways to gain exposure to quantitative strategies. In order to better understand these, it is important to know the different components that go into the making of a quant strategy.

**Exhibit 2: The Components of a Quant Strategy**



Source: NEPC



### Signal

A signal is usually a stream of data, an anomaly, or another form of input that goes into a model.

One way to distinguish between signals is to look at their time horizon. For instance, short-term signals utilize a time horizon ranging from intra-day to a few days. Strategies using these signals are characterized by frequent trading, high turnover, and leverage. The excess return for these funds typically comes from their ability to quickly capture a small mispricing in the markets.

Longer-term signals, usually with a time horizon of over six months, are focused on fundamental factors, for instance, the relationship between price-to-book-value, price-to-equity, and discount-to-enterprise-value. Quant funds utilizing these longer-term signals follow a process similar to that of many fundamental managers, that is, buying undervalued stocks and holding them until they reach fair value. The quantitative tools allow these managers to cover larger numbers of securities.

Some managers employ blended signals, that is, a combination of shorter-term signals and longer-term signals. These funds often have a core quant process focused on longer-term fundamental signals. This core process is the primary driver of the funds' returns. In addition, managers may use shorter-term signals as a secondary way to generate returns for the fund.

### Model Development

A model is a tool used by quantitative firms to synthesize the various sources of data or signals. Models can be classified as fundamental or non-fundamental.

A fundamental model usually incorporates signals of company-specific information, such as balance sheet metrics, to analyze securities. A fundamental model, for instance, could rank stocks into four quartiles based on two signals, say, net income growth and price-to-earnings. As an investment strategy, the fund could go long the securities in the top quartile and short those in the fourth quartile.

A non-fundamental model uses complex math and algorithms to look for anomalies across various signals. These models usually operate within what is often called a "black-box." Black-box firms employ complex inputs and mathematical algorithms,

while providing limited disclosure or transparency into their funds' construction, implementation, and output. An example of a potential black-box trade: the model may be geared to buy cyclical stocks based on three signals, such as a dip in energy stocks, a rise in Japan's GDP, and a strong quarter for the technology sector.

Quantitative equity firms devote a substantial portion of their resources to developing models in efforts to earn outsized returns, or alpha, and reduce risk. As market anomalies disappear over time due to better information flow or additional market participants, quant firms are forced to constantly refine and develop new models due to this decay or decrease in the "alpha" of a model.

## NEPC PREFERS MANAGERS THAT EXHIBIT A STRONG ORGANIZATION, A REPEATABLE ALPHA GENERATING PROCESS, AND THOUGHTFUL PORTFOLIO CONSTRUCTION.

### *Optimizer*

Following model development, the optimization process takes the output of a model and creates a portfolio of securities. At the most basic level, quant funds optimize a portfolio to achieve specific risk and return objectives by assessing the volatility of equities, the expected return, and myriad other forward-looking and backward-looking factors.

### *Risk Controls*

Risk management can vary across quant strategies based on the different degrees of human involvement. The most notable area of distinction is between managers who exclusively use computer-driven, systematic processes, and managers where team members have some engagement in the process. Typically, human involvement comes into play as a risk management tool. Our research points to portfolio managers intervening in the models/optimization process to manage risk, for instance, removing securities behaving erratically due to major news or corporate actions.

### **The Types of Quant Strategies**

In this paper, we distinguish between the different quant firms by using three categories: types of

models/signals, the model development process, and risk management. The analysis of quant strategies based on the above three metrics allows us to categorize funds along a spectrum, ranging from those using rankings and screening metrics involving a company's financial performance at one end, to pure black-box firms at the other.

### *Fundamental Quant*

In this approach, managers employ mostly fundamental models using signals incorporating company-specific financial data into the investment process. This strategy may appeal to investors seeking a fundamentals-focused approach that uses some quantitative techniques. It offers more transparency, and a research and selection process that is relatively easier to grasp than other more quant-intensive strategies.

### *Multi-Quant*

This strategy combines fundamental models and non-fundamental models that use signals across multiple time horizons. The majority of managers in our quant universe falls within this category.

