Diversification – are we managing away too much return?

Abstract

Portfolio construction can be defined as the process by which risky assets are combined into an efficient portfolio, one that has the highest return for a given level of risk or the lowest risk for a given level of return. There are several influences on conventional approaches to portfolio management including Modern Portfolio Theory (MPT) and the Capital Asset Pricing Model (CAPM).

This paper provides a brief introduction to these models including their real world limitations. In the ideal world every asset in a portfolio is sized fully cognizant of all the other assets in the portfolio. In the real world, there are practical impediments to this caused by behaviours in the wealth industry.

How much diversification is enough and when are we diversifying way too much return? We argue that where there is a quality gradient and some degree of selection skill there is an optimal number of managers, which can be derived from the correlation matrix. When correlations are low portfolios can (and should) be bigger, but when correlations are high the optimal number is much smaller. We show that adding more managers can actually reduce return.

We address the construction of a multi-manager alternative product that is at odds with conventional wisdom in that it has a very small number of managers. Systematic Trading managers (like Winton, Aspect and AHL to name a few familiar firms) have relatively stable (and high) correlations to one another and a quality gradient in terms of skill (i.e. some managers have higher expected Sharpe ratios than others). We show how the optimal portfolio is a relatively small number of managers, but not one.

Finally, this paper addresses the use of such a fund in a typical Australian diversified portfolio.

Part 1 A brief summary of traditional portfolio frameworks

Investors are faced with determining which asset classes, such as domestic fixed income, domestic equity, foreign fixed income, and foreign equity, to invest in and what proportion of the total portfolio should be of each asset class.

Harry Markowitz first described a method for constructing a portfolio with optimal risk/return characteristics in the 1952 *Journal of Finance*. His portfolio optimization method finds the minimum risk portfolio with a given expected return. A portfolio of assets is less risky than a single asset provided the risks of the various stocks are not directly related.

Markowitz showed that investment is not just about picking stocks, but about choosing the right combination of stocks. Markowitz's ideas inspired the Capital Asset Pricing Model, which argued the optimal portfolio was to hold all assets in the proportion they exist in the market. This is particularly convenient for portfolio management, because it automatically rebalances as asset prices change; managers only have to trade in response to market events such as mergers or IPOs. However it is difficult to define market weight outside of equity markets.

The major legacy of MPT is that portfolio diversification can reduce investment risk. In MPT there are two kinds of risk: Systematic risks are market risks that cannot be diversified away. Idiosyncratic risks are specific to individual stocks and can be diversified. For a well-diversified portfolio, the risk of each stock contributes little to portfolio risk. Instead, it is the covariance between individual stock's levels of risk that determines overall portfolio risk. As a result, investors benefit from holding diversified portfolios instead of individual stocks. Markowitz showed that every possible portfolio could be calculated and it would form a bullet shape. The top edge of the bullet is the efficient frontier where every portfolio dominates any other potential portfolio for a given level of risk.

CAPM is a model was independently developed a by several academics including Jack Treynor (1961, 1962), William Sharpe (1964), John Lintner (1965a,b) and Jan Mossin (1966). Each was building on the earlier work of Harry Markowitz on diversification and modern portfolio theory. Like MPT, a security has systematic risks and idiosyncratic risks. A rational investor should not take on any idiosyncratic as only systematic (market) risks are rewarded *in this model*. The CAPM assumes that as each additional asset introduced into a portfolio further diversifies the portfolio, the optimal portfolio must comprise every asset with each asset value-weighted. This is the market portfolio. It is subject to many of the same criticisms, for example that returns are normally distributed and that variance is meaningful measure of risk

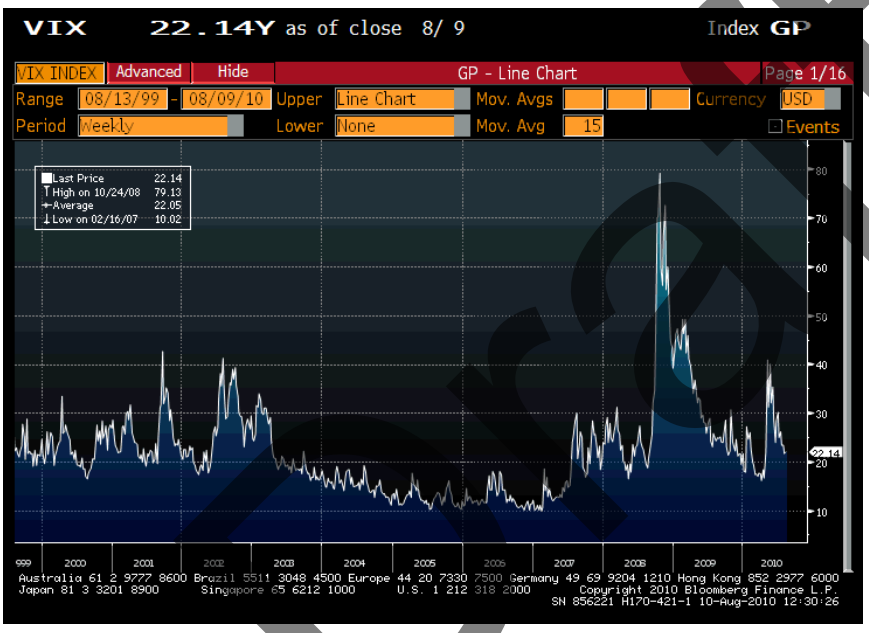
The risk, return, and correlation measures used by MPT are based on expected values. Investors must estimate key parameters from past market data because MPT attempts to model risk in terms of the likelihood of losses, but says nothing about why those losses might occur. Douglas Hubbard's, *The Failure of Risk Management (2009),* drew on the engineering approach of probabilistic risk assessment. In MPT various outcomes are simply given probabilities. *If nuclear engineers ran risk management this way, they would need to see several reactor meltdowns before they could compute the odds of a meltdown.* .

Shortcomings and impediments to implementation

We divide the shortcomings of these theoretical constructs into two buckets. The first is the well articulated reservations about the models themselves; the second is about how the way we manage money in Australia renders the theory impractical.

