## ABSTRACT OF THE DISCUSSION

**The President (Mr T. M. Ross, O.B.E., F.F.A.):** The subject of hedge funds has risen in the consciousness of all of us, even though, for most of us, our day-to-day work is not closely involved with investment management. Until recently, the mystery surrounding these funds was such that they were viewed with a fair degree of suspicion. Most people did not really understand what they were about.

I find this paper extremely useful, in that, as well as delving more deeply into some technical aspects, it gives a good description of how different sorts of hedge funds operate. I found that aspect extremely clear. So, I should like to think that, for all of you, the paper offers something useful, whether you are experts in the field or, like me, beginners. The paper helps to dispel the early suspicion of hedge funds, and to affirm that they have an important place in investment portfolio management.

**Mr J. J. Caslin, F.I.A.** (introducing the paper)**:** Why bother with hedge funds? What are the necessary characteristics of hedge funds that would make them interesting to investment managers, finance directors of companies sponsoring pension schemes, pension fund trustees and actuaries of life assurance companies? If the characteristics of a hedge fund are appealing to an investor, the next question is: "What questions should you ask before you make a decision to invest in the hedge fund?" So, we look at manager selection and at the statistical analysis that might be performed as part of this exercise. I want to look at volatility management strategy, which is a key issue in hedge funds, and then at a couple of issues for fiduciary investors, because you are probably looking at hedge fund investment mainly from the point of view of a fiduciary, rather than a direct, investor.

So, why bother with hedge funds? Suppose that you are the finance director of a publicly quoted company. You have your chief executive officer breathing down your neck about the FRS 17 deficit in the accounts. You have a dilemma, in that you can easily reduce the risk of the portfolio by switching it all to bonds, but the real answer is to get long-term returns similar to those from equities, but without the kind of risk that comes with equities. If your pension scheme is currently invested with Manager A, the first thing that you might think of is: "Let us diversify it by putting in another similar traditional manager, Manager B." However, you do not get much reduction in risk. Their returns go up and down together 92% of the time. Only 8% of the time is Manager B's negative performance compensated by Manager A, or vice-versa.

Then, maybe, a hedge fund salesman comes to see you and presents you with another option. If you stay with Manager A, but put a small part of your portfolio into a Currency Fund, the down times, where Manager A and the Currency Fund have their negative months together, drop from 30% to 11%. That should lead to a reasonable reduction in risk. Secondly, you find that 48% of the time, Manager A and the Currency Fund are compensating each other, in that, when Manager A has a negative month, the Currency Fund has a positive one. Just in case anybody is under any illusions, hedge funds have their negative months, too. When the Currency Fund has a negative month and Manager A has a positive month, Manager A is compensating for the negative returns of the Currency Fund. If the Currency Fund has long-term returns similar to those of equities, and you add it to your existing portfolio, then you should get lower risk and at least as good long-term returns.

So, why bother with hedge funds? Certain hedge funds can reduce your downside risk of an existing portfolio, and, if you choose one or a number from among the group which reduce the risk of your existing portfolio, then your portfolio can enjoy higher, or at least as good, returns as equities. In this way, you will not have to reduce your return to obtain lower risk. In fact, you may even be able to increase your return. However, not all hedge funds can give you these diversifying characteristics.

We need to look at what are the necessary characteristics of a hedge fund that can reduce the risk and increase the return of a pension investment portfolio.

Consider a range of hedge funds with different correlations to your existing portfolio, running from 100% correlated to minus 25%. You do not really get hedge funds that have a correlation of much more than minus 25%. The typical pension investment portfolio in Ireland is approximately 70% equities, 20% bonds, 5% properties and 5% cash. Consider, also, the risk (in terms of standard deviation of annual return) of the new portfolio that you generate by adding some of the hedge fund. Before adding any hedge funds to your portfolio, the risk of your portfolio might be of the order of 12.25%. The first thing to notice is that, if you have a hedge fund that is up to 50% correlated with your portfolio, you will not reduce the risk very significantly. You need to choose hedge funds with correlations of the order of 25% or less to get a 20% reduction in the standard deviation of returns. That requirement would tend to rule out the most common hedge fund by number, but not by assets under management, the long/short equity hedge fund. Such hedge funds are too highly correlated with traditional portfolios.