### *Pure Quant*

Under this strategy, non-fundamental models are exclusively used. This is the most complex sub-strategy of quantitative equity managers. These strategies come closest to our definition of black-box trading. Often, pure quant managers, unlike fundamental quant or multi-quant, will not share the inner workings of their models and signals.

In Exhibit 3 we summarize the differences between these three categories of quant funds. We also highlight the historical performance for these funds based on our grouping of managers.

At NEPC, regardless of strategy, we are looking for managers that exhibit a strong organization, a repeatable alpha generating process, and thoughtful portfolio construction. These components are at the heart of any successful quantitative equity strategy. To this end, managers must possess strong quantitative skills to construct models, incorporate signals, and perform research. Quant managers should also have a repeatable process that is verified through rigorous empirical analysis and back tests. Finally, it is necessary for these funds to have a thoughtful way to put all of the factors together to construct a forward-looking portfolio.



## Benefits of Quant Funds

Based on our research, we believe that quant equity funds have an edge over more traditional fundamental managers in five areas: model development, decision-making, optimization, risk controls and diversification. Liquidity can be a benefit of quant strategies as well, but we will discuss this during the risk section. While some funds may select securities based on complex models, the underlying instruments are usually exchange-traded instruments, which are liquid and easily tradable.

## Model Development

Quantitative strategies not only include the drivers of portfolio performance used by fundamental managers, such as security analysis, but they also use factors that go beyond a company's financials. The result: a stock selection model incorporating more factors affecting stocks than just a company's performance.

The ability to understand how micro factors influence the market on a macro level requires the ability to analyze large datasets, that is, big data.

Big data is typically used to describe the rising velocity, density and variety of structured and unstructured data available to investors. These data have outpaced the human ability to analyze such overwhelmingly large pools of information. Quantitative analysis concedes this point and focuses on filtering the noise in the data in order to interpret patterns identified by the programs and algorithms. Machine learning, or the ability of computers to adapt to changing information, is vital in order to see patterns in large reams of data. Using computers and algorithms, machine learning is able to take large sets of data and search for patterns that develop over time. As the data evolve, the machines are able to adapt to the new information and 'learn' from the change. This analysis of big data is important because it could lead to informed, more accurate decision-making, which may increase gains from and reduce risk in investments. To this end, model development to seek alpha and lower risk is vital for quantitative equity firms.

For instance, sales at hardware stores (micro) may be a potential bellwether to gauge

**Exhibit 3: Spectrum of Quant Equity**

	Fundamental Quant	Multi-Quant	Pure Quant
Definition	Models incorporate predominantly balance sheet and simple price or momentum signals	Models incorporate fundamental and mathematical computations	Models incorporate increasing complex mathematical computations often involving multi derivations of signals
Signal Time Horizon	Tend to be longer term (3 months to multi-year)	Combination of longer-and shorter-term signals	Typically a few days to a few years
Transparency	Most transparent	Blend of transparency and manager specific	Least transparent
10-Year Historical Return	3.5%	6.6%	7.3%
10-Year Historical Standard Deviation	4.3%	5.3%	5.6%
10-Year Historical Sharpe Ratio	0.4	0.9	1.0
Beta to S&P 500 Common Time Period	0.1	0.2	0.1

Source: Dow Jones Credit Suisse, PerTrac, Hedge Fund Research, NEPC (June 2003–June 2013)



the performance of the housing market (macro). Given the proliferation of hardware stores, the data could be unwieldy and complex. Enter: quant funds. To get the most out of these data, quant funds will use computers and algorithms to allow a frequent and quick review of data to glean insights into the health of residential real estate. Knowing how to analyze and interpret data is the hallmark of quant funds.

Another benefit of model development is the ability to monitor the predictability and the persistence of alpha from these models. For instance, some firms have developed weighting schemes around the persistence of an alpha signal, that is, they can tilt the portfolio towards or away from models that are outperforming or underperforming.

### *Decision-Making*

Quant equity investing can benefit from being unemotional. Behavioral finance theory posits that individuals exhibit some emotional or behavioral biases when identifying investment opportunities. Quant strategies often look to exploit these very biases. In most quant funds, there is limited human involvement, other than to manage risk. These funds typically rely more heavily on the strength of the process, rather than the individual decisions of a specific portfolio manager.