Well articulated reservations

There are well articulated reservations about the models described above. One is the difficulty in estimating variables. The use of optimization as a technique assumes a degree of stability in the variables that is not supported by observations. Take volatility for example. The VIX Index is an implied volatility index that measures the market's expectation of 30-day S&P 500® volatility implicit in the prices of near-term S&P 500 options. Often referred to as the fear index, it represents one measure of the market's expectation of volatility over the next 30 day period. The following chart shows the VIX index over five years to August 2010. Clearly expected volatility is not stable.



Source: Bloomberg

Returns are not easily predicted either. The following table from Bloomberg shows three, five and ten year returns to the end of the June 2010 for the S&P500 Index. It is unlikely that these were the expected returns used three, five or ten years ago.

S&P500	Total Return %	Return % pa
3 years	-26.62	-9.79
5 years	-3.90	-0.79
10 years	-14.77	-1.59

Source: Bloomberg, includes dividends, USD returns, past performance is not a good guide to the future.

Variance as a measure of risk does not distinguish between variation to the upside and variation to the downside. The use of variance tends to penalise assets that are viewed as risky. A volatile asset class with a high expected rate of return and less than perfect correlation to a core asset class might be a perfect addition to a portfolio, but may be discarded if variance is the only measure of risk.

The underpinning of CAPM is that idiosyncratic returns are not rewarded and therefore should be diversified away to leave the investor with systematic risk that cannot be further diversified. This is problematic for an investment strategy that at least says it is focused on the idiosyncratic returns. Hedge funds are dynamic investment entities, trading their portfolios with relatively high frequency and fundamentally changing the make-up of their portfolio with regularity. It can be said that hedge fund managers generate 'skill-based' returns rather than 'asset-based' returns, and as such it is inevitable that some managers will be inherently better than others (i.e. are able to deliver a higher expected return per unit of risk). When considering skill-based, non-static exposures, one can find situations where the thinking surrounding CAPM becomes questionable. In particular, the concepts of specific risk and systematic risk are largely meaningless when analysing skill-based returns, which in turn implies that a high level of diversification (to eliminate specific risk) should also be questioned.

Structural impediments

There are structural impediments to good multi-manager portfolio construction in the Australian wealth management environment. These arise generally from the use of benchmarks for the specialist components of balanced funds and the use of interfunding. Interfunding is the practice of using pools to create a new product.

Interfunding is convenient for fund managers but is not consistent with good portfolio construction. Diversified fixed income (Australian and foreign sovereign debt) is an easy example to demonstrate this point. Diversified fixed income portfolio has some merit. Expanding the opportunity set enhances the potential to add return. However there is huge difference between a fund that owns all its securities directly and one that is made up of an Australian bond fund and a Global bond fund. At this point there is an intersection with the other impediment mentioned earlier – the use of benchmarks. The Australian bond fund will have its own benchmark as will the Global Fund. It follows that each manager will manage to their own benchmark with no regard for the assets held in the other fund. US Treasury Bonds are the largest component of a Global sovereign debt fund. If the correlation between Australian Government Bonds and US Treasury Bonds was (say) 100% then there would be almost no diversification benefit gained from this combination. So the use of specialist benchmarks and the separation of assets combine to destroy almost all of any potential benefit. If however the assets were all commingled in one fund, the portfolio manager would at least have the opportunity to recognise the correlation between the assets and build a portfolio accordingly.

Another impediment is the propensity of the investor (or their advisor) to look at the performance of each and every component of the portfolio in isolation. This has been addressed earlier. Investors who look at each investment in isolation and think about risk in terms of variance will naturally select against volatile assets without thinking about the role those assets play in the portfolio at different times.

The baby and the bathwater

There has been a lot of criticism of MPT after the global financial crisis. We are not in the camp that says MPT should be thrown out. *Models like MPT and CAPM are models that should be believed but never used.* That is – they provide a framework that is useful to ground one's beliefs but are so obviously constrained that their blind use is nonsense. However, diversification has not worked as expected in stressed markets. The diversification that has been achieved is the removal of idiosyncratic risk leaving only systematic risk in the portfolio. Along the way, return opportunities have been sacrificed because as stand alone investments they may have appeared too risky.

The balance of this paper talks about how we construct a particular portfolio to overcome the obvious limitations of MPT and CAPM. We then put this investment in the context of a typical Australian diversified fund to show the role it can play in a classical portfolio construction context. That is – a risky asset can reduce the volatility of a broader portfolio.

Part 2 - FRM Sigma as a case study on the risk of diversifying away return

FRM Sigma Fund Limited (FRM Sigma) is a strategy-specific hedge fund portfolio that only invests in managers in the Managed Futures strategy (note: other names for Managed Futures include CTAs and Systematic Trading). As FRM Sigma is focused on systematic traders we will use the term "CTA". In this paper we use FRM Sigma to look at two aspects of diversification when building a portfolio of skill based returns, namely:

- How to build an optimal stand-alone portfolio and how the existence of a quality gradient can make diversification unattractive.
- How the portfolio complements an investor's existing assets

Building the optimal stand-alone portfolio

Using Modern Portfolio Theory framework, in order to build a portfolio of CTAs we need expected inputs for the key characteristics of the possible underlying managers, namely:

