Axioma
By SimCorp

RESEARCH

USING AI TO UNCOVER HIDDEN FACTORS FOR HEDGE FUNDS

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A NEW ERA FOR HEDGE FUNDS

IN A PREVIOUS CAREER, I USED TO RUN DUE DILIGENCE ON HEDGE FUNDS.

I was recently reminded of a trader who had been churning it out at a large multi-manager fund around the dot-com bubble, while all the other PMs there were struggling and losing money. The hedge fund was running a long-short market-neutral strategy, so basically they were expected to be neutral to various risk factors and to generate 'pure alpha.'

What was his secret? The hedge fund trader noticed that a group of seemingly unrelated companies were moving together – both up and down – and neutralized his portfolio to this "internet" factor. At the time, anything that could have some potential internet exposure was getting caught up in the mania, so even seemingly unrelated companies, like the now bankrupt Borders, had shot up on the speculation it might become like Amazon.

Why hedge funds should leverage factor risk models

Identifying these types of hidden factors is extremely important, especially for hedge fund strategies. For statistical arbitrage or market neutral managers, hedge fund traders will want to mitigate that risk. For discretionary or macro strategies, traders may want to take a directional bet, based on this hidden factor.

Factor risk models can help hedge fund managers understand risk factors and exposures and can be an important part of their toolset. This is why we provide clients both statistical and fundamental risk models as a standard package, enhancing the potential for signal and alpha generation.

Statistical models can potentially pick up sources of risk not captured by a linear fundamental risk model. They are very powerful but lack intuitive explanatory power because the fundamental factors get jumbled together. Linear fundamental risk models, on the other hand, provide a good understandable story but are limited by their factor set, potentially leaving more unexplained residual risk on the table. The standard assumption is that this fundamental residual risk is random and unstructured. *Or is it?*

Embedding machine learning (ML): Two distinct approaches

One way to try to find structure within the residuals is to apply a neural network, a machine learning technique that uses trial and error to find stocks that may have exposure to an undefined factor. The issues with this approach are twofold: First, it is a complicated 'black box' function with no transparency on how it arrived at a solution, and second, the factors still do not have an easily interpretable meaning, which can be uncomfortable for some.

Of course, the linear model structure has many advantages, so we sought to create an additional linear factor that would capture nonlinear effects embedded in the residual returns. We do this using Instrumented Principal Components Analysis (IPCA), another ML technique that reduces the dimensionality of the data that's being analyzed. The residual security returns from our linear model are mixed and matched using PCA (harnessing the power of a statistical model) but are "instrumented" on a polynomial structure based on our fundamental factors. This allows hedge funds to leverage the power of a neural net-like approach but without losing the explanatory benefits of the fundamental model.

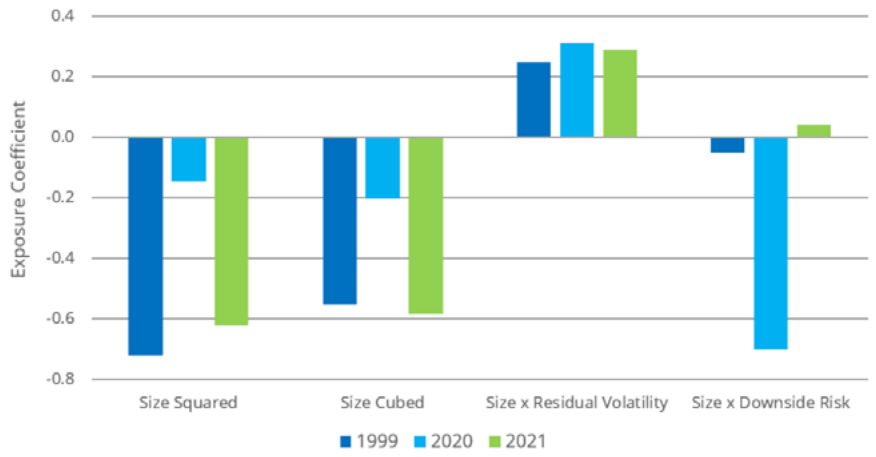
In this way, we can identify additional important, higher-order factor terms and relationships. In other words, it gives more clarity on the co-movement of individual securities, while still using an intuitive factor lens. This new factor is called the Non-linear Residual Structure.

How can hedge funds spot non-linear residual factors?

The most important non-linear terms will change over time as the residual structure, driven by investor preferences, changes with the market environment. Size Squared and Size Cubed are by far the most common important terms, with Size x Residual Volatility is a distant third. Value was a leading cross-term until the mid-1990s but at the end of 1999, during the height of the dot-com bubble, the most important non-linear factors were negative Size Squared, negative Size Cubed, and positive Size x Residual Volatility, indicating positive factor exposure from extreme small-caps and high-volatility large-caps (Figure 1). These probably represented exposure to recent IPOs and the internet giants.

