

IS MOMENTUM BEHAVIOURAL?

AHL/MSS ACADEMIC ADVISORY BOARD

March 2014

OVERVIEW

- The AHL/MSS Academic Advisory Board consists of leading academic experts with diverse perspectives. The Board's mandate is to provide insights relevant to our systematic businesses.
- The board met on 14 January 2014 to tackle the question 'Is Momentum Behavioural?' and came up with some perceptive observations. Momentum is a complex phenomenon, and the evidence indicates that behavioural factors are important in the emergence of trends.
- The outlook for momentum trading may be changing. The uncertainty of the post-crisis environment may accentuate the impact of some common behavioural biases and create new opportunities for momentum investing in coming years.

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INTRODUCTION

The AHL/MSS Academic Advisory Board met in January 2014 to address a key question: *Is momentum behavioural?*

The Board, whose members bring diverse perspectives and deep expertise, consists of:

- **Nick Barberis**
Professor of Finance at the Yale School of Management
– one of the world's leading experts in behavioural finance.
- **Campbell Harvey**
Professor of Finance at the Fuqua School of Business at Duke University and Editor of the Journal of Finance from 2006-2012
– a leading financial economist with a focus on the dynamics and pricing of risk.
- **Neil Shephard**
Professor of Economics and of Statistics at Harvard University. He was the founding director of the Oxford-Man Institute of Quantitative Finance in Oxford and directed it from 2007-2011
– one of the top theoretical and applied econometricians.

These distinguished academics¹ were joined by Tim Wong the Chairman of AHL/MSS, Sandy Rattray CEO, Matthew Sargaison CIO, Doug Greenig CFO, Anthony Ledford, the Chief Scientist at the Man Research Laboratory in Oxford and Thomas Flury, a Quantitative Analyst with AHL.

Before launching straight into the discussion, we point the interested reader to the appendix for some background information on momentum.

THE DISCUSSION

AHL/MSS: What causes momentum?

Nick Barberis (NB): Let me frame the problem by discussing three categories of explanations for momentum. The first says that the high average returns to momentum are just a risk premium – compensation for risk that investors face. The second says that momentum earns high returns because it exploits a mispricing caused by a friction of some kind. And the third category, so-called 'behavioural' explanations, says that momentum earns high returns because it exploits a mispricing caused by irrational thinking on the part of some investors. Today, most academics believe that momentum is at least partly a mispricing phenomenon, but there is debate about what exactly is causing the mispricing.

Cam Harvey (CH): Yes. It's hard to distinguish between the purely behavioural framework and the rational framework with frictions, where we can obtain momentum from an interaction of rational agents with different views.

NB: Sometimes people put those differences-of-opinion explanations in the behavioural category because it is hard to sustain disagreement between people without invoking some overconfidence. In terms of what kind of irrational thinking might be driving momentum, there are various proposals: *anchoring* biases, in which people rely too heavily on prior estimates of value; *extrapolation* heuristics, which lead people to overreact to perceived trends; *overconfidence*; and *limited processing* capabilities, which slow the incorporation of fundamental information into prices.

Sandy Rattray (SR): Extrapolation seems a particularly likely explanation, seeing what happens on trading floors.

Matthew Sargaison (MS): Traders very early on get taught the two main rules: The trend is your friend and never fight the Fed!

Doug Greenig (DG): Framing and anchoring are really important. Trading can be a frightening activity. To make sense of things, you rely on past experiences to tell you what's reasonable, what you can expect and how bad things can get.

NB: A key question is: What leads people to over-extrapolate trends in financial markets? One idea is that it is a learned heuristic: many things in the real world keep moving in the same direction for some time. People then assume that financial markets will work similarly.

Neil Shephard (NS): Just processing information is difficult: Obtaining the relevant information and building robust econometric models to produce rational forecasts can be a great challenge given that the world's constantly changing. This can lead to prices not immediately reflecting the 'rational expectations'.

AHL/MSS: Does having a theory of momentum matter to traders or policy makers?