### *Optimization*

Portfolio optimization is another approach taken by quant managers to enhance and create superior risk-adjusted returns for investors. Similar to the benefits of objective decision-making in quant strategies, the optimization process systematically buys or sells securities based on factors impacting the investment opportunity and not emotions that may color the selection. This dispassionate approach to portfolio construction has the potential to deliver strong cumulative returns when implemented consistently.

Some fundamental managers utilize optimization packages to identify unintended risk in portfolios. At NEPC, we believe that quantitative managers with custom optimization tools are better able to match the individual signal/model risk. With non-customized solutions, there is a risk of optimizing away the anomaly one is seeking to exploit.

### *Risk Management*

We view risk management and optimization sepa-

ately, even though they often overlap. Risk management is systematic and data-heavy, and thus, plays to the strengths of most quant managers. Factor sensitivities at the level of individual positions and risk metrics for the total portfolio are measured and reported in the language of most quants. This is distinct from a purely fundamental manager who focuses on analyzing corporate financial statements and interviewing management.

Typically, human involvement comes into play as a risk management tool. This type of intervention was widely seen in 2012, when many quant funds removed the common stock of J.P. Morgan Chase & Co. (JPM) from quant portfolios. These moves came amid heightened volatility in the bank's shares after revelations in May 2012 that J.P. Morgan traders in London placed bad bets on credit derivatives. These outsize bets, made primarily by a trader who became known as the London Whale, ultimately cost the company more than \$6 billion.

Risk management for many quant funds is dispassionate and systematic, with varying degrees of human involvement.

Quant funds have an additional benefit: Many fundamental managers come with a key man risk, that is, a portfolio manager or key analyst driving a disproportionate share of the earnings. With a quant strategy, the excess return potential is driven by the process, so the departure of any one key person may not impact the portfolio as greatly.

### *Diversification*

We believe quantitative equity managers can add diversification to long-term investors' hedge fund portfolios. Quantitative equity gives long-term investor portfolios exposure to non-fundamental drivers in addition to the usual fundamental drivers. To this end, quantitative funds may add factor diversification rather than diversifying portfolios across asset classes, market capitalizations, and geographies, which may be highly correlated. This allows investors to gain exposure to additional factors such as momentum, value, growth and interest rates.

### **Incorporating Quantitative Equity into Long-Term Investment Programs**

To further analyze the additional diversification quant strategies provide, we have constructed



**Exhibit 4: Correlations to Hedge Fund Indices and Fundamental Hedge Fund Managers<sup>3,4</sup>**

	Fundamental Quant	Multi-Quant	Pure Quant	HFRI Equity Hedge-Quant Directional Index
Credit Suisse Long-Short Equity	0.3	0.6	0.4	0.9
Credit Suisse Hedge Fund Index	0.4	0.6	0.4	0.8
Healthcare Manager <sup>3</sup>	0.1	0.3	0.2	0.6
Technology, Media and Telecommunications Manager <sup>3</sup>	0.1	0.3	0.2	0.5
Thematic Manager <sup>3</sup>	0.3	0.3	0.2	0.5
Core Long-Short Manager <sup>3</sup>	0.3	0.4	0.3	0.6
Core Long-Short Manger <sup>3</sup>	0.2	0.5	0.3	0.8

Source: Dow Jones Credit Suisse, PerTrac, Hedge Fund Research, NEPC (June 2003 – June 2013)

three composites to explore the benefits of fundamental quant, multi-quant and pure quant. The three composites were created from a sub grouping of managers in a database managed by NEPC. These managers were placed into the fundamental, multi-quant and pure quant categories based on our assessment of the managers and then weighted equally. These composites are not all-encompassing and represent a sampling of managers from the qualitative analysis. Individual manager returns will vary within these categories.

Exhibit 4 shows the correlation of select quant funds to a list of fundamental equity managers over the 10 years ending June 30, 2013. Our analysis shows that many of these funds offer equity exposure with a lower correlation to a selection of fundamental equity managers.<sup>3</sup> Adding these strategies could potentially diversify a portfolio made up of existing fundamentals-focused equity managers.