As we all know, correlation is by no means stable, and what we are looking for is good correlation, in that, when your basic traditional portfolio is doing well, the hedge fund is not detracting from it. It is having a mixture of good and bad months at the same time as your portfolio is bounding ahead, but, most importantly, when your portfolio is doing poorly, the hedge fund does well, or it does well for the majority of the time. That is good correlation. Bad correlation is when your portfolio is doing badly and so does the hedge fund, and when your portfolio is doing well the hedge fund behaves randomly.

It is very important to stress test the correlations, to look back over, maybe, the best ten months of your traditional portfolio, and see how the hedge fund behaved during those periods, and, if the track record is not long enough, you need to spend some time thinking carefully about those circumstances when these two asset classes become highly correlated and defeat the purpose of your exercise.

In the area of manager selection, past performance is definitely not a guide to the future. The caveat should be extended to say that, if you do not understand the manager's strategy, it is certainly no guide to the future.

Consider a particular hedge fund which takes your money and essentially invests it in cash, but, in order to give it that hedge fund extra bit of return, it writes one month, out-of-the-money put and call options on the S & P 500 Index, 2.5 standard deviations out from the current level of the index. This means that there is only a 1% chance that one of these options is likely to be exercised against it in any particular month. The hedge fund keeps the premium in 99 out of 100 months, and it writes sufficient options to give you a return on your money of 1.5 times the going return on cash. So, it is a great way to make money, provided that the index does not move by more than 2.5 standard deviations in a month. If it does, then you are going to have losses in that month.

Remember that there is only a one in a 100 chance of this hedge fund having a month where it is going to have to pay out on the options. It could be going for six years, which is a long track record in the hedge fund world, without incurring one of these one in a 100 months. It would have a Sharpe ratio of something of the order of ten. For anybody who is familiar with the hedge fund world, you would definitely be suspicious of a hedge fund with a Sharpe ratio of ten. One is very good for an individual fund, and about 2.5 for a fund of funds, so ten would certainly cause you to think.

The above fund could easily have a Sharpe ratio of ten, because it has not had the big hit yet. Once it has the big hit, the Sharpe ratio could switch to minus ten. So, past performance is absolutely no guide to the future, unless you understand what the manager is doing.

If you are going to meet with the hedge fund manager, you really need to prepare for the meeting, because, generally speaking, hedge fund managers have very slick presentations which present their strategy in a very simplified, easy-to-understand way. You will come away from the meeting saying: "That sounds like a good way to make money. I like it. And you have the past track record to prove it.'' So, you should have your questions ready, something along the lines

of: "How exactly does the manager make money? How does he identify, measure and manage the risk? If he says that he is identifying, measuring and managing the risk, where are the systems that support that? From where does he get his information? From where do the data come? How does he aggregate the risks in the portfolio, and what assumptions does he make in doing that?" That is a very important question. Hedge fund managers like to talk through their best months of performance and how they got those returns, but that is often a very interesting guide to the kinds of risks that they were taking in generating the return. They should also be asked to talk through some of the worst months that they have had, because, again, that is an indication of the risk that they were taking and what can go wrong.

The big question for all hedge fund managers is: "While you are here presenting to us, who is minding the portfolio?" These are not like the large institutional investors of the world. These are very much intellectual capital businesses, where the intellectual capital resides, usually, in one or two individuals' heads. So, if they are here with you, who is managing the portfolio? That is a big risk management question.

