

Seeking Diversification through Efficient Portfolio Construction Using Cash-based and Derivative Instruments

Abstract of the London Discussion

[The Institute and Faculty of Actuaries, Sessional Research Event, 25 February 2013]

Contact

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This abstract relates to the following paper: Jones, M. W. Seeking diversification through efficient portfolio construction using cash-based and derivative instruments. *British Actuarial Journal*, doi: 10.1017/S1357321713000366

Mr P. J. Sweeting, F.I.A. (Chairman): Before I invite the author to present his paper I should just like to say a few words about it in order, I hope, to stimulate discussion.

The paper covers important issues of the moment, looking at how to measure diversification and how to achieve it. I am looking forward to an interesting discussion on many of the areas raised and also on some areas which are not covered explicitly by this paper.

I found the work on measuring diversification particularly interesting. It has occurred to me for a while that a large number of institutional investors should be much more aware of the extent to which their apparently diversified investment strategies are actually providing diversification. It would be interesting to hear from members of the audience how well they think that investors appreciate this lack of diversification, and how people generally think about diversification.

The question then turns to how you deal with this issue. Correlations of a range of asset classes with global equities are shown in the paper. It is noted that correlations can be unstable over time. It is interesting to think about this also in terms of the shape of the relationships, and the degree of stability between the relationships, of different asset classes, and the levels of tail dependence. If any of you in the audience is also thinking about these issues, it will be interesting if you can share your views here.

It is also important to recognise that increases in correlations are sometimes a symptom of stressed markets and can be thought of as a side effect of issues like liquidity that are in the marketplace. When markets do not like risk, everything that contains risk and can be sold is often traded at the same time and prices all move together in the same direction, which is why you have correlations increasing. While derivatives can provide increased diversification, there is a risk that the liquid nature of the exposure may limit the extent of diversification.

The alternative is to use exposure to premia other than market risk premia, such as liquidity premia. It would be interesting to hear the extent to which investors and advisers in the room think in these terms about different risk premia and the level of diversification that it is possible to achieve.

Staying with market risk, it was good to note the presence of some alternative market risk premia in the paper which do appear to have lower correlations with more traditional market risk. Large cap versus small cap is one of the examples which was shown. It will be interesting to hear if other people are recognising these as risk premia, and investing in them.

In terms of the derivative use, there seem to be two main areas that are covered in the paper: the use of derivatives for explicit hedging and the use of derivatives for diversification. Explicit hedging uses are covered in some detail and many of the potential issues with hedging using derivatives are addressed. I think it will also be interesting to think about some of the practical considerations. This is already quite a detailed paper, so there is limited space for some of these considerations. Things like the European market infrastructure regulation are specifically excluded. Issues such as volatility, basis risk and practical implementation are also important. If these issues have either deterred people from taking on some of these strategies, or if people have been aware of them but have used these strategies anyway, that will be interesting to hear about.

Finally, much of the motivation around this paper seems to be on the topic of systemic risk. While the paper talks about how systemic risk can be measured, it is also worth considering ways of mitigating this risk. It is not necessarily the case that derivatives can fully prevent issues arising from systemic risk, particularly if everyone has exposure to the same sorts of derivatives and all strategies remain similar. It will be interesting to hear any other thoughts on this issue.

I will now hand over to Malcolm Jones to introduce his paper.

Mr M. W. Jones, F.F.A. (introducing the paper): I will start with one of my favourite quotations. John Allen Paulos is a commentator seen on the financial news channels and is a professor in America. He had this great idea back in the late 1990s and early 21st century of applying mathematics to his own investment portfolio. He lost his shirt and a whole lot more investing in WorldCom and the ‘tech wreck’.

To me it was a classic lesson: you can be smart and still lose a lot of money in mathematics and investment. One of his quotations is “Uncertainty is the only certainty there is, and knowing how to live with insecurity is the only security”.

That captures the challenges of investment and the need to build robust portfolios. Also, one of the underlying reasons for writing this paper, and my question to the actuarial profession, is: how can we, as a profession, use the skill set we have (making financial sense of the future) in the world of investment?

The paper began as a working party paper that we presented at the Financial Risk and Investment Management Conference early in 2012. The working party was made up of practising actuaries in the world of investment. One of the most basic questions we asked ourselves was “What do we, as actuaries in investment, do when you take the word ‘liability’ out of the equation?” Looking at pure investment and portfolio construction and thinking about asset classes, what role does and can the actuary play?

This paper builds on the working party paper. Firstly, we consider the measurement of portfolio diversification, its importance and its potential links to systemic risk. Additionally, we present the benefits of using derivatives to implement investment strategies. In my experience as an investment manager, the word ‘derivative’ is not usually warmly received, particularly by UK pension schemes. But I hope to demonstrate that it is not the derivative itself that is important to any investment strategy. It is the diversification benefit of the strategy implemented using a derivative that matters.

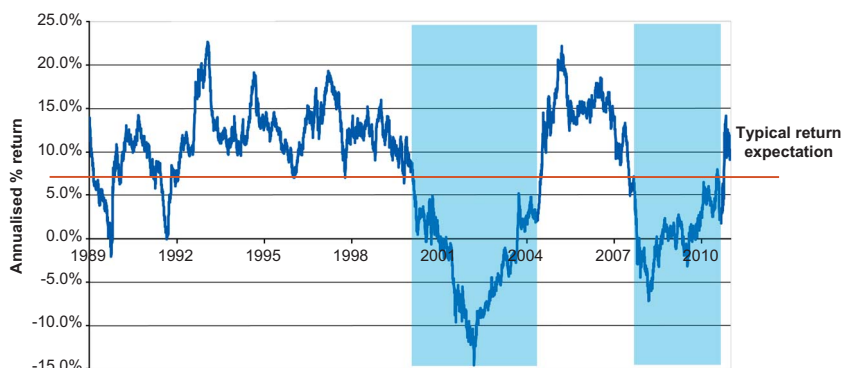


Figure 1. Annualised rolling 3 year returns – Standard Life balanced fund (Source: Standard Life Investments)

The paper considers longer-term market-based exposures. The subsequent risk methodologies are based around these longer-term market exposures rather than the high-frequency trading strategies that investment banks might use. So, the focus is on the timeframes for longer-term investors.

To introduce what is wrong with the old multi-asset approach, Figure 1 shows the annualised rolling 3-year return of a typical UK balanced fund all the way back to the 1990s.