**Risks**

Like any investment, quantitative equity strate-

gies carry risks. Some of these risks are unique to this strategy.

*Liquidity*

Quant equity strategies generally benefit from high levels of liquidity, that is, the ability to easily sell positions in a portfolio due to investment reasons or to meet investor capital demands. This is because quantitative equity strategies are generally evaluating variables that influence stocks across the board as opposed to those that impact only individual stocks. When these strategies find stocks to invest in, they will often invest in a large number of different stocks in the same sector. This reduces the portfolio’s exposure to any one single stock, thereby improving the liquidity of the portfolio.

For instance, a quantitative strategy identifies biotech stocks will likely outperform the market after an imminent announcement from the U.S. Food and Drug Administration. To capitalize on this insight, a quantitative fund will invest in a number of biotech stocks—rather than a single one—that shows sensitivity to this expected outperformance factor. Therefore, the fund gains exposure to the factor without the illiquidity that comes with owning only one or two names. In contrast, a fundamental equity manager has to tolerate the relative illiquidity that comes with being invested in fewer stocks.

But liquidity can also be a weakness for a quant strategy precisely because the fund relies on liquid markets in order to make investments and identify signals. During periods of market illiquidity, quant strategies are hurt in two different ways: the ability of models to source signals in the data is reduced, and the strategy has a diminished capacity to construct a diverse portfolio of stocks to express this model.

<sup>3,4</sup> Refer to End Notes 3 and 4.



## Transparency

Transparency in quantitative strategies should be considered from the viewpoint of both the investment holdings and the process. Transparency includes the ability of investors to see the underlying portfolio holdings and have access to information or disclosures that shine a light on the investment process.

With regards to holdings, the diverse assets of most quant portfolios mean quant funds are comfortable sharing details with their investors. This is in contrast to concentrated hedge funds, which are often reluctant to disclose core positions.

Many quant managers, however, are less transparent while disclosing information about their models. Funds may not share details of their quant model and the factors they use to select stocks. Further, investors without formal mathematical training may have trouble understanding even those funds willing to disclose details of their process. Investors often avoid quant strategies because they simply do not understand them well enough to be comfortable investing in them. While this is not without merit, there may be an excess return associated with investments that are profitable but complex to grasp.

## Leverage

Leverage can play an important role in quant strategies. For some, their signals may be consistent and uncorrelated to the market, but they may only generate small returns based on minor discrepancies in price. Leverage is often used to amplify these gains. To this end, leverage can help exponentially increase a portfolio's expected return, but it also increases risk.

As a portfolio begins to implement leverage, its losses can exceed the capital invested. In quantitative equities, leverage is usually measured by gross total exposure, the addition of the gross long exposure and gross short exposure. We believe that not all leverage is created equal and should be analyzed in conjunction with liquidity and strategy. It is crucial when evaluating a quantitative strategy to understand the level of leverage expected to be used and the historical leverage utilized. Most managers in this space have explicit risk limits as measured by total gross exposure, or gross long and gross short risk limits. When viewing the universe of quantitative managers it is important to understand the leverage levels needed to exploit anomalies, which can take

the form of total portfolio leverage constraints.

## Crowding

Crowding occurs when managers invest in the same securities or operate models that rely on similar signals. The risk of crowding is that a change in opinion by one or multiple managers can distort prices, increase the velocity of price movements and increase drawdowns. Crowding risk is not unique to quantitative managers. Fundamental managers may often traffic in similar portfolio positions. That said, crowding risk can assume a different dimension for quantitative managers. For instance, it can fuel a market crash if all quantitative equity funds utilizing similar models have the same sell signal. While there is no systematic way to measure the crowding effect in quant hedge funds, we do know that most hedge funds monitor the decay of their alpha signals. Limiting a fund's leverage and broadening its time horizon can help mitigate some of these factors as certain arbitrage situations are not as appealing with low leverage or higher transaction costs.

## Examples of the Risks of Quant Investing - Long-Term Capital Management and the Quant Crash of 2007

A conversation on quant funds is incomplete without talking about the two major crises related to this investment strategy: the collapse of hedge fund Long-Term Capital Management and the so-called Quant Crash of 2007.