In late 2020 during COVID, a more unusual pattern appeared, in which the usual Size terms were reduced in importance and the largest contributor to exposure was negative Size x Downside Risk. Thus, there was an extra benefit for higher exposure to mega-caps, low-volatility large-caps, and low-risk small-caps as investors sought safety (supporting the emergence of the "Magnificent Seven"). By the end of 2021 a more typical structure had re-appeared, similar to 1999, but with the return benefit this time on the other side of the trade, favouring mega-caps and low-volatility large-caps.

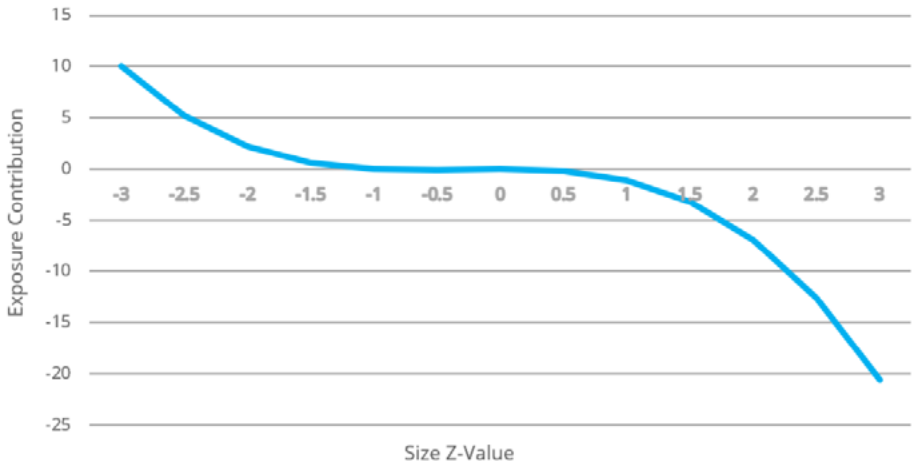
Figure 1: Sample of common Non-linear Residual Structure factor terms



Source: Axioma US Equity Factor Risk Model (5.1)

An example from 2022 of the net contribution of the Size exposure to the Non-linear Residual Structure factor is shown in Figure 2. Most often, the Size Squared and Size Cubed terms are negative, indicating positive exposure from extreme small-caps and negative exposure from mega-caps. This chart shows that the additional risk effect from non-linear Size was mainly concentrated in stocks with normalized Size exposures below about -1.5 and above about +1.0. This could be a consequence of the market recently being dominated by a narrow group of seven extremely large tech stocks and therefore portfolios with large or small-cap tilts actually had an additional exposure they didn't know they had! A savvy portfolio manager (like the dot-com trader I met above) who wished to neutralize exposure to this additional risk factor would stick to moderately-sized stocks in the flat, middle part of the curve (with Size exposures between, say, -1.0 and +0.5).

Figure 2: Recent net contribution of Size exposure to the Non-linear Residual Structure factor



Source: Axioma US Equity Factor Risk Model (5.1)

Figure 3: Growth of the Non-linear Residual Structure factor over time (US5.1 MH): 1983-2022

Source: Axioma US Equity Factor Risk Model (5.1)

Introducing a new era for sentiment analysis

The Non-linear Residual Structure factor brings together the explanatory power of fundamental models with the dynamic combinatorial power of statistical models. It is part of a family of market-based sentiment factors within the US5.1 equity factor risk model, which includes:

- Hedge Fund Crowding (captures risk/return differences based on hedge fund holdings)
- Short Interest (explains risk/return based on degree of stock being shorted)
- Opinion Divergence (measures lack of consensus among investor opinion via unexplained volume)

This factor family helps uncover the unseen structures below the market surface, so that hedge fund managers can better predict and exploit sentiment and factor relationships to manage their sources of risk and return.

Learn more about our solutions for hedge funds.

1 Past performance is not a guarantee of future profits. These returns represent the idealized index performance of long-short factor mimicking portfolios, and do not take into consideration transaction fees, bid-ask spreads, or liquidity. It is not possible to invest directly in an index.

ABOUT SIMCORP

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Founded in 1971, with more than 3,000 employees across five continents, SimCorp is a truly global technology leader that empowers more than half of the world's top 100 financial companies through its integrated platform, services, and partner ecosystem.

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The Axioma analytics suite by SimCorp provides investment management solutions to a global client base, including asset managers, asset owners, hedge funds, wealth managers and sell-side firms. Axioma solutions are part of the SimCorp One platform.

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