I have used the Standard Life Balanced Fund, but I could have used any UK balanced fund because they are all pretty much the same because they all follow the same asset allocation over the years.

You can see, on the left-hand side of the chart, that, for the most part, the blue line is quite high up. The orange line across the chart represents a typical return that actuaries used to assume on assets in their pension scheme valuations. In the 1990s, returns were comfortably above that assumed and everyone was happy because that meant surpluses and contribution holidays.

Clearly, when we went into the tech wreck and the bear market at the turn of the 21st century there was a massive change in outcomes. This, coupled with other changes going on in pension schemes, led to deficits and helped to accelerate the trend of closing defined benefit schemes. We then had the market recovery that went on in the first part or middle part of the ‘noughties’, then, of course, we had the global financial crisis. Despite people having added more asset classes to their multi-asset approach from the first tech wreck and seeking more diversification, multi-asset funds again delivered negative returns on a consistent basis, putting more pressure on pension scheme funding levels. In practice, therefore, the overall multi-asset approach has shown itself to be prone to failure and unable to withstand market stresses.

Another way of looking at this problem is to see how diversification benefits, as measured by average correlation, have changed.

The bars in Figure 2 show the average correlation of a range of asset classes from property on the left-hand side through to high yield bonds on the right-hand side. The dark bars represent the average correlation of the asset classes from 2000 to 2007. You can see that the correlation is quite low. In respect of diversification, the lower the correlation the better in terms of building lower-risk portfolios. If you can find investment strategies that have low positive or even negative correlation to growth assets, then these will help build a highly diversified portfolio.

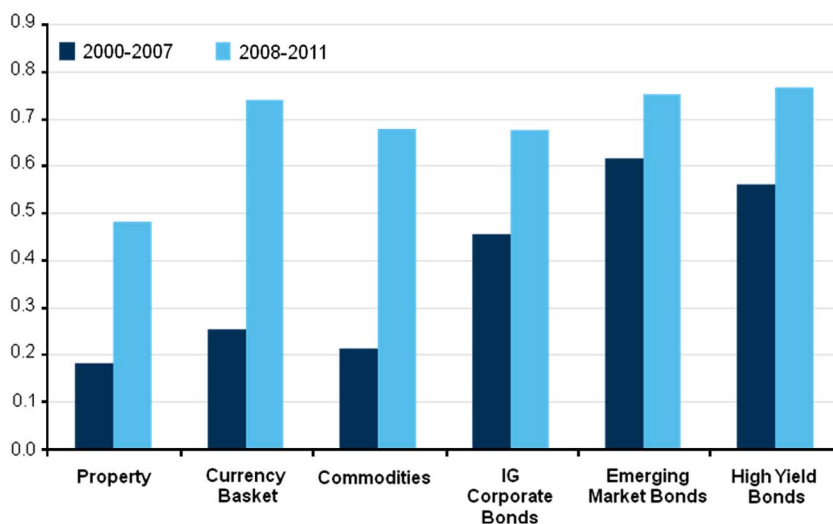


Figure 2. Correlation of Global Equities with other market sectors

(Source: IPD UK Monthly Property Index, All Property; Federal Reserve Trade-Weighted Exchange Value of US Dollar vs 6 Countries; Dow Jones UBS – Commodity Index; Barclays Capital Global Corporate Index, Excess Returns; Barclays Capital Emerging Markets Index, Excess Returns; Barclays Capital US High Yield Index, Excess Returns; Standard Life Investments, 31 December 2011)

For the most part, adding more diversification through investing in high yield bonds, emerging market bonds, commodities, and so on, worked well in the first part of the 21st century. However, once everyone started investing in these asset classes, the diversification benefits reduced substantially and, after the financial crisis, you observe that the correlations are much higher.

The portfolio constructor’s perspective has become: “What I thought were good diversifiers are actually not as good as they used to be or are likely to be in the future. Where else can I find investments to provide diversification?”

First and foremost, it is important to have a measure of what we mean by portfolio diversification. There is no single measure that exists, although there is a growing level of academic literature on systemic risk. There have been more published papers in recent years, and, in particular, in terms of definitive measures of diversification. Much of this work is based around the mathematics of principal component analysis, which looks to better understand the structure and sophistication of correlations within the underlying assets.

Some of the best-known work in the marketplace at the moment is by Kritzman who measured diversification by developing a measure called the absorption ratio. For the benefit of the presentation for the paper, I have taken it a step further, using work that we have developed internally, which uses principal component analysis and, from the world of physics, entropy, to come up with measures that look to measure diversification in two ways. First, how much effective diversification is in a given portfolio? Then, given a selected investment universe, how much diversification benefit could exist within it?

A discussion on the methodology and use of these measures is a paper in itself. The developers of the methodology will be publishing a paper later this year. My paper focuses on the output from the analysis and how it can be interpreted.

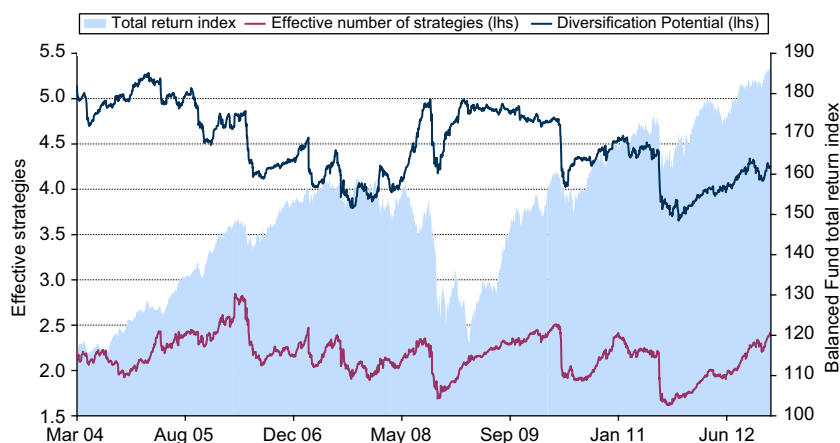


Figure 3. Effective number of assets in UK pension portfolio

Figure 3 considers an average UK pension portfolio (using Purple Book measures).

This portfolio has seven broad asset classes – a couple of equity asset classes, three bonds, one real estate and one hedge fund. But in risk terms, how many do you really have? The equity ones will behave quite similarly. The bond ones will probably also behave quite similarly.

The ‘effective factor’ methodology asks the question: “In reality, how many independent clusters of risk can you come up with that effectively describe the risk behaviour of the seven asset classes in the weightings you currently have, without loss of information”?