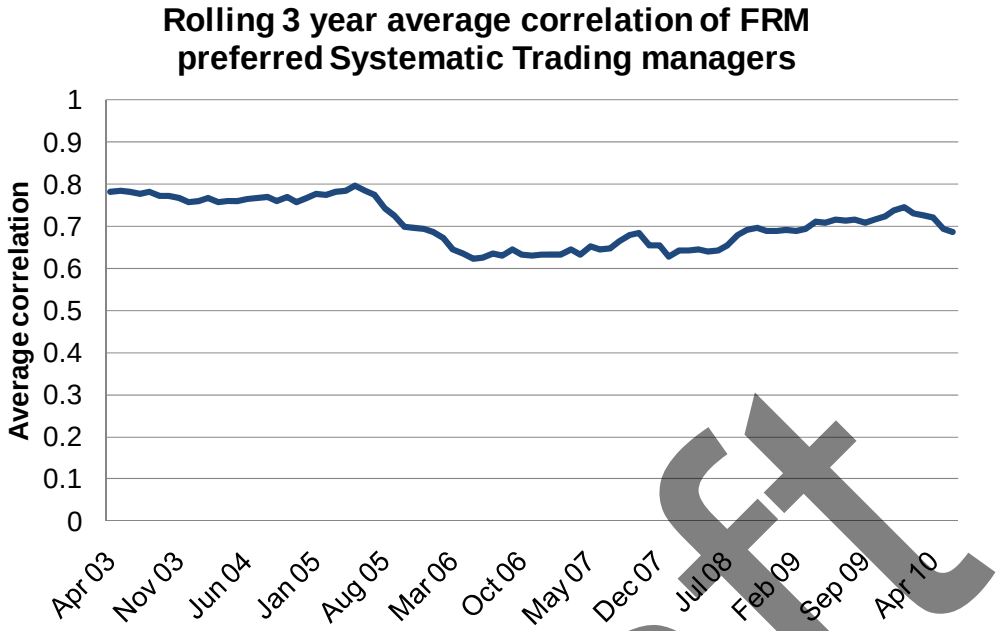
- The expected return from each CTA
- The expected volatility of each CTA
- The expected correlation of each CTA to each other CTA.

Given the dynamic nature of skill-based returns, forecasting these variables can be difficult. We address each of these separately, starting with expected correlation:

Expected correlation

Despite the fact that the assets in each managers portfolio are constantly changing, the types of models used by managers in the Managed Futures strategy are relatively similar. All of the managers will use 'trend-following' models to trade futures markets in a systematic manner. They are heavily quantitative strategies that use mathematical models. For this reason, during a strong bull or bear market in any asset class, it is likely that most CTAs will hold similar exposures to that asset class. There is therefore a fundamental reason why we would expect Managed Futures managers to have relatively stable correlation characteristics with one another.

The chart below shows the rolling three-year average pair-wise correlation of all of FRM preferred long-term CTAs.



Source: FRM, please see important notes and disclosure at end

One can see that the correlation characteristics of these managers have stayed remarkably consistent over the past ten years, keeping between 0.6 and 0.8 at all times. We can therefore have a relatively high degree of comfort for using similar values in our portfolio construction models.

Expected volatility

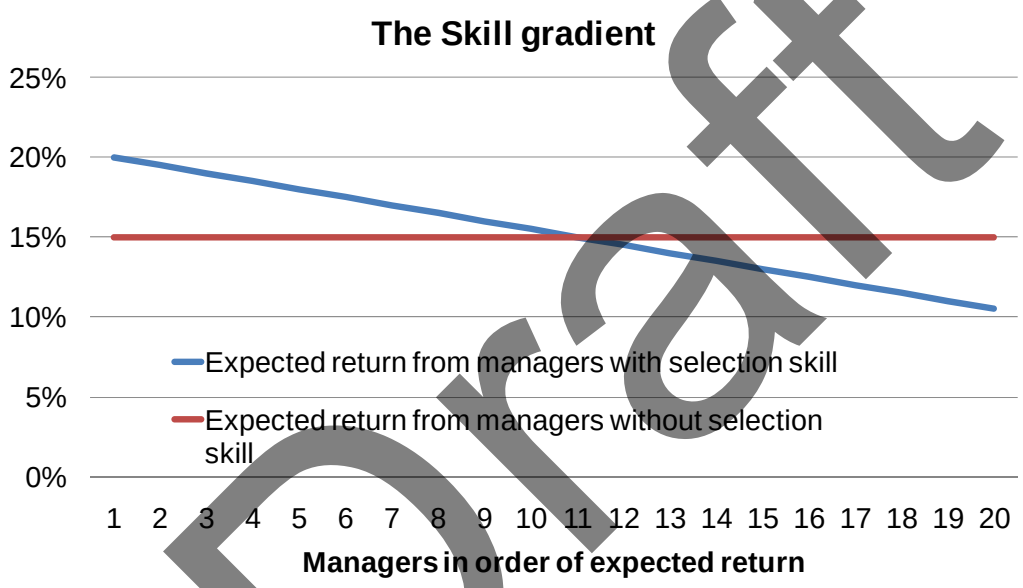
The quantitative nature of the Managed Futures strategy means that managers generally have a high degree of control over their portfolio's long term expected volatility. The degree of aggression with which the manager allocate to the signals given by their models is shown by the level of leverage that the managers use. Since the managers are trading futures, this manifests itself as a relationship between the size of the margin required to buy or sell a future and the overall size of the fund. However, whilst it is some help to have individually stable levels of expected volatility at each hedge fund, if each hedge fund has different stable levels of expected volatility then the portfolio construction process becomes more difficult.

How do we manage this in FRM Sigma and how does this then flow through as a benefit to the user of FRM Sigma in broader portfolios? In FRM Sigma, we use a proprietary in-house managed account platform to control our holdings in each of the underlying CTAs. One of the benefits from using a managed account platform to hold Managed Futures funds is that we are able to dictate the expected volatility from the underlying funds. In FRM Sigma, we control the exposure of each managed account to deliver an expected long-term volatility of 15%. This in turn allows the volatility of FRM Sigma to be targeted to a specific level and maintained at that level. The investor using FRM Sigma has at least one of the variables kept more stable than might otherwise be the case.

Expected return

Forecasting the expected return of skill-based managers is inevitably the most subjective part of the process, and is ultimately a function of the skill of the party that is selecting the CTAs for inclusion in the portfolio. If that party has no skill in assessing the abilities of different CTAs, that one should assume an equal expected return per unit of risk from all funds.