NS: It may be good enough to have a model that works. It would be obviously nice to have fundamental understanding but ultimately that may be too difficult. Take the example of volatility: There is no successful general theory of what moves volatility and reduced-form econometric (or purely statistical) models work better. In the same way reduced-form trading strategies might be better. It may not be productive to pine for a general theory?

¹ The external members of the Man Academic Advisory Board are compensated for their membership of the board.

NB: It does matter. If momentum is caused by under-reaction, then exploiting it is stabilizing. If it is caused by over-reaction, then exploiting it is destabilizing. It appears that momentum involves both under-reaction and over-reaction, so there may be a destabilizing component to trading it. But it would be too much to blame bubbles on momentum traders; other things are needed to cause a full-scale bubble, for example, a 'story' that investors find compelling.

CH: For traders, knowing the source of momentum could be useful. It can help them build models that better capture momentum through conditioning on the source of it.

Anthony Ledford (AL): One theory of momentum is information diffusion. Different investors receive information at different times. We think there is increased efficiency in information diffusion in recent years, and the performance of momentum at short horizons, a few weeks, has tailed off.

DG: We are seeing that phenomenon more in highly liquid markets than less liquid markets, which may remain informationally inefficient.

AHL/MSS: Is momentum (really) everywhere? And is momentum the same in all places where it can be found?

SR: In the past there has been little focus on time-series momentum in the academic literature, where most research was done on cross-sectional momentum in cash equities. In practice the main focus however has been for CTAs to trade time-series momentum.

CH: Historically, the first paper on momentum was Jegadeesh and Titman in 1993 with cross-sectional momentum in cash equities. It is important to distinguish between time-series and cross-sectional momentum. Many academics look down on technical analysis, and time-series momentum sprang out of technical analysis; hence the neglect.

Thomas Flury (TF): As long as humans are involved, momentum is likely to be there. Probably even if machines are trading as they are designed by humans and often trade based on rules, i.e. heuristics... That is not to say that momentum could at least temporarily be over-shadowed by other market forces, so momentum might not always appear to be there.

NB: It does look like momentum is everywhere. And recent papers – for example, the Moskowitz et al. paper from 2012 – show that both cross-sectional and time-series momentum are driven to a significant degree by time-series autocorrelation, suggesting a common underlying cause. For futures, as opposed to single stocks, carry and roll-down components are important too.

CH: It might be of importance to understand who trades the assets. Retail investors appear to be less skilled and so momentum might be stronger where more retail investors are trading.

AL: The composition of investors varies from asset class to asset class. In cash equities there are more retail investors than in futures, where most traders are professionals. I would expect individuals to make more mistakes than professionals at institutions, although cognitive biases affect everyone. For equity index futures the retail behaviour might feed through to futures. In equities we see a bigger downside response to momentum.

AHL/MSS: What conditions do you need for momentum to arise?

DG: Let's not underestimate the role of 'carry' and risk premia in generating momentum in total returns. Carry refers to sloped forward and futures curves, which are important especially in FX and fixed-income. For example, if a currency cross has no carry, our research shows momentum has a considerably lower expected Sharpe. So one should separate the impact of carry from momentum in spot prices, which is where the behavioural stories apply.

CH: If the behavioural story is that of limited attention from investors, perhaps we can use this to identify particular situations when momentum arises. If there is sufficient media coverage to focus people's attention, investors will try to get the price right. If the information arrives slowly and is diffuse, we're more likely to see price drifts. Additionally, during earnings announcements all information arrives at the same time, which is too much to absorb and we observe the post-announcement drift.

NB: Yes, if you think that momentum has a lot to do with slow diffusion of information driven by inattention, then momentum should work better in markets that are more complex or that have less analyst coverage – and there is evidence to support this prediction. And a quite general prediction of behavioural explanations is that momentum should work better in markets with a larger share of less sophisticated investors. Another prediction is that momentum should work less well if there is more arbitrage capital trying to exploit it.