In 1998, the then famous quant hedge fund, Long-Term Capital Management (LTCM), not only imploded, but also threatened to bring down the global financial system. LTCM's complex computer models failed to anticipate some severe one-off market events. In addition to these missteps, it was massively leveraged, which magnified its losses. These losses were exacerbated by the illiquid nature of some of the assets. As LTCM reeled, Wall Street and the Federal Reserve feared that its unraveling could set off a systemic meltdown. Subsequently, the Fed roped in major Wall Street firms and senior bankers from Europe and engineered a bailout to avert financial contagion.

The Quant Crash occurred in July and August of 2007. This time period exposed risks that weren't analyzed before. A number of high-profile and successful quantitative hedge funds experienced



unprecedented losses, suffering large drawdowns when measured on an intra-day and intra-month basis. The losses were fueled by a combination of excessive capital in quantitative strategies and highly levered players who needed to de-leverage liquid portions of their strategies, with equities being the most easily traded. In the days following the crash, some managers were able to recoup losses due to the sharp bounce-back in equity markets.

Since that time, the overall quant landscape has changed: banks have deleveraged their balance sheets, capital has flowed out from quant funds, proprietary trading desks are smaller, and there is generally lower leverage among some of the remaining funds. We think this has created an opportunity for quants to apply their models to a less trafficked, less efficient market.

## QUANTITATIVE LONG/SHORT EQUITY HEDGE FUNDS CAN OFFER A DIFFERENTIATED PROCESS TO PORTFOLIO CONSTRUCTION.

### Conclusion

Quantitative long/short equity hedge fund strategies can add value to investor portfolios. We believe quant funds' differentiated process to portfolio construction, the lower correlation to equity markets, and the ability to capture the growing Big Data trend are compelling reasons for investors to add these strategies to their portfolios. These funds can be a source of alpha for clients looking to build a diverse portfolio; they can be a diversifier for an existing equity allocation, and can add a differentiated return stream to a portfolio that is biased towards fundamental analysis.

Given the range of approaches that fall under the quantitative umbrella, we think investors should be able to find comfort in considering quant funds that pursue one or more of these approaches.

### End Notes

1. The three composites were created from a sub grouping of managers in a database managed by NEPC. These managers were placed in the fundamental, multi-quant and pure quant categories based on our assessment of the managers, and then weighted equally. These composites are not all-encompassing

and represent a sampling of managers from our qualitative analysis. Individual manager returns will vary within these categories. Not all managers have performance dating back to July 2003; their respective performances were added to the composites at the relevant inception dates.

2. The HFRI Equity Hedge (EH)—Quantitative Directional Index is an equal weighted benchmark of quantitative equity hedge funds with at least \$50 million in assets under management maintained by Hedge Fund Research Inc. The Credit Suisse Long/Short Equity Index is a weighted benchmark of long/short equity hedge funds with at least \$50 million in assets under management maintained by Credit Suisse Hedge Index LLC. For the Sharpe Ratio calculations, the Citi 3-Month Treasury Bill Index was used as a risk-free rate.
3. To select the individual fundamental managers for Exhibit 4, we followed this multi-step process:

Step I: We selected managers from the NEPC Focus Placement List in Long/Short Equity. These managers have track records of at least 10 years through June 30, 2013.

Step II: Managers were organized by their sub-strategies, including core long/short, healthcare, thematic, and technology, media and telecommunications.

Step III: When more than one manager was present in a sub-strategy, NEPC selected managers with higher correlations to quantitative equities.

4. The Credit Suisse Hedge Fund Index is a weighted benchmark of equity, credit, global macro, and multi-strategy hedge funds with at least \$50 million in assets under management maintained by Credit Suisse Hedge Index LLC. For the Sharpe Ratio calculations, the Citi 3-Month Treasury Bill Index was used as a risk-free rate.





## Disclaimers and Disclosures

- Past performance is no guarantee of future results.
- All investments carry some level of risk. Diversification and other asset allocation techniques do not ensure profit or protect against losses.
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