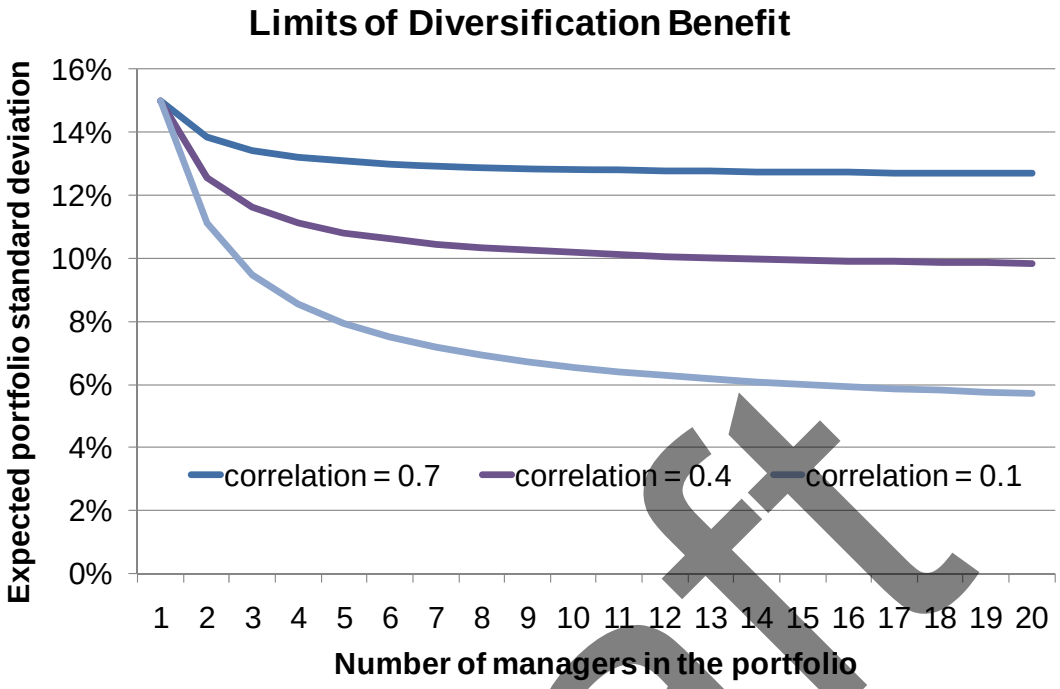
When the party that is selecting the funds for inclusions has some selection skill, then a quality-gradient emerges across the universe of available funds. In particular, it becomes apparent that some managers should be expected to deliver a higher return per unit of risk than other managers over the long run, as illustrated in the chart below:



Source: FRM, please see important notes and disclosure at end

Implications for diversification

Let us first just consider the objective elements of the portfolio construction process, namely expected correlation and expected volatility. The chart below shows the expected portfolio volatility of a combination of assets with fixed expected volatility of 15%, at three different levels of correlation.



Source: FRM, please see important notes and disclosure at end

One can see that when correlation between managers is 0.7, then after 6 managers or so there is very little benefit in terms of risk reduction from adding additional managers. One can also see that less correlated strategies might continue adding 15+ managers before the incremental reduction to portfolio volatility becomes negligible.

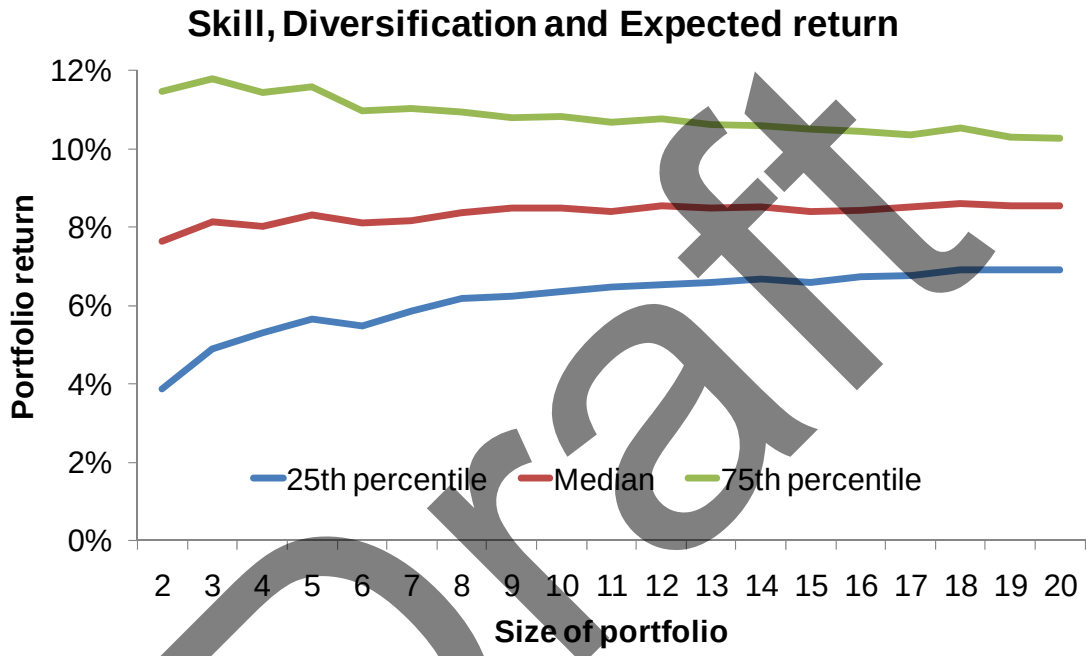
Introducing expected return into the model inevitably makes things more complicated. However, the fundamental law of active management that was espoused by Grinhold and Kahn in *Active Portfolio Management (2000)* suggests that the expected return per unit of risk is proportional to the investment coefficient multiplied by the square root of the number of independent decisions taken.

IR = IC*SQRT(Breadth)

(where IR = information ratio, IC = skill and SQRT(Breadth) is the square root of the breath of the portfolio. Breadth is the number of independent decisions in the portfolio).

In other words, as your skill increases, the required number of managers decreases to achieve the same level of return per unit of risk.