What the chart shows is that, over time, given the heavy weighting that pension schemes have in equities, the number of different types of risk is between one and a half and two and a half, which you can effectively think of as equity and interest rate risk. The downside of principal component analysis is that you never really know what these risks are, but you can work out broad proxies.

In terms of the investment universe of seven asset classes, the reason that you do not have much diversification is the heavy weighting in equities. You can, by changing the weightings, achieve a much broader level of diversification, as indicated by the blue line that you can see on the graph, which is the maximum diversification potential for the investment universe.

To achieve maximum diversification potential for an investment universe is broadly similar to an equal weighting by risk contribution across these equities, bonds, real estate and hedge fund categories. You might be obtaining more diversification for a pension scheme but it comes at a cost to investment return. The actuary might observe: “I must invest more in bonds. But, one, bonds are expensive; two, from my valuation perspective, I am going to have to lower my long-term level of return which is unlikely to please either my trustees or plan sponsor”. Seeking return, especially for schemes in deficit, remains a high priority for pension plans.

Let us redefine the investment challenge, then. You want a better diversified investment portfolio but you still want good returns. Allocating more to bonds is not going to achieve both of these goals.

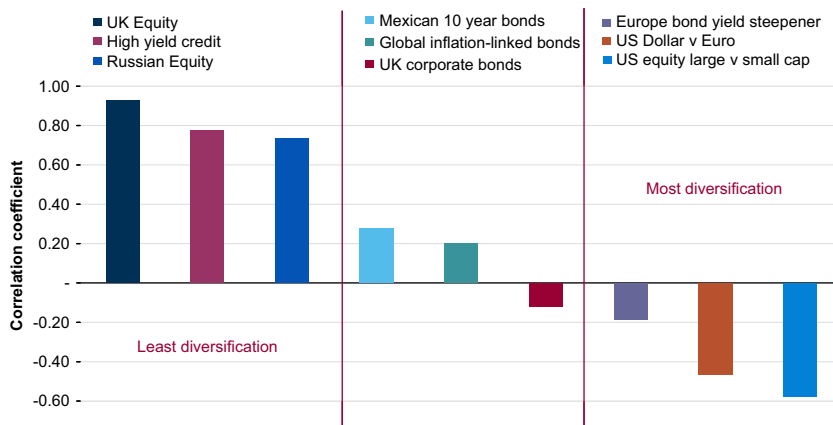


Figure 4. Strategy correlation with global equity
(Source: Standard Life Investments, July 2012)

Using the methodology above for guidance on how to get more diversification, having many more different return-seeking asset strategies is a logical progression. Look at more asset strategies for a start and broaden your scope in terms of investment strategies that can make money beyond traditional ‘risk premia’ choices. In terms of strategies that make money, you can make money in currencies, or in asset classes in specific sectors or maturity points in bond markets. You can look across geographies and look for ways to make money between two asset classes. Effectively, there are many ways of making money using a longer-term three-year time horizon for strategies whose statistical risk premium is zero.

Let us have a look at Figure 4.

I have picked nine strategies. The fund manager believes these market exposure investment strategies will make money in the future. The height and direction of the bars represents diversification benefits – the more diversification, or negative correlation, we have, the better the diversification potential for our portfolio.

Let us look at the three groupings. The first three strategies provide the least diversification: UK equities; high yield credit; and Russian equities. Whilst they may sound quite different to global equities, their correlation to global equities is actually quite high. When you move to the next column, bonds, I have chosen Mexican bonds (emerging market debt); global inflation-linked bonds (inflation-linked debt); and UK corporate bonds (credit). We know intuitively you should achieve more diversification from bond investment and the numbers agree with lower correlations to global equity. However, the investment challenge is that bonds, after a 30-year bull market, are now incredibly expensive with very low yields. Trying to find bond strategies that you think are going to make money as well as provide diversification has become difficult.

On the right-hand side are the three most diversifying strategies: that is, the strategies that are negatively correlated to global equity. If I did not have the chart legend telling you what the strategies were and I asked you to pick three return-seeking but diversified investment strategies then you would logically choose the three on the right-hand side.

What are these strategies? The first one is a strategy based on the idea that over three years the difference in the yield between European bonds that have 10 years' maturity and those that have five years' maturity will be much higher than it is today. The second one is based on a view that over three years the euro will be much cheaper than it is today versus the US dollar. The third one is based on the idea that, whether US equities do well or badly over the next three years, large cap equities should do better than smaller cap equities. Do these have statistical risk premia? Probably not. But in terms of an investment time horizon, if you want to define three years as 'cyclical risk premia' then these opportunities exist if you have the ability to take them.

What you notice about all three of these strategies is that you will need derivatives to implement them. Diversification exists in the financial world today in great abundance. To access it, however, you will have to use derivatives.

One of the additional benefits is that the idea of strategic asset allocation disappears because the range of your investment universe will be big and you will choose whatever you think is going to work for you. As an investment manager for the past 25 years, I always found it frustrating working in an investment house where there are fantastic levels of research being done but where, for multi-asset investment, you have to come up with two main sets of views. Am I overweight or underweight on my equities or bonds, and in which equity markets or bond markets will I be overweight or underweight? It is an inefficient use of this investment information.

A far better use of this information is to allow the fund manager to construct a portfolio of return-seeking strategies that will also provide the diversification necessary to provide robust performance in a wide range of future market conditions.

I shall return to my UK pension scheme portfolio example.

The blue line at the bottom of Figure 5 now represents the UK pension plan. As you can see, its seven asset classes in reality are about two different clusters of risk. What that means is that it is

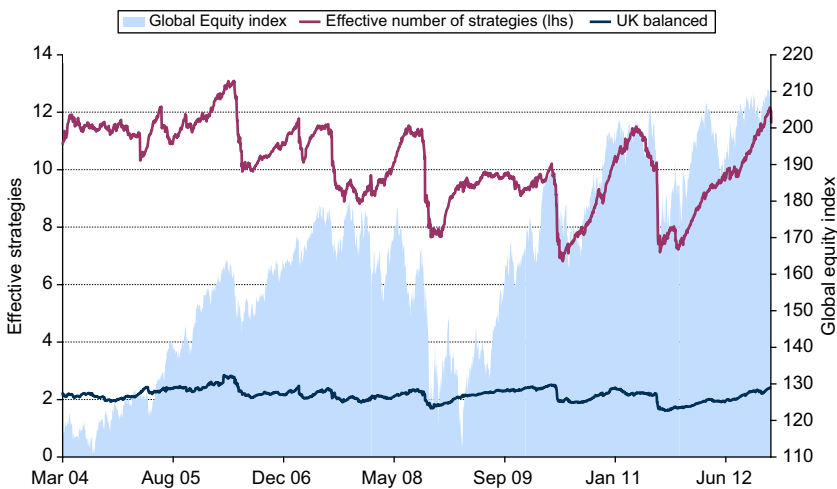


Figure 5. Effective factors for unconstrained multi-strategy portfolio

vulnerable to bad markets, to stressed markets, and that is what many of your clients have experienced in terms of performance within these types of fund.

