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# Multifactor and the Machine

Like computing, space exploration and many other modern inventions, the sophistication of factor investing has increased manifold since the first pioneering papers on the concept in the 1960s and 1970s.

The logic is clear. There is only a small number of active managers that outperform the stock market for long periods by making subjective assessments of individual stocks that are consistently more often right than wrong, and the annual management fees are relatively large. Given this, why not investigate the common characteristics, or 'factor premia', of stocks that tend to outperform the market in the long term, and select securities on this basis instead? For example, if a fund followed a Value factor strategy, it would put much more money in companies with characteristics such as historically low price-to-book or price-to-earnings. It would put much less, if any at all, in companies with opposite characteristics.

Factor investing started with strategies based on selecting for just one characteristic, such as Value, but quite rapidly more and more factor strategies started to use a number of them. This was the birth of multifactor investing. By splitting and splitting again like an atomic physicist, some investors have used as many as 20 or more, but sceptics have argued that this approach falls foul of one of the time-honoured precepts of good investment: don't make it any more complicated than it needs to be because, if you do, there's a risk that you'll stop thinking clearly. They argue that many new-fangled factors overlap with each other. In the end, multifactor equity investors tend to opt for the same five factors, even if they invest in these factors in different ways: Value, Quality, Momentum, Small Size and Low Volatility.

## Superior multifactor performance

Multifactor investing has worked well over the years. The MSCI World Diversified Multi-Factor Index has generated an annualised return in the high single digits since the late 2000s (including the 2008-09 crisis), in dollar terms. This is a couple of percentage points above the plain and simple MSCI All Country World Index<sup>1</sup>, though Aberdeen Standard Investments' SMARTER Beta Diversified Multifactor Global Equity Index has done better than both, and with a lower annualised risk.

But could multifactor investing perform even better than this? Consider 2008, when the MSCI Diversified Multi-Factor Index dropped 40.0%<sup>2</sup>. Although this was pretty much the same as for MSCI All Country World Index, that was scant consolation to multifactor fund managers and their clients. However, this catastrophe also presented an opportunity to learn something useful. Small-cap stocks did particularly badly, as they tend to during financial and economic crises, because of their financial

model. They often pay meagre dividends if they pay them at all, preferring to plough cashflow back into growth. When prospects for growth suddenly deteriorate, they begin to look far less attractive. What if a multifactor investor had foreseen that small-cap stocks would fall, and responded by shorting the Small Size factor: going underweight temporarily in small-cap and overweight in large-cap?

Such thoughts spawned dynamic multifactor investing, where investors remain fully invested throughout the market cycle, but underweight and overweight different factors at different times. However, the idea of timing factors took investors back to the problem that spawned factor investing in the first place: a scepticism about investing based on subjective assessments. Getting the timing right is difficult. It calls to mind an unlucky motorist caught in a traffic jam. Noticing that the cars are powering ahead in the lane next to him, he switches lane, only to discover that in the new lane the traffic has stopped. But – to his chagrin – it is now speeding forward in the lane he's just abandoned.

Machine learning can play an important role here by warning us when it pays to make the switch. It can replace hunches with a rules-based system seeking signs that it's time to underweight or overweight a particular factor, based on indicators from the past that can serve as early warning signals.

## Using the machine to DISCOVER Alpha

Aberdeen Standard Investments has worked on developing a global equity machine learning strategy over the last two years – training the machine to the point where it has learnt enough to discover 'alpha'. The new DISCOVER Alpha<sup>3</sup> strategy uses the machine learning system to drive investment decisions and employs the same five 'factor premia' families used within our equally-weighted SMARTER Beta multifactor equity strategy: Value, Quality, Momentum, Small Size and Low Volatility, albeit with a broader range of metrics inside each factor.

We believe our DISCOVER Alpha strategy is rare outside the hedge fund world: few mainstream asset managers, pursuing long-only strategies as long-term stock market investors, have used it. Based on backtesting, we believe that this strategy can generate considerable alpha over the course of a market cycle – adding between 4% to 6% above benchmark returns over the medium to long-term, which is 2% to 4% higher than our equally-weighted SMARTER Beta multifactor equity approach. In other words, we believe that dynamic factor timing could potentially deliver considerably more alpha.