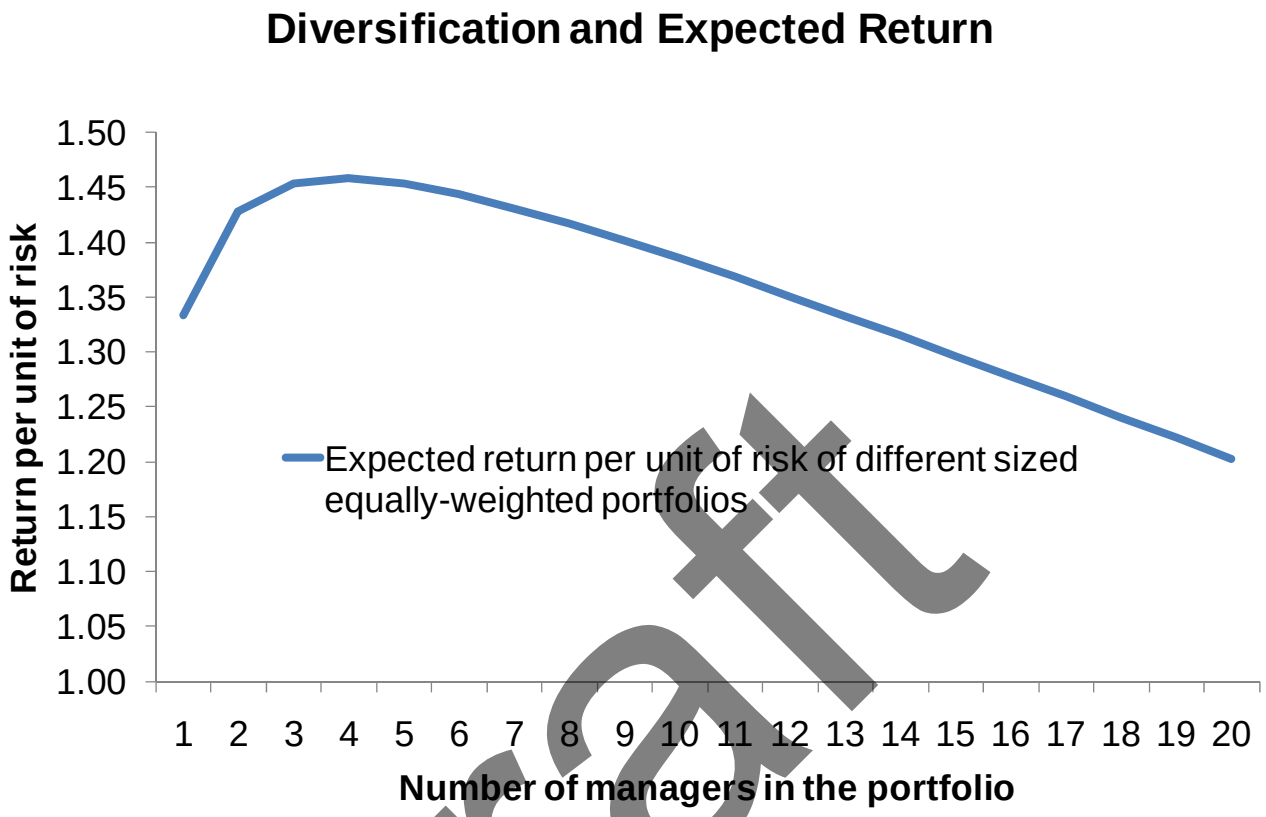
The chart below shows the mean return of random portfolios of CTA hedge funds of different sizes over the past five years (taken from FRM's database). Suppose the person picking the managers had the skill to always select a portfolio that was better than 75 percentile of the possible portfolios available. The green line on the chart shows that this person would achieve a better return from a smaller portfolio than a larger one, since they are able to concentrate in higher returning managers.



Source: FRM, please see important notes and disclosure at end

Combining the two concepts above suggest that in this CTA example allocating to more than a handful of managers doesn't reduce the portfolio risk, but does impact the expected level of returns.

We can show this more clearly by explicitly constructing an example of a quality gradient that a skilled hedge fund analyst might be able to identify. Assuming a portfolio is constructed from managers whose expected return per unit of risk follows the chart in the expected return section above, with an expected volatility of 15% each, and expected correlation with one another of 0.7, then the expected return per unit of risk of the whole portfolio as the number of managers increases is shown in the chart below.



Source: FRM, please see important notes and disclosure at end

Here we can see that under these assumptions, the optimal number of managers in this portfolio is around 5, and that extra diversification is detrimental to the expected return of the portfolio.

Limitations of this approach

This approach only considers the statistical element of the returns, and as a result assumes normally distributed returns. Experience has taught us that the tails of the distribution of hedge fund returns tend to behave non-normally, i.e. that managers can experience large losses for idiosyncratic, non-investment reasons. As a result, a portfolio manager may wish to hold more managers in their portfolio that statistically optimal due to unknown risks.

The concept of identifying a quality gradient within hedge fund returns is very subjective, and therefore reduces the robustness of any output containing this kind of thinking. Not only must the person selecting the hedge fund have skill, they must be able to somehow quantify their own skill in order to ascertain when extra diversification is simply diluting returns. In practice, this level of self-awareness is rare.

Part 3 - How can FRM Sigma help to 'shock proof' a traditional portfolio?

Due to the systematic nature of their trading strategy as outlined above, CTAs tend to exhibit very low correlation to other asset classes and to other hedge funds over a market cycle. In periods of stress, they tend to become inversely correlated to risk assets, which are typically in a strong downward trend.

The table below shows the performance of the Barclay CTA Index to a variety of asset classes over the past 20 years, and over the recent crisis period of 2008-2009. The benefit of low correlation over the long term, and negative correlation to risk assets during periods of market stress, means that when added to a portfolio, CTAs can considerably improve the characteristics of the whole portfolio.

Performance during stressed markets

	S&P 500 %	US High Yield %	Barclay CTA Index %
Sep - Nov 87	**-29.58**	**-2.58**	9.74
Aug - Oct 90	**-13.83**	**-11.18**	10.92
Aug 98	**-14.48**	**-5.05**	5.92
Sep - Nov 00	**-13.13**	**-7.7**	2.1
Feb – Mar 01	**-14.88**	**-0.51**	3.76
Aug – Sep 01	**-13.83**	**-6.18**	3.31
Jun – Jul 02	**-14.32**	**-11.32**	9.56
Sep 02	**-10.87**	**-1.56**	2.42
Aug 07 – Dec 08	**-35.87**	**-24.64**	21.36

Source: FRM. Past performance is not indicative of future performance, September 1987 – December 2008
S&P 500 TR Index (USD), ML US High Yield Master Index (USD), Barclay CTA Index (USD)
Please see important notes and disclosure at end

Portfolio management should be as much about generating return as it is about reducing risk. We have demonstrated that diversification beyond a certain number of managers has the potential to reduce both portfolio return and risk when selecting from a group of correlated managers. FRM Sigma not surprisingly has outperformed the Barclays CTA index. In the following charts we address the three legs of the portfolio construction process; return, volatility and correlation.