You certainly would not invest in any hedge fund based only on a statistical analysis. It is part of the discussion that you would have in considering a hedge fund, and you should also do some graphical analysis as well as numerical analysis. Relevant graphs and pictures are very helpful in this regard.

Daily data are very important. Many hedge funds will say: "Sorry, we do not give you daily data." You have to be very worried about that, because, if the manager does not value his portfolio daily, how is he managing the risk? He has to value the portfolio to be able to work out statistics such as: the sensitivity to changes in interest rates; changes in the level of the equity market; etc. If you do not value the portfolio, you cannot manage the risk.

I divide the world of hedge funds into two broad categories. At one extreme, we have: the 'FewButLarge' manager; and, at the other extreme, the 'ManyButSmall' manager. Let us assume that both managers had returns of 20% p.a. over the last five years, which is very impressive and attractive. The 'FewButLarge' manager achieved his returns by doing five big deals over the last five years. The 'ManyButSmall' manager got his returns by doing three, four or five deals every day. He was in the market every day. So, I will leave you with the question: "With regard to their past performances, which of these two managers' past performance is more likely to be a guide to the future?"

You have to look behind the data. It is not like a manager who is in the equity markets, because people who are managing traditional portfolios are in the equity, bond, property and cash markets every day; that is not so with hedge funds. There is much more discussion of this issue in the paper.

You need to look very closely at correlations in the analysis phase. To illustrate, let us take the S & P 500. If you calculate the correlation of the S & P 500 with itself, you get 100%, but if you time lag it by two hours, let us say, you take the S & P 500 at two o'clock, and you take it at four o'clock, and you calculate that correlation, you will get an answer something of the order of 80%, which is not a high correlation. That is an important issue if you are looking to add a hedge fund to your portfolio. At what time does the manager take his valuations? At what time do you take yours? Sometimes it is not easy to synchronise them, because the manager is not going to change his valuation time just to suit you. There are certain statistical techniques that can give you a better estimate of the true correlation, because time differences tend to understate the correlations. Remember where we came into this discussion. We are trying to find something that does not have its good times and bad times at the same time as your portfolio, so that you can cut the risk. If a low correlation figure is due simply to timing differences, you may be fooling yourself in the area of risk reduction!

I find kurtosis to be a useful statistic in the analysis of hedge funds. I am not saying that we major on kurtosis as a statistic for choosing hedge fund managers, but I like kurtosis, because I think that it is a good guide to the level of risk management in the fund. Kurtosis is just the volatility of volatility. If the volatility of a hedge fund varies a lot, you will pick that up in the kurtosis statistic, particularly if you have daily data. You need about 250 data points

as a minimum to calculate a kurtosis figure for daily returns — with fewer data points, the confidence interval around your estimate is so large that you probably could not make any reliable conclusions. Kurtosis is really a good measure of the extent to which you are going to get surprises in the future, surprises as in big negative returns that would not have been indicated by looking at the past standard deviation.

The penultimate part of the paper looks at the implications of the volatility management strategy of hedge funds. One should definitely spend some time understanding how the manager controls the volatility, because, basically, hedge fund managers get 20% of the return above the previous high. So, if you think about it, they have a call option. If they can get the return to run up a bit they can generate significant fees.

Let us consider someone managing £100 million. If he can run that portfolio up by 20% this year he will generate £20 million for his investors (before performance fees). He gets £4 million of that. Even if he holds on to the assets for only another couple of years, £4 million is not a bad reward for one year's work. The manager effectively has a call option against the investors. You need to understand his control and operation of volatility, because it is potentially in the manager's interest to pump up the volatility to get the risk up. Of course, if the volatility jumps up and down all over the place, then you get surprises.