What you see within a multi-asset unconstrained portfolio by comparison is shown on the top part of the chart. This is a real-life multi-asset portfolio that uses both traditional and derivative-based strategies. It has about 30 positions. But some of those are going to be correlated. In terms of how many different effects, or how many different clusters of investment risk exist, the effective factor methodology shows anything between eight and 12 different types of investment risk.

What that means is that this portfolio should be more robust to different market forces. It is not going to be swayed as much: it has much more rigidity in terms of being able to deal with different types of setbacks that happen from week to week in an investment market.

The paper discusses some potential uses of this diversification measure. I would welcome further ideas from the audience.

In terms of constructing a portfolio using this wide range of investment strategies, you need to move away from traditional asset allocation. Why? Firstly, you are dealing with multiple asset classes with different volatilities. Secondly, for some of those strategies implemented via derivatives, you do not have to physically invest all of the monies to achieve your desired exposures.

Using risk-based construction is a simple way to build a portfolio of cash-based and derivative instruments. Stand-alone investment risk is a key metric. In terms of a simple example, US equity measured by a model may have historic volatility of 23%. If you invest 10% of your portfolio into that strategy, then the risk at the fund level of that single strategy is just 10% of 23%, or 2.3%. This measure takes account of the strategy's size and volatility and represents the risk at the fund level.

In a multi-asset portfolio you are going to have many different asset classes with different volatilities: under some strategies you will physically invest, and under others you will use derivatives. Let us go through the examples on Figure 6.

The first strategy is US equities. The volatility is around 23%, investing just under 10% of the fund in it. So the stand-alone risk, the green bar at the bottom, gives you a number of 2.1%.

Let's move to the next strategy, Russian equities. As the volatility bar shows, Russian equities are around twice as volatile as US equities. However, if you invest a much smaller proportion of your portfolio in something this volatile you can produce a stand-alone risk that is less than the US equity stand-alone risk. You can see this in the bottom graph. Because you use the same approach looking at historic volatility and the strategy size, you have a methodology that is consistent to measuring risk across asset classes and how they are implemented in the portfolio.

Strategies worth highlighting on the right-hand side of this chart, where you see the big dark blue bars of nominal holdings of 20%–25% but you can barely see the volatility, are ones based on very short-dated two-year bonds. The price volatility is not much at all. So the stand-alone risks positions of these strategies are much lower than the equity strategies we discussed earlier. If you have an idea about making money in a two-year bond position, you have to invest quite a lot of money in them.

The actual size of any holding is meaningless unless you know the volatility of the assets in which you are investing.

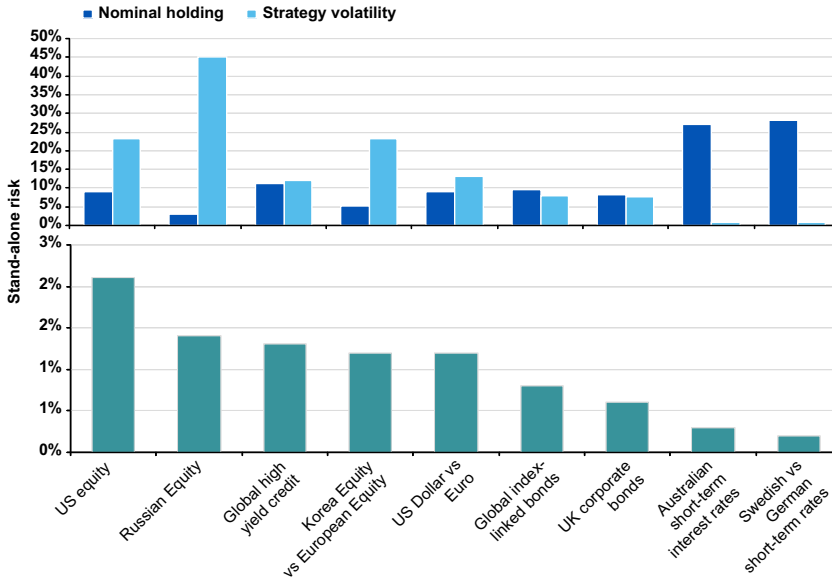


Figure 6. Absolute return investing. Risk-based portfolio construction (Source: Standard Life Investments, sample absolute return portfolio, March 2012)

In terms of your multi-asset portfolio, how can you calibrate how much investment risk you are taking? This is a methodology where you use historic returns and historic correlations. There are weaknesses in solely relying on this as a portfolio construction tool, but it gives a good guide on the aggregate investment risk to take.

Consider the waterfall chart in Figure 7.

If we used this approach to measuring equity portfolio absolute risk, you would have just one big bar of investment risk (over around 20%) that is searching for a return. But this equity portfolio is just one main risk. When it misbehaves, performance could be both more volatile than history expects and downwards in direction.

Is it not better, in terms of searching for a longer-term equity risk premium to break that one large risk into as many smaller different risks as you can find? So rather than just placing all of your investments in one asset class or even in the one asset class across geographies, you disperse that investment risk across geographies, asset classes, and wherever else you can find diversification.

In terms of this model, I can perform a simple test of: “What happens if all my risks go wrong? What risk do I have?” This is the correlation to one scenario where you simply add all the investment risks. In this example, you come up with a number in the region of 22% to 23%, which again is similar to historic volatility on equities for the model for when this model was run. It is recognised that the model’s measured volatilities on strategies and correlations will change over time with market conditions.

When you allow for historic diversification benefits, you can produce an expected volatility for the portfolio. In this example, you can observe that exceptional diversification benefits exist within this portfolio of selected investment strategies.

