

Dynamic Correlations and Active Risk Management.

Introduction

Diversification is a critical aspect of any investment portfolio. Headland Investment Management utilises sophisticated active risk management techniques to maximize the benefit of diversification from investing in a variety of themes. This paper discusses the use of dynamic correlations in the risk management process. There are two key concepts:

- (1) For the purposes of risk management an **investment strategy** can be thought of as an **asset**. Consequently, to obtain the maximum benefit from diversification, the theory of **Mean-Variance Optimisation** is applied to the portfolio of investment strategies.
- (2) **Correlations** between investment strategies **change through time**. Mean-Variance optimisation utilises the correlations between assets to construct a portfolio with the best risk-return profile. Understanding the behaviour of the correlations through time assists in dynamically managing the portfolio risk.

Mean-Variance Optimisation

In a traditional portfolio consisting of a basket of stocks, the industry standard approach to portfolio construction is the use of Mean-Variance Optimisation (Markovitz, 1952). This technique takes into account correlations between assets when constructing an investment portfolio.

If two assets are highly correlated then there is a concentration risk formed by investing in both assets. To mitigate this risk it is necessary to reduce the amount of funds invested in these two assets in favour of other assets that are less correlated.

On the other hand, if two assets are negatively correlated, they form a natural hedge for each other, and the portfolio can afford to increase the funds invested in these two assets without compromising the overall risk profile for the portfolio.

Headland seeks to obtain a high level of diversification by investing in a variety of **investment themes**. The investment strategy for each theme is similar to an asset: each strategy has a return series associated with it, and the strategies have various degrees of correlation with each other. To obtain the best level of diversification from investing in multiple themes Headland applies Mean-Variance Optimisation theory to its portfolio of investment strategies.

This approach is very similar to that taken by many hedge fund of funds, who seek managers with different styles so as to minimise the correlations between the constituent hedge funds.

Dynamic Correlation

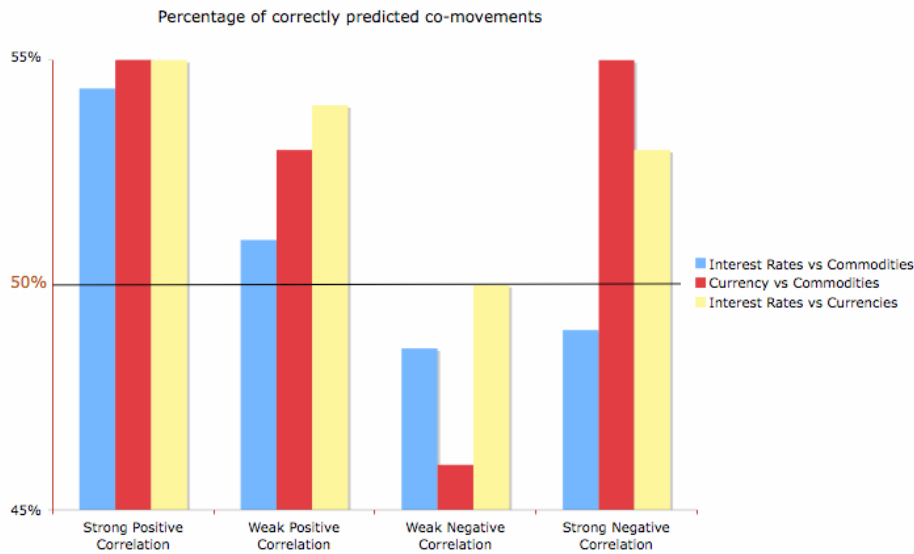
Headland's risk management approach recognises that the correlations between investment strategies may change over time. A key aspect of Headland's risk management process is the mitigation of concentration risk, where investment strategies that were behaving independently change their behaviour and become highly correlated with each other.

In order to detect changing correlations between investment strategies Headland has adopted the RiskMetrics™ approach for measuring dynamic correlations between assets (Engle, 2002) and applied it to the portfolio of investment strategies. The RiskMetrics™ approach uses an Exponentially Weighted Moving Average of the sample correlation matrix to estimate the dynamic correlation. What this means is that in calculating the correlations between strategies most weight is given to recent observations. This technique yields a good trade-off between responsiveness (correlations are quick to respond to changes in the behaviour of the strategies) and robustness to noise (the effects of a single abnormal day are moderated by recent history).

Case Study: Currencies, Interest Rates and Commodities

How can we evaluate the quality of the dynamic correlation measures? One way of looking at the question is to ask how well the dynamic correlations predict the behaviour of the investment strategies. If two strategies are positively correlated then they should exhibit a statistical tendency to move in the same direction; in other words on any given day if one of the strategies has a negative return then the second strategy should have more than a 50% chance of losing money as well. From a risk management perspective this is important information – it means that there is a concentration risk involved in investing in both of these strategies.

The chart below examines the quality of the predictions of the dynamic correlations between Headland's major investment themes of currency, interest rates and commodities. If the dynamic correlation is positive, then the prediction is that the two strategies will either both make money or both lose money. If the dynamic correlation is negative, then the prediction is that one strategy will lose money and the other will make money. The chart is further broken down into regions where the dynamic correlations are strong or weak. This can be thought of as the signal strength of the correlation (thinking of the correlation as an indicator of the likely co-movement of the strategies). If the dynamic correlations are being measured correctly then a greater signal strength should correspond to a greater chance of the prediction being correct.



- When the system reports a **strong positive correlation**, the strategies have a **54% - 55%** chance of moving in the same direction. This may not seem like much more than the chance level of 50%, but at a daily frequency this is quite a significant predictive ability.
- When the system reports only a **weak positive correlation** the likelihood of the strategies moving in the same direction is reduced to **51% - 53%**.
- In the case of a **weak negative correlation**, the correlation gives a misleading signal about the likely co-movement of the strategies.
- However when the system reports a **strong negative correlation** there is significant predictive power that the strategies will display contrary motion, **54% - 56%** of the time.

If dynamic correlations were not considered, then in constructing an optimal portfolio the hedge ratio between two strategies would be fixed. However the chart above shows that measuring the dynamic correlations will suggest quite different optimal portfolios through time. In particular, the use of dynamic correlations yields a strong indicator of times when two strategies are likely to move in step – constituting a concentration risk to the portfolio.

Headland utilises both the direction (positive or negative) and the signal strength of the dynamic correlations to adjust its level of investment in each theme so as to obtain the maximum benefit from diversification.

References

Markowitz, Harry M. (1952). Portfolio Selection. *Journal of Finance* 7 (1), 77-91

Engle, R.F. (2002). Dynamic conditional correlation. *Journal of Business and Economics Statistics* 20 (3), 339-350.

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