Figures 1 and 2 are self explanatory. They show the cumulative return of FRM Sigma since inception and over three years to the end of June 2010. We will return to these data later but suffice to day the returns are substantial compared to the traditional asset classes normally invested in.

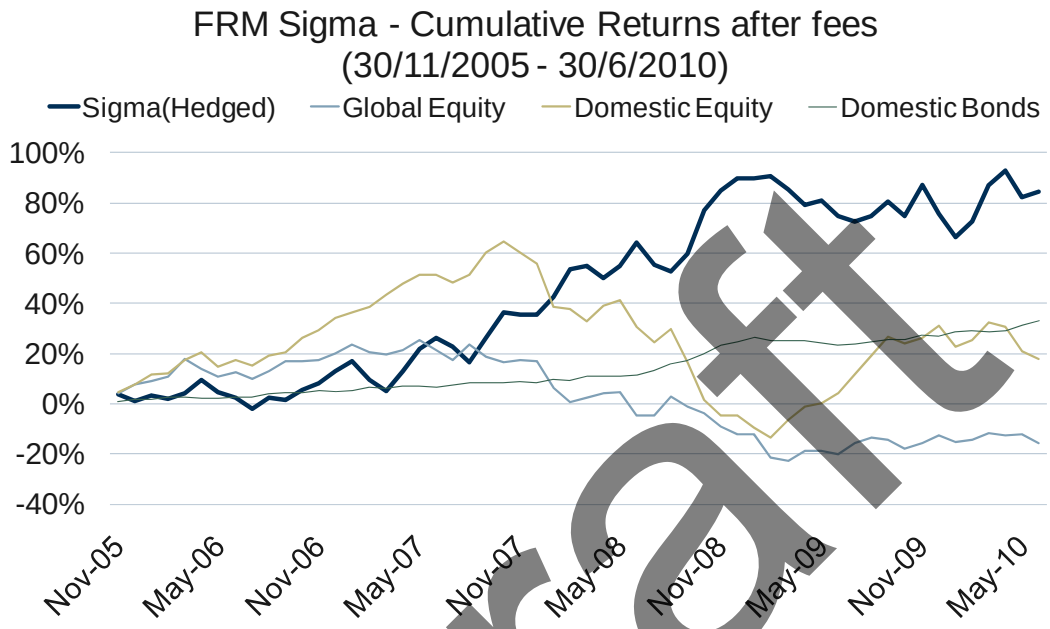


Figure 1 - See important notes and disclosure at the end of this paper, past performance is not a good guide to the future.

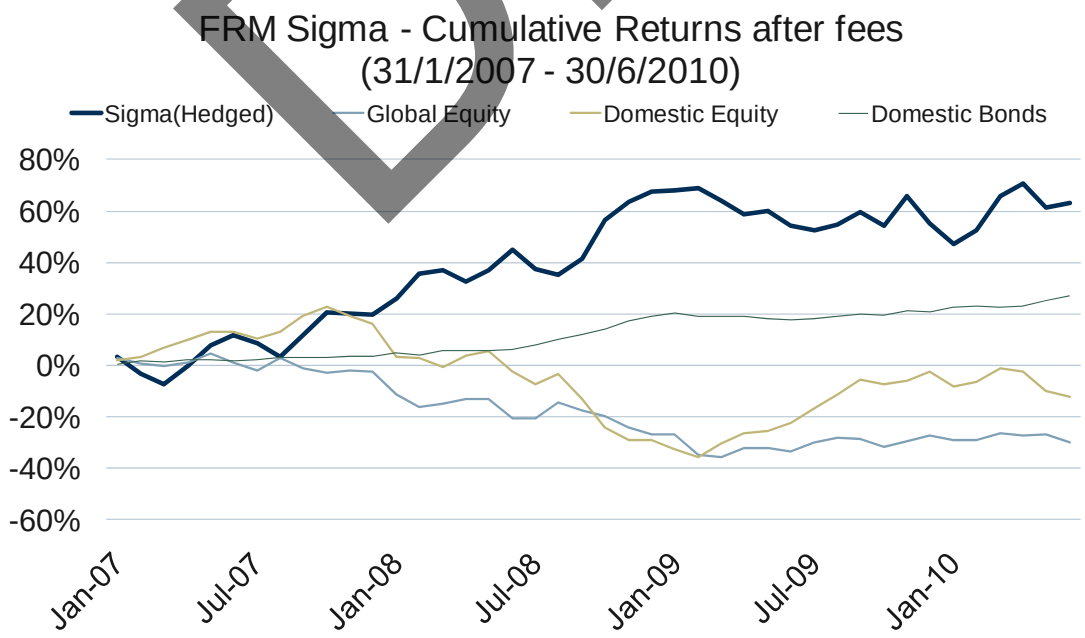


Figure 2 - See important notes and disclosure at the end of this paper, past performance is not a good guide to the future.

In Figures 3 and 4 we show risk (volatility) and return for three and five year periods to the end of June 2010 for FRM Sigma, global and domestic equities and domestic bonds. The main observation to make here is that FRM Sigma has similar volatility to both domestic and global shares. Investors who use volatility as a measure of risk might dismiss Sigma for its apparent risk.