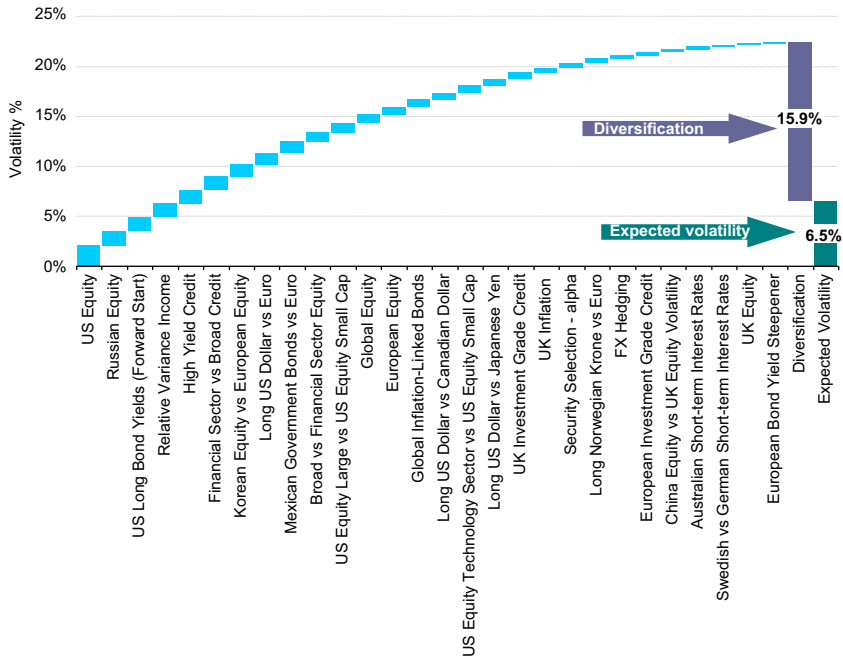


Figure 7. Risk-based portfolio construction (Source: Standard Life Investments, APT system, March 2012)

Portfolio	Leverage factor	Strategy volatility	Portfolio risk
US equity	1.0	23.2%	23.2%
UK corporate bonds	3.0	7.7%	23.1%
Australian short-term interest rates	10.0	0.9%	9.0%

Figure 8. Leverage and portfolio risk

Is the model output accurate? Invariably no. Models are inherently flawed. “All models are wrong; some are useful,” to quote George Box. Also, in stressed scenarios, modelled volatilities are underestimated and diversification benefits are overestimated. However, by spreading that investment risk as widely as you can, you are certainly mitigating the dangers of losing money in a systemic manner in stressed marketplaces.

The sum of the strategy sizes is 220% for this sample portfolio. That then leads to the question of leverage. Most people’s knowledge of leverage is that it is bad – just look how leveraged portfolios suffered in 2008. Even though nominal exposures by themselves are meaningless, as highlighted earlier, the issue of 220% total exposure and leverage has to be addressed.

You have a portfolio of, say, equities. To leverage it in the traditional way, you borrow money and invest it in equities. You then have a leveraged portfolio. A twice leveraged portfolio (200% exposure) would clearly be a very volatile portfolio, so this portfolio of 220% has to be as risky, right? No, it is just the opposite, as I will demonstrate using Figure 8.

I have used three examples in this figure 8 – US equities, UK corporate bonds and Australian short-term interest rates.

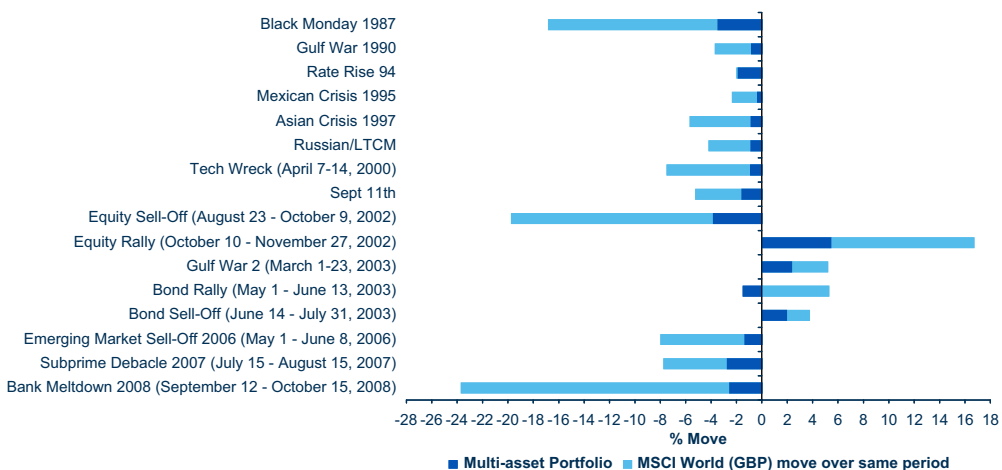
Again, using the stand-alone risk methodology with historical volatilities and using a leverage factor, you come up with the portfolio risk numbers that you can see on the right-hand side, where three times leveraged corporate bonds look the same as equities. But on the face of it, the portfolio of 10-times leveraged Australian short-term interest rates looks quite good from a risk perspective. But the problem for all these examples of leverage is that you are dealing with only one risk factor.

In our examples, the lowest risk portfolio is the most leveraged. The problem is that when things go wrong, they can go very wrong. Leveraged credit, which was a popular strategy in most of the ‘noughties’, came a cropper in 2008. People talked at the time about having events that were a 25 standard deviation event on a value-at-risk basis. To give you a feel for this, it means that the probability of it happening is less than one day in the whole history of the universe. It makes the core point: numbers are numbers, but investments are real markets where people trade.

Let us return to the portfolio we looked at of 220% nominal exposure. Is it one risk? Could you say it is leveraged 2.2 times? No, because we have more than one major component to this portfolio’s investment risk – indeed the effective factor analysis indicates there are 8 to 12 uncorrelated effects within the risk.

So, when is a portfolio leveraged or not? Looking at nominal exposures of a portfolio without considering the number of different investment risks involved can lead to an incorrect interpretation of the portfolio’s likely risk behaviour.

We know investment risk models are flawed and hence the need to do a broader range of risk tests to assess the likely performance of a portfolio in stressed scenarios. You can have two broad types of stress scenarios: one, historical; two, forward-looking. Historical scenarios are always good to look at because they have actually happened. Using modelling techniques, you can deconstruct a current portfolio into risk factors, look at how those factors behaved in stressed markets, and collate these outputs to see how your portfolio today might have performed in those different scenarios.