Crucially, the strategy analyses data going back to 1990, giving it a strong opportunity to find many parallels with the past. It treats each of the five factors as a discrete market. As a supervised learning program, it looks only at three specific features to find parallels from the past with each of these factor markets today. These are whether each factor is looking expensive or cheap, the recent trend of that factor's performance, and the volatility of performance.

Let's say it finds that, judged by these three features, the Value factor market looks similar now to how it was in October 1999, to pick a time at random. It also finds that in the three months following October 1999, stocks scoring highly on a Value basis did badly. This is interesting to a dynamic multifactor investor, but the parallel is much more persuasive if further parallels back it up. For example, let's say that for Value stocks, the present moment also looks pretty much like September 2006 and January 2013 as well as October 1999, and that in the three months following all these points in time Value stocks did badly. In this case, the lesson that history can teach us about the future is very interesting indeed – it might be time to short Value temporarily.

Although our model concentrates on five factor premia, the depth of analytical power allows for highly nuanced investing within those five. The strategy might find, for example, that, in the three-month periods following October 1999, September 2006 and January 2013, Value stocks with high forward price-to-earnings ratios did well but Value stocks with low dividend yields did less well. Responding to this, investment in Value in the present day can be skewed to emphasise the former rather than the latter.

The operation of the DISCOVER Alpha strategy reflects an understanding that the attractiveness of different factors, and different components within those factors, can change rapidly. Instead of quarterly investment meetings to consider possible factor adjustments, with ad hoc meetings during times of rapid change – the model for many dynamic multifactor investors – DISCOVER Alpha responds to the information produced by the system every day. Acting on this information, it will periodically alter its long and short positions in different factors, as well as investment nuances such as relative exposure to high and low dividend yields. Most days, it will not come up with conclusions that are very different from the day before. However, just as flash floods, earthquakes and volcanic eruptions are apt to occur seemingly out of nowhere, to wreak immense short-term damage on landscapes, stock markets can suddenly change rapidly. The great virtue of applying machine learning to dynamic multifactor investing is that it can detect the early warning signs of market movements that to the human brain appeared to come from nowhere.

## The future

But even though our new machine learning system for dynamic multifactor investing is highly innovative compared with what other asset managers are presently doing, the opportunities to improve on current systems will grow greatly in the coming years as data sources multiply and machine learning techniques become ever faster and more sophisticated.

In the course of time dynamic multifactor systems could even marry two alternative approaches to using AI for investment. It could combine the three-pronged approach to assessing factor investing as described in this article – current pricing, recent trend and volatility for different factors – with 'big data' techniques that make sense of 'alternative data'. Big data techniques involve crunching enormous amounts of data of many different kinds. 'Alternative data' is information, such as social media feeds, not normally assessed by stock analysts.

For example, a crunch of alternative data might unearth a past correlation between a change to more negative language among Twitter users and ensuing outperformance by Quality stocks, which tend to perform relatively better during economic downturns. That could justify keeping a weather eye on the social networking service. But before investment managers decide this, they would first have to be convinced that this was more than a case of coincidence.

All things considered, most of the future machine learning advances in dynamic multifactor investing will relate to how the machine uses conventional rather than alternative data. This will include finding new kinds of patterns in historical data not previously detected – seeing the shape of things in the past with greater clarity and sophistication, and using it to identify the shape of things to come. It will also include accelerations in the speed with which machines can process data and respond to it. The machines are already extremely clever and nimble, but they will grow progressively more so in the coming years.

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<sup>1</sup> <https://www.msci.com/documents/10199/0f369f17-3a93-41d3-9b8d-fc3594176fcb>

<sup>2</sup> <https://www.msci.com/documents/10199/0f369f17-3a93-41d3-9b8d-fc3594176fcb>

<sup>3</sup> DISCOVER Alpha is an acronymic spelling: Dynamic Factor Timing, Innovative, Systematic, Collaboratively Developed, Optimised Portfolio Construction, Versatile, ESG Inside, and RIPE Factors.

<sup>4</sup> SMARTER Beta is an acronymic spelling: Systematic, Multifactor, Active Measures, Resilient, Transparent, ESG Inside, and RIPE Factors.

## Important Information

Investors should be aware that past performance is not a guide to future results. The value of investments, and the income from them, can go down as well as up and investors may get back less than the amount invested.

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