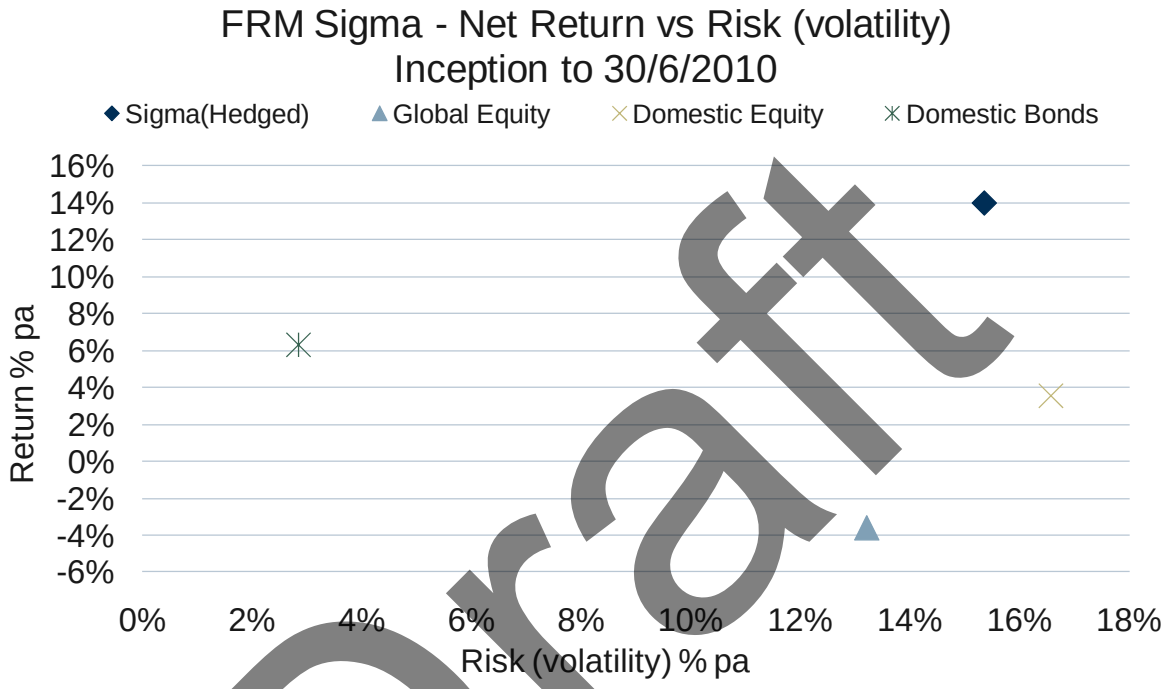


Figure 3 - See important notes and disclosure at the end of this paper, past performance is not a good guide to the future.

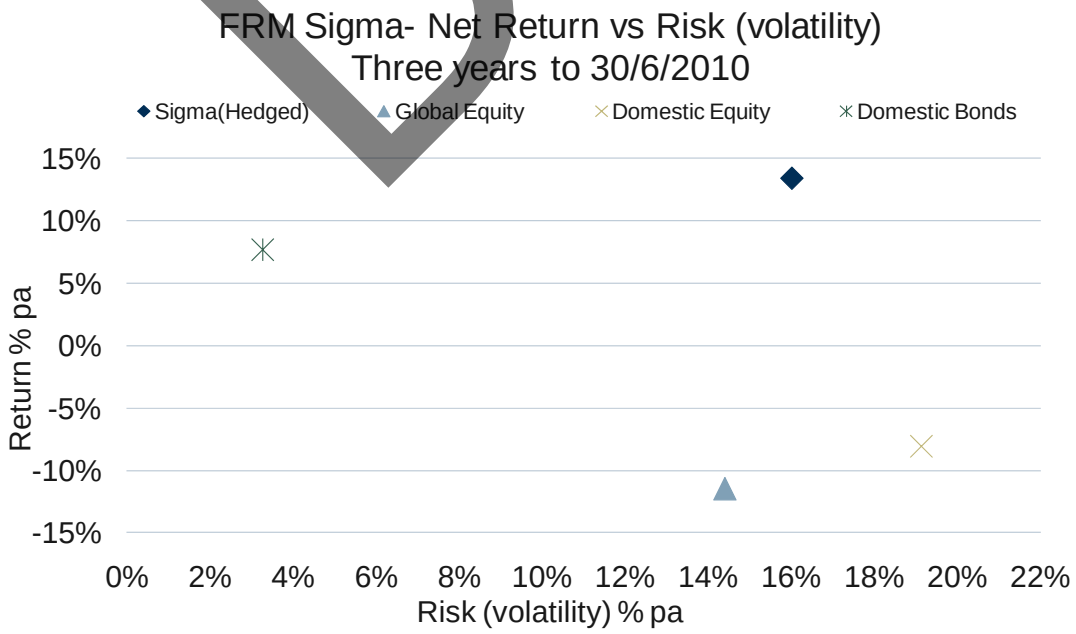


Figure 4 - See important notes and disclosure at the end of this paper, past performance is not a good guide to the future.

In Figures 5 and 6 we show the impact on a traditional balanced fund of adding FRM Sigma in 5% increments to a maximum of 15%. FRM Sigma is funded equally from domestic and international shares. Note the reduced volatility of the overall portfolio – notwithstanding a level of FRM Sigma volatility which is similar to the volatility of both domestic and international shares.

Even ignoring the impact on return, we observe overall portfolio volatility has fallen by between 1.5% and 2% pa. A similar reduction in volatility may have been achieved by investing in a more diversified portfolio of CTAs but as we demonstrated in Section 2 of this paper, greater diversification may well have led to lower return in this asset class where correlation between the players is quite high. But let's not ignore return. Clearly good quality CTAs trading in deep and liquid markets have been able to post strong returns and that, as much as low performance correlation, has reduced the shock to portfolios dominated by the equity risk factor.