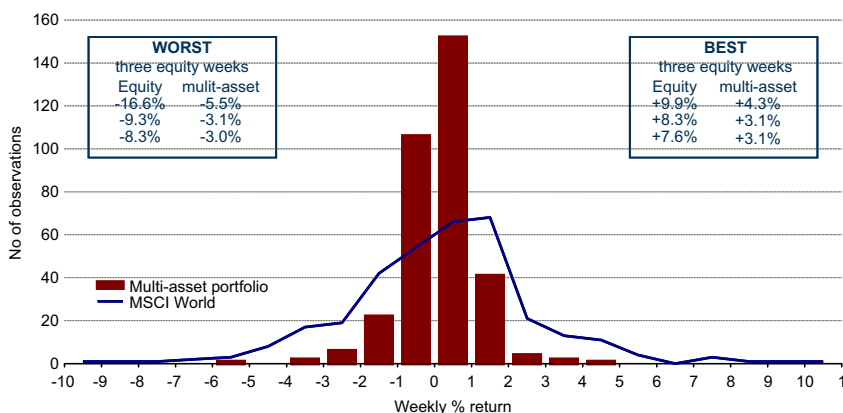


Figure 9. Distribution of weekly returns of unconstrained multi-asset portfolio v MSCI Global Equities

(Source: Standard Life Investments, net performance from 12/06/2006 to 30/11/2012)

On the left-hand side of this chart is a range of different market events, such as equity collapses, financial meltdowns, currency crises, wars etc. It is in your interest as an investment manager to try to find as many different historical scenarios as possible to investigate whether you have any unintended concentrations of risk.

The light blue bars look at how much the equity markets have moved. The darker blue bars show the performance of the multi-asset portfolio. When you see the likely performance of the multi-asset portfolio in stressed markets, you observe that this is a well-diversified portfolio.

The other way is to think about future scenarios. The major downside of the historic scenario test is that it may not be the worst outcome for your current portfolio. There may be other things happening in the world, in terms of how correlations are changing or how investor behaviour is changing, where you might become unintentionally exposed to having the risk concentrated.

I cover future scenario analysis briefly in the paper. This is maybe an area, along with diversification metrics, where the actuarial profession can constructively have an input into investment discussions between the investment consultant and the trustees of pension schemes. I would be interested in your views.

Finally, there is another way of looking at it. You have done all your risk modelling but there is nothing quite like looking at what is happening in reality.

Portfolio performance is based on the £, institutional pooled pension portfolio; Thomson Datastream, MSCI World (£).

Figure 9 is a histogram of the distribution of returns of the multi-asset constrained portfolio. The blue line is the distribution of equities. What you observe over the period used (mid-2006 onwards) is the distribution of equity returns illustrating the fat tails that we know and worry about. You can observe that the multi-asset portfolio, with its diversified risk constituents, has significantly mitigated the negative tail effects.

To summarise, with multi-asset investment we can continue to add new asset classes. We can add illiquidity just to add to the challenges of trying to manage portfolios on a day-to-day basis that allow new investments and withdrawals. The problem with doing this is that there will always be limits as to how much diversification benefit you can achieve.

If you look at a broader investment universe, looking for diversification, and considering strategies that you can only implement via derivatives, you are going to increase your opportunities for finding diversification benefits.

Investment managers are obviously keen that we consistently provide our clients with as positive an investment experience as possible. It is my belief that using a wider investment universe, and better diversification, ends up with better results for clients.

Mr M. G. White, F.I.A.: I should like to emphasise that I am talking about planning for the long-term future, not only for the next 10 years, for example. Given that context and the topic of diversification, I want to take issue with having any concern about short-term volatility. I think it is something which we, as actuaries, in the context of no liabilities to match in the shorter term, should be far happier to live with than we appear to be.

When you take liabilities out of the question, the intelligent way to think about it is long term. Let us say that you are aged 40, investing with the objective of maximising your spending power from the ages 70 to 95, say, or perhaps even 100. Let us introduce the constraint that you must be able to survive a period of hyperinflation. There is no point retiring on a fixed income if the government is going to print money or otherwise default on its debts.

I think the quotation about living with uncertainty is spot on. You have to be able to live happily with the market value of your assets moving about violently. But you do not want to take wipe-out risk. So I would say gearing is out. And so is counterparty risk. Will all those European banks or governments stay solvent, for example?

What is my idea of a low-risk asset? It is a portfolio of companies with decent historical return on assets and no or very little gearing. But it would have to be spread across industries and jurisdictions since whole industries and jurisdictions can fail, as we have seen recently. There are plenty of examples.

I think derivatives are for short-term gambling and useless for the long term if the long term is your context. If you are trying to manage shorter-term liabilities, it is a different story. What advice would I give to long-term savers about handling long-term uncertainty? It would be to emphasise the importance over time of minimising expenses, and not letting anyone take an annual percentage of your fund. It is possible to get this annual cost down to almost nil if you know where to look. But if you allow money to go to an adviser and to a fund manager each year, it mounts up. I know some fund managers are much cheaper than others. Retail investors, investing in typical funds and advised by typical advisers, will suffer something in the region of a low single digit per cent per annum. If you compound this over the decade, it is not a risk, it is a certainty.

So, where does the actuarial profession believe it has most to add in the realm of portfolio construction? I speak for myself, of course, and my answer relates to long-term investment only, that is, to that part of your portfolio which you own in order to provide for yourself or your family

perhaps a couple of decades or more ahead. It is to explain to the public first the importance of expenses and how to avoid them; and, second, to explain how an intelligent, long-term approach is not to worry about market fluctuations but to think of market falls as opportunities.

Mr I. J. Kenna, A.I.A.: Diversification is to be welcomed. However, it is questionable whether derivatives are the answer.

The term derivative covers a multitude of financial products. Anyone can issue a derivative. Anyone can buy a derivative. Derivative buyers do not need to have an insurable interest. The market in derivatives is very large.

In his paper on financial corruption, Associate Professor Xu Duoqi of Shanghai Jiao Tong University writes: “Research estimates indicate that total US financial product contracts before the outbreak of the crisis amounted to 530 trillion US dollars, in which CDS (credit default swaps) exceeded 60 trillion while the collateral security or material financial assets on which they were based were worth only 2.7 trillion”.¹

This represents a leverage rate of about two hundred.

It would be interesting to learn whether the authors of the paper under discussion are in a position to supply the profession with corresponding up-to-date figures for the world as a whole and for the UK.