AL: There are some studies – for example the 2012 paper by Baltas and Kosowski – which show that the increase in assets under management within trend following does not seem to reduce momentum profitability.

SR: Are behavioural effects permanent? What are the conditions for these behavioural effects to disappear? Or does it mean the effects are permanent because they are behavioural?

NB: Many forms of irrational thinking are thought to be deeply ingrained, suggesting that they could be an important influence on asset prices for a long time to come. But certain kinds of mispricing have declined over time – post-earnings announcement drift and short-term reversal, for example – perhaps because their short-horizon nature makes them easier to exploit.

NS: Nick's point about horizon is important. Some questions are essentially longer term, e.g. knowing the true US GDP growth rate. Having more efficient diffusion of information is not the same as uncertainty being resolved more quickly, as higher frequency data does not necessarily tell you more about long term information. For some things, it simply takes time to infer. In econometrics, for example, one needs a long time interval of data to estimate a drift term. Finally, in a world that evolves through time, how can one ever know something for sure? Some things are fundamentally unknowable.

TF: Could momentum arise in a world with no change? Probably... if people respond to market noise with heuristics like extrapolation. But the most likely trigger for momentum, however, seems to be some change in the real world, to which traders are responding in their possibly biased ways.

Momentum arises in the process of trying to figure out the price impact of some real world change.

AL: It is not only the speed of information diffusion, but also the speed of reaction from market participants that matters. Different market participants respond differently to the same information based on their abilities. For institutional reasons some market participants can only update their allocation quarterly, others monthly, or weekly, or even within milliseconds.

MS: The information flow today is compressed and everyone can respond immediately, even via a mobile phone app for example, whereas in the past only banks could respond instantly to new information.

CH: The level of disagreement among market participants is an important factor.

MS: I agree Cam. In a takeover you know the target price and the market price jumps there almost immediately. If the Prime Minister of some country promises some economic policy changes, not everyone agrees or believes it straight away, so the market price doesn't jump to the new fundamental value immediately.

DG: Resistance to change to a new regime – maybe due to anchoring – is another cause for heterogeneous views. Some people are more flexible than others.

NS: It is disagreement on material that cannot be resolved quickly.

MS: Emergence of consensus often marks the end of the trend.

SR: Are there conditions where momentum does not arise? Can too many arbitrageurs stop momentum? Or what about policy makers?

MS: Someone controlling the market can kill momentum at any time. Policy makers sometimes want to crush trends, but sometimes they are happy to let them run.

AHL/MSS: When momentum is not working, how long should you take until you give up on it?

NS: If the time scale of momentum is long, it takes much longer to measure it statistically. Fast momentum is more likely to be traded away because it's easier to test as only a short period of time is required. For slow momentum, it's also harder to risk manage and harder to trade away.

MS: Behaviourally, investors often give up on things at the wrong point in time. One tends to drop markets just before they trend again. There is an important lesson here.

AL: We've tested if we should get rid of lemons, markets where momentum has underperformed recently. Overwhelming result: No.

Tim Wong (TW): If momentum arises from a market anomaly or a structural cause like deleveraging events for example, it may be traded away and can eventually disappear. But to what extent can and do people change their behaviour? The behavioural causes of momentum are there to stay.

NS: You also need to think about the risk premia and carry you might be harvesting.

MS: Historically we have made more money in equities and fixed income, less so in commodities, where the risk premium is less obvious.

NB: There's a difference between momentum and value. If value hasn't been working for a while – if undervalued assets are becoming even more undervalued – then you can tell a story for why it's more likely to start working: the undervalued assets must eventually rebound. But if trends haven't been building up, it's not clear why they should now be more likely to do so.

MS: The USD-YEN exchange rate didn't show a trend for a long time and was unattractive to trade. As Doug sometimes points out, people did not want to believe that change came along in 2013 with Abenomics. Momentum not working for some time creates a reference point – that is a bias – which will make momentum work very well, when there is a regime shift.