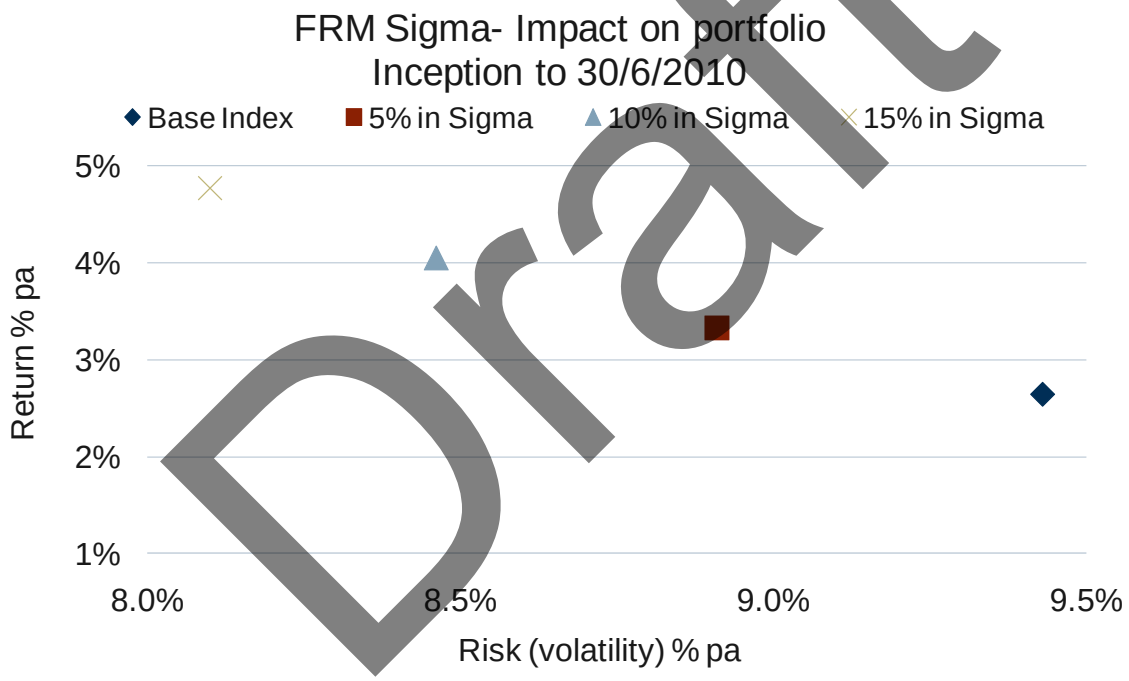


Figure 5 - important notes and disclosure at the end of this paper, past performance is not a good guide to the future.

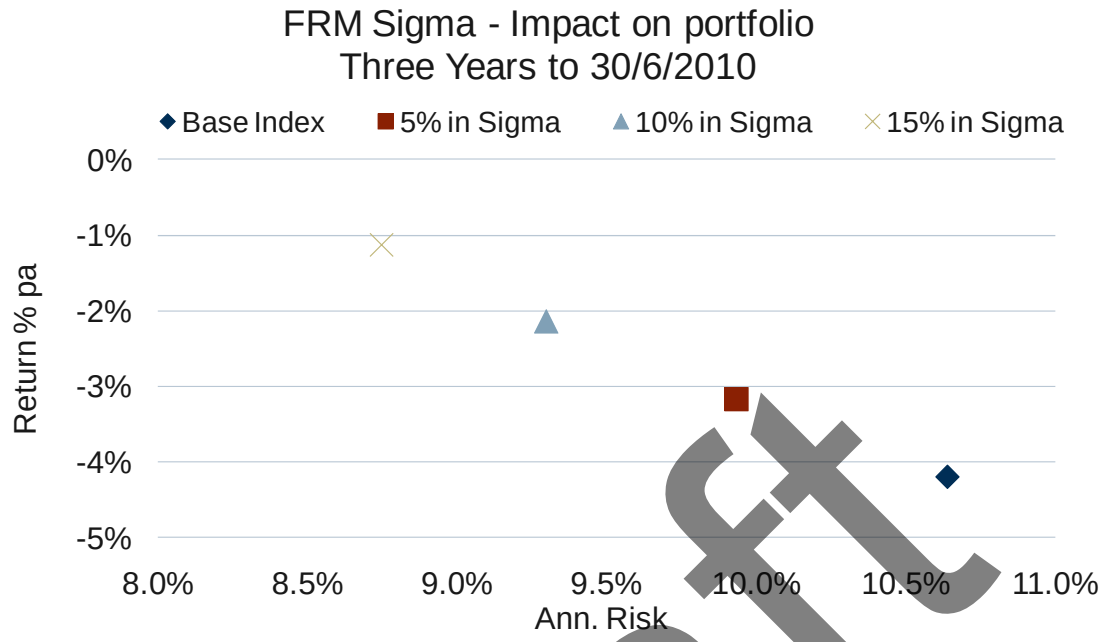


Figure 6 - important notes and disclosure at the end of this paper, past performance is not a good guide to the future.

Conclusion

In this paper we have introduced FRM Sigma, a multi-manager CTA product and how its construction addresses the shortcomings of MPT. FRM Sigma is built as a pure investment vehicle. It deploys capital to a small number of managers because of the high correlation between CTA managers and the risk of return degradation beyond a certain point. Further, its structure allows the volatility of each manager's portfolio to be targeted to a specific level so that FRM Sigma itself can maintain the desired level of volatility.

FRM Sigma should be an attractive proposition to an investor who wants to build good portfolios by combining risky assets that have the required rate of return whilst allowing the low correlation between the assets to deliver the diversification benefits. CTAs have a long history of low performance correlation with traditional assets like shares and FRM Sigma is designed to deliver super returns through manager selection and portfolio construction.

FRM Sigma may not appeal to an investor who wants to build a diversified portfolio by combining already diversified products across a wide range of asset segments.

Important Notes:

Typical balanced fund	Referred to as the 'base index' in charts is comprised: 40% Australian shares, 30% international shares, 5% global fixed income, 20% Australian fixed income, 5% cash
Indices used	S&P ASX 300 accumulation Index MSCI World ex Australia net div reinvested in AUD Barclays Capital Global Aggregate (AUD hedged) UBS Australia Composite Bond Index UBS Australian Bank Bill Index
FRM Sigma	FRM Sigma Limited (FRM Sigma) is a Cayman Islands Registered Mutual Fund managed by FRM Investment Management Limited, based in Guernsey. FRM Sigma will be offered in Australia via registered managed investment scheme called FRM Sigma Fund. FRM Sigma Fund will launch on 1st September 2010 and so does not exist at the time of writing. FRM Sigma Fund will own shares in FRM Sigma. Any performance of FRM Sigma shown here is the USD performance net of fees hedged to the AUD.

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