More recently, Xiao Gang, President of Bank of China, has stated:

“In the next five years, the top risk to China’s financial system is the country’s shadow banking system”.²

There is a problem of choosing in what to invest. Interest rates are low, inflation is high and longevity is improving. There is a property bubble. The FTSE 100 is based on replacing undesirable components by healthy firms as occasion demands.

It is, however, unlikely that derivatives will provide a solution.

Mr P. L. Howard, F.I.A.: I am possibly one of the younger members of the profession here. I advise clients on liability-driven investment strategies with the use of derivatives.

One of the key things to remember is that many of the financial instruments used within society are leveraged in the UK. An example might be a 40 to 45-year-old who has borrowed, on a mortgage perhaps, to an extent that far exceeds the leverage in the author’s presentation.

Similarly, if you are investing in a company, you have to appreciate in what you are investing. You are investing in a set of companies that use derivatives for financial management purposes, and they will also be leveraged. Many of them will have unfunded defined benefit pension schemes. That in itself is a form of leverage, which is a risk factor. From my experience, leverage aversion is a significant behavioural finance factor that can bias individuals in their decision-making process for investment strategies. Last week, I heard a presentation refer to this topic as LSD – leverage shorting

¹ Social Sciences in China, November 2011

² Beijing Review, February 14th, 2013

and derivatives. That is how the average person will respond to leverage and to LSD in the financial setting. Actually, what you do find with many sophisticated investment strategies is that leverage is important to manage: it is important to understand into what you are going.

The worrying thing about the use of leverage is its impact on portfolios in markets that are susceptible to short squeezes: Long-term capital management is a great example. But you have to understand where you have leverage. If you have a significant pensions deficit, you have a leverage position in the interest rate positions implied by your liabilities.

Just to counter the earlier comment on a long-term perspective, you can only have a long-term perspective in the context of having an on-going employer for a UK defined benefit pension scheme. So your liabilities are important in the short term because you have no certainty on the covenant of your employer over the short term, the next 10 years say, and that is an uncertainty with which trustees do need to deal.

Generally speaking, as a profession, I do not think we should outlaw derivatives. I think they should be sensibly managed, and that we should be involved because they form a risk structure on which we can advise. We can help our clients look at them appropriately.

Mr R. J. Houlston, F.I.A.: I think that in figure 2 it was suggested that asset classes moved to greater similarity in their volatilities over the last 10 years. I just wonder whether what we are talking about now is playing in a very small market and making hay while the sun shines. As more and more derivatives are used, they too will become equally risky and you will cease to gain the diversification benefits.

Listening to the presentation, I realised that there seems to be some alchemy occurring. We seem to be now talking about being able to make money by minimising volatility. I am quite sure that money and wealth is created from economic activity. It seems a shame that investment strategy is allocating finance based on volatility.

The Chairman: While you gather your thoughts, I have a couple of points.

What do you mean by the diversification measure that you employed? I wondered how sensitive that measure was to the way in which asset classes were defined. For example, if you had global equities redefined as a number of different regional equity asset classes, would the level of diversification that was shown in the portfolio reduce? Would the action that you took change in any way?

Mr Jones: In terms of the numbers, not markedly. You will obtain slightly different numbers, but the overall weight and concentration in assets broadly behaves the same. It is certainly something we can look at and about which we can provide more information.

Mr H. N. H. Peard, F.I.A.: On reading the paper, there were a number of occasions where I had a sense that I would like either more precision or more detail. I know that is difficult in terms of the scope of the paper and where to stop.

For example, you mentioned collateral provision. The implications of that are going to be significant in the future. In general, the cost of derivatives will depend on the nature of the collateral provisions. There are a number of risks associated with derivatives in relation to the collateral provision. That is not least in terms of liquidity risk management.

Counterparty risks are managed to some extent by the use of collateral. However, it would be worth having a footnote that the economic risk or the economic return is the same using a derivative as using the underlying asset, provided things do not go wrong. If things go wrong, then you have a completely different position. For example, counterparty risk, I would argue, is highly correlated with many of the underlying exposures in the event of a severe scenario.

You also talked about leverage in the use of repos. Just as an example, depending on the amount, leverage can introduce operational risk. Operational risk, again, could potentially be correlated in severe scenarios with market disruptions.

In the paper, you mention that risks are sub-additive. I would personally add a footnote to that to say that it depends on the risk metric, and it depends on the distribution that is being assumed.

The Chairman: I have another question. The risk measure point that was just mentioned highlights something. Everything here was considered in essentially a normal world in terms of the risk measure being volatility. Have you looked at this in terms of non-normal, risk-type measures instead of volatility?

Mr Jones: No, but that is further work that we would love to do. The work in the paper is the normal scenario with a range of different approaches to stress tests, to assess when effectively non-normality occurs in order to try to measure the tail risk impact that might exist within a portfolio. This comes back to my point about trying to ensure you have as much diversification in your investment risk as you can.

We, as a profession, can probably do more sophisticated modelling in this area.

Mr J. W. Roe, F.I.A. (closing the discussion): I should like to thank the authors for an interesting paper. I have a few thoughts and I will just go through them quickly. You can split the paper into broadly four sections: risk measurement; derivative types; implications for investors; and risk management. I think the majority of the discussion from the floor has focused on the first and the last of those, risk measurement and risk management, which are probably the two most important areas for actuaries, particularly in relation to the topics covered in the paper. I have a few thoughts on the middle two topics, derivative types and implications.

The first point is that there is a wide range of derivative types. Before 2008, there was a high level of confidence that derivative markets would continue to grow, that liquidity would prevail and the benefits of using those derivatives potentially exceeded the costs of doing so. The drying up of liquidity in 2008 and 2009, particularly in smaller markets and in respect of the more esoteric derivative types, highlighted the size of the problem that that can exist and the over-complacency that can result.

One thing that we have touched on a couple of times in the discussion is operational risk. I would count the rolling of derivative positions as a key risk, particularly when the derivatives are used with the assumption that you can roll them. This is one of the things that we have seen increasingly in pension funds with the use, for example, of leverage gilt funds with 30-year positions rolling on an annualised basis.

I am not saying that they are wrong, but I am saying that it is important that users of those derivatives understand the risks associated with the continued rolling of them. In fact, even those

who gained from the recession, such as some of the big hedge funds that correctly shorted credit positions, eventually realised that they could not get mark-to-markets on them for days and started unwinding risk positions, despite the fact that they were going more and more into the money, through sheer panic as to whether or not they would ever be able to realise those positions.