AHL/MSS: Do momentum investors do harm because they do not follow fundamental information?

DG: If there are too many momentum investors relative to fundamental investors, capital allocations might get out of whack.

CH: Policy makers might choose fundamental traders over momentum traders as value trading moves prices to where they should be, whereas momentum might move them away. Prices moving away from fundamental values could have a social cost. At the same time, momentum traders are good for providing liquidity.

SR: Value investing feels right. It's a good thing to be doing. Finding cheap stocks is seen as a valuable skill. A value investor is seen to stand on higher moral ground than momentum investors.

NB: But value and momentum may be more similar than they appear. According to under-reaction theories of momentum – for example, the slow diffusion of information theory – a stock that has been trending up is also a cheap stock: not all information about it has been absorbed into the price.

DG: In terms of distorting capital allocations, I wonder whether momentum trading has such a big effect. I'd claim that past bubbles did not come because of momentum traders but because of stories about fundamentals that many investors chose to believe.

TW: People tried to prove that CTAs caused the oil price bubble in 2007-2008. Subsequent academic research however found no evidence of financial speculation driving the oil spot price. Today, the consensus seems that economic fundamentals were driving oil prices instead. It's not only about financial speculators, but also about fundamental traders.

DG: I agree, in that bubble it was non-CTA people driving oil prices as they fundamentally believed in the combination of the peak oil story and the China growth story. But what is the difference between buying really hard into a story and momentum trading?

TW: Yes, in the same way that during the internet bubble investors were all buying into the same story that we are fundamentally heading for a brave new world. Unfortunately, everyone grossly overestimated the benefits of the internet.

NB: Again, under a slow information diffusion view of momentum, momentum traders are actually expediting the incorporation of fundamental information into prices. In that sense, momentum trading can help the price discovery process. But the academic literature stresses that there is also a danger of overshooting – of continuing to trade even after the fundamentals are fully reflected in the price.

AHL/MSS: Is there a difference between fundamental and financial momentum?

TF: There is momentum in the real world as most things are moving slowly. Factories take time to build, technological progress takes time to spread... and crucially, as Neil said earlier: finding out about the current state of the real world takes time. When a gradual shift from one equilibrium to another occurs, we often don't know where exactly we are in terms of progress from old to new. Even the fundamental price will only change gradually, while we are learning about the true state of the world.

CH: Just because there are momentum patterns in the fundamental economy does not mean that prices will trend. Price trends will be shaped by the degree to which people correctly process those fundamentals and build the information into today's prices.

NB: Momentum is often linked to over-extrapolation of trends by investors, but a key question is: what is it that people are extrapolating, past fundamentals or past returns? The academic literature points to extrapolation of past returns as being more likely. If people were extrapolating past fundamentals, those fundamentals should predict future returns, but there isn't much evidence of that – see Daniel and Titman's 2006 paper, for example.

MS: For many assets outside equities it's really hard to come up with the three most important fundamental factors.

CH: Nick said price changes are used to forecast price changes, but the academic research shows that fundamentals such as price-earnings ratios are more effective in forecasting equity price changes.

NB: Yes, so that suggests that a story based purely on extrapolation of past returns is incomplete. But I think it's an important part of what's going on.

AHL/MSS: Are there certain market conditions under which investors are more likely to succumb to behavioural biases?

DG: Anchoring could be reinforced by seeing the same thing again and again. Extrapolation might work better in conjunction with a nice story.

NB: People might be more likely to stick to an anchor if the new information is confusing and unclear. Also, we are more likely to have slow diffusion of information in an uncertain or complex environment.

SR: When do people extrapolate more?

NB: One idea is that, in more uncertain or complicated situations, people rely more on heuristics. If the situation is complex, 'System 2', people's more deliberative mode of thinking, has a hard time coming up with an answer. As a result, 'System 1', which represents more instinctive thinking, may have a bigger impact. ('System 1' and 'System 2' are terms from Daniel Kahneman's book *Thinking, Fast and Slow*).