On the implications side, I can understand the view that for a long-term liability, which is relatively open-ended for a number of decades, it may be appropriate to focus on the long term. However, with the shortening of defined benefit pension schemes and their closure, that luxury, unfortunately, does not sit with many of these schemes. This is particularly the case in the circumstances where there has been, partly through a falling of real rates, a level of underfunding and therefore a requirement to bring down risk levels without moving into gilts and similar types of asset. I can see the value in derivatives for hedging purposes. I think that the key lies in understanding and categorising the risks that they have, such as operational risk.

Moving on to risk measurement and risk management, I think that the use of innovative approaches for risk measurement is essential. Some of the ones highlighted here are potentially incrementally beneficial alongside more traditional approaches.

The danger with all of this is that there are certain comments in the paper that are axioms – they are functionally true by design – but there are others that rely on a set of beliefs that are understandable but may or may not turn out to be true. If, for example, you add diversifying risks and you take out risks that are less diversifying, it is an axiom to say that that will reduce the risk of the portfolio. What is less clear is whether that will improve the risk-adjusted return of the portfolio because it crucially relies on there being a risk premium associated with the risk that is introduced or the successful use of active management. I think that this is one area where the profession, through its deep statistical understanding and its longer-term focus on assets, both historically and in the future, can add value.

For example, if we could separate out the diversifying solutions that genuinely can be expected to contain a risk premium because they contain rewarded risk, and those where effectively we are reliant on active managers to identify and successfully access opportunities, it helps trustees and insurance companies to understand the drivers of the risk reduction. Is it reduced risk and reduced expected return, or is it something different? Where are the sources?

That is one of the benefits of diversification through physical assets which Mr Jones highlights in his paper. You can obtain relatively long-dated histories for them. You can look at the risks associated with those asset classes. This can become slightly more esoteric or difficult with derivatives. One of the examples given in the paper was the use of small cap versus large cap US equities to reduce the risk position of a portfolio. Generally, small cap equities have a higher market beta than large cap equities and therefore it is consistent that going long large cap and short small cap will reduce the risk in a portfolio. It is effectively reducing the equity beta of that portfolio. All else being equal, it will also reduce the expected return of that portfolio unless you believe that there is a systematic risk premium for large cap versus small cap, which would go against most historical research, or you believe that the active manager is capable of timing that based on a three-, five- or one-year view.

The implication of this is that the more, as a profession, we are able to separate the axioms and the fundamental risk drivers from those that rely on active management, I think the stronger our position. It will help investors understand those risks that are systematically expected to provide a return over the long term, and those which are more reliant on shorter-term investment manager choices.

I will leave it there except to highlight a key point on derivatives – one that has been recycled a number of times over a prolonged period. It is the idea that investors are generally split into three groups, the first being hedge investors, for example, UK pension schemes, who hedge interest rates and inflation. Then come the speculative investors – those who are seeking a return through the use of an investment. Finally, there are Ponzi investors. One of the important elements of risk management, particularly in relation to derivatives, is that their leveraged form massively increases the potential for Ponzi investors. That is not to say that they will be used in that way, but it brings me back to the most important point of this paper, which is, in my opinion, from the profession's standpoint, diversification and its risk measurement. We should have new angles of understanding the positions of our investors and their risk management. How are individual fund managers using independent risk calculations and managing to capture those risks on a forward-looking basis to protect investors overall?

Mr Jones: Thank you to Mr Roe and to all contributors. I will comment on as many of your comments as I can. I will preface it by saying that derivatives are now an age-old and well-proven technology. Can derivatives end up in doing bad things? Yes. But, to me, that is synonymous with saying the Internet is bad because it is used by paedophiles and terrorists. However, there are many benefits in using the Internet in terms of how we live our lives today. Used prudently, there are many benefits to derivatives.

Can derivatives be used for gambling? Yes they can. However, for many companies they are used for hedging investment risk. Good investment companies probably use derivatives as part of the day-to-day sensible, prudent management of their multiple currency sales revenues. Does this make them gamblers? I think not.

I am a believer in long-term investment. I love the idea of putting money away and not looking at it for 10 years. As a personal investor, I can do that and not worry day-to-day about how the value of my money moves round.

Unfortunately, many people in the UK do not have that benefit. In terms of how defined contribution (DC) works, with heavy allocations towards equity investment and a limited time span at which they are exposed to that equity risk, what we are seeing is that whether you achieve a large final pot from your DC investment or a small pot is primarily a result of whether you were invested in good equity markets or bad equity markets at that time. Effectively, it becomes a matter of luck – not something you would want to depend upon for your retirement income.

Much as we would not want to worry about mark-to-market on-going valuations, the reality is that, in terms of trying to deliver investment solutions for people and providing people with decent incomes for their retirement, this is something with which we have to deal.

Derivatives may do good things and they may do bad things. However, let us face the broader truth – multi-asset investment, as we know it, has really not delivered for its investors over the last 15 years and the outcome from that has been both profound and significant for the UK pension scheme industry. Diversified investment opportunities, enabled through the use of mainstream derivatives, are what we need to face as a profession. Derivatives are a widely-used technology, used by multiple organisations – investment banks, investment managers – around the world. It is something that we have to embrace and to which we must adapt our historic mind-set.

I agree with the comments on the areas of the paper that focus on the quantitative aspects of risk management and not the operational issues, of which there are many, including the current work on

the clearing of over-the-counter derivatives, which goes ahead in the US this year, and in Europe, it is to be hoped, next year. Again, that will help mitigate counterparty risks.

Liquidity risk is an on-going concern for all derivatives, both in terms of collateral and in terms of what types of derivatives in which you invest. Again, we are back to the core point of relying on investment managers to use their prudence and their experience to choose wisely.

The actuarial profession, I believe, has the skillset and the capability to provide more work, to incite more colour, into the worlds of risk measurement and risk management as portfolios evolve over time, and to become more invested in strategies providing diversification.

The opportunity for us, as a profession, is to recognise that the world is changing and is continuing to change, and to figure out where we can make a constructive input into the world of investment and diversification.

The Chairman: Thank you, Mr Jones. I am sure we have found the paper to be full of new concepts and ideas for further analyses in a number of areas relating to diversification, derivatives and portfolio construction.

It remains for me to express my own thanks and, I am sure, the thanks of all of us, to the author, the closer, and all of those who participated in this evening.