DISCUSSION SUMMARY

- Momentum is a complex phenomenon, driven by different forces in different contexts
 - Behavioural biases, such as anchoring, may lead to under-reactions to information
 - Other behavioural effects, such as extrapolation, may lead to over-reactions
 - Carry and risk-premia create trends in total return
 - Information diffusion may be slower in less liquid markets
 - Deleveraging events (like 2008) may cause trends from forced liquidation
- Momentum is widespread and found in most markets
 - Both time-series and cross-sectional momentum occur
 - Certain conditions, e.g. informational uncertainty or structural change, make momentum more likely to arise
 - Policy interventions can help or hinder momentum
- Momentum may face a changing opportunity set
 - More efficient information diffusion and easier access to liquid markets may reduce opportunities for fast momentum
 - Slow momentum based on behavioural biases and risk premia is likely to be more persistent
 - The evolving and unprecedented post-crisis environment may produce significant trends from anchoring and other behavioural phenomena

APPENDIX: MOMENTUM – SOME BACKGROUND

Cross-sectional momentum in cash equities was reported in the academic literature for the first time in 1993 by Jegadeesh and Titman. They constructed a momentum portfolio by going long the winners (best recent performance) and short losers (worst recent performance) in stocks. They found cross-sectional momentum for up to a year and then reversal for years 3-5. Time-series momentum, the typical investment strategy of CTAs in liquid futures contracts, has a much longer history. The famous turtle traders in the 1980's were essentially placing systematic bets on trend break-outs. AHL has been trend-following liquid futures since 1987. In the academic literature time-series momentum has only recently received more attention. A good overview is given in the Norges Bank Investment Management discussion note from January 2014 on momentum in futures markets.

There is no consensus in the academic literature on the source of momentum, but explanations for momentum can be placed into three (not necessarily exclusive) categories: rational explanations, frictional stories, and behavioural biases.

In the traditional framework, dating from the 1960's, markets are assumed to be efficient and frictionless, and investors rational. Returns to momentum are interpreted as compensation for bearing risk, although it is hard to tell a coherent story about the nature of this risk.

More recently, the efficiency hypothesis has been relaxed and models incorporate frictions in the financial markets. Investors are still assumed to be rational, but this framework allows for mispricings to occur, and momentum is one of the mispricings. In some of these academic models, a number of heterogeneous agents, who are not fully informed, have to form beliefs about other agents' information and not just their own in order to determine asset prices. This literature also focuses on the 'limits to arbitrage', the factors which prevent rational agents from converging to a fair price.

With the advent of behavioural finance, the assumption of fully rational investors has been dropped. In this framework both market frictions and investor irrationality can lead to momentum. Behavioural biases can affect both the processing of and reaction to information.

Various behavioural biases are then used to derive models where market prices exhibit over- or under-reaction to news about fundamentals, i.e. persistence in market returns. Major behavioural biases and heuristics include: *representativeness*, *conservatism*, *overconfidence*, *self-attribution* of success (and attribution of failure to bad luck), *limited information processing* capabilities or attention, *the disposition effect*, *the classification heuristic* and *cognitive dissonance*.

Within the category of belief-based stories the main strands are the over-reaction and the under-reaction explanations. Over-reaction is explained by *extrapolation* heuristics of market participants: 'What went up will keep going up'. This behaviour can lead to intermediate-term momentum and long-term reversal, when the over-reaction is corrected. The under-reaction-based explanations of momentum build on the behavioural biases of *conservatism* or *anchoring*. The latter biases result in market prices not immediately reflecting the fundamental value in response to news.

Some behavioural stories relate to investor preferences. Such a preference-based explanation of momentum is under-reaction motivated by the *disposition effect*: Market participants want to sell (too early) after price increase to realise gains. This premature selling puts pressure on the increasing price and blocks the rapid move toward fair value, hence creating momentum. Similarly, traders tend to hang on to losers and this lack of selling leads to a slower downward drift until the market price has eventually reached the fundamental value.

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