There is no point in measuring average risk when you are talking to hedge fund managers. Average risk is not enough. You need to understand maximum risk. Drawdowns are proportional to maximum risk, not average risk — hence the interest in kurtosis. A hedge fund can have an average risk of 13% p.a., the same order of magnitude as the volatility of a managed fund, but, if the range of risk taking goes from zero up to 25%, and the manager gets hit by a bad day, as it were, when he is running at 25% risk, he is going to have quite a big drop in value or drawdown. If he then retrenches to average risk of 13% to get your money back, it is like losing money in the equity market when your portfolio is down 33%, and saying: "I have had enough. I am going to switch to cash. I will wait until the deposit rate makes it up. It just takes a long time." It is the same issue in hedge funds which lose money at high volatility, and switch to low volatility to recoup the lost return.

How do you watch out for these? Changes in volatility, changes in the underlying assets, changes in leverage, and changes in correlation are all pointers to changes in volatility. Changes in underlying assets and in correlations are already features of the traditional world. Leverage is too, to a certain extent. None of the hedges that traditional managers put on to manage their currency exposure to the dollar (to hedge the portfolio in the United States' equity markets) are perfect, so there is also an element of leverage in the traditional portfolios.

Here is a simple example to illustrate the point in the traditional asset world. Take the year 2000. The S & P 500 had volatility annualised at about 20%, whilst the NASDAQ 100 annualised at 57%. You invest with a manager who said that his strategy is to invest in U.S. equities. Suppose that he switches from the S & P 500 to the NASDAQ, because he thinks that the NASDAQ is going to do well that particular year (which it did in the early part). In doing so, he is changing your chances of a return for the year of minus 32.5% from one in 100 to one in five. Remember, if you change the standard deviation from 20 to 57, the probability of the event happening increases exponentially rather than just linearly.

Here is another more hedge fund type example, with the same volatility figures as I used in the previous example. The strategy here is: "I am going to invest your money in U.S. equities, and I can leverage the portfolio by up to two times." If the manager switches from unleveraged exposure to the S & P 500, to being twice leveraged on the NASDAQ 100, he changes the chance of you having a minus 32.5% return from one in 100 to one in three. So, you need to understand the volatility risk management strategy of the manager.

I put forward the idea of a hedge fund controlling its volatility, so that it is kept in a very tight range around a target level chosen by the investor. You cannot have constant volatility, but you can certainly control it in a tight range. The idea is that risk and return are inextricably linked, provided that you have some intellectual capital in the generation of return. As a hedge fund manager, if you maintain a constant level of risk, you ought to generate return as a

by-product. If your volatility is constant, then your average volatility is much closer to your maximum, so, your investors get fewer surprises. Past volatility or past standard deviation is a much better guide to the future. Fiduciary investors have a very good way to monitor a style drift when dealing with constant volatility managers. Style drift is where the manager does something other than what he promised to do. With a constant volatility manager, investors can see if he is pumping up his volatility to exercise that call option which he has against you.

I now consider a couple of issues for fiduciary investors, like life assurance companies and pension schemes. If you are a trustee of a pension scheme or the Appointed Actuary of a life assurance company, you have fiduciary duties. Somebody is going to sue a group of trustees or a life assurance company some day, saying that what you did for them in the past was not good enough, particularly when they have the benefit of hindsight. So, here you are, sitting in the dock. The barrister is saying: "Tell us why you invested the assets backing the policyholder liabilities in a Cayman Islands unregulated investment vehicle." While there is nothing wrong with an unregulated investment vehicle domiciled in the Cayman Islands, especially when you are talking to professional investors, but in the minds of members of a typical jury or of the judge, anything to do with offshore may be 'evil', and, if it is not regulated, it is not good. That is the first dangerous question that you are going to get. So, for fiduciaries, you probably have to look for regulated hedge funds. You may say that that is an anathema. That is not true. About 15% of all hedge funds are now regulated.

I look for daily, or at least weekly, liquidity, because it is no use having wonderful risk management systems and data coming in about what is happening, if you cannot do anything about it or if you are in a six-month lockup period or a 12-month lockup period. So, the higher the frequency of liquidity, the better. People in the hedge fund world will say to me: "But you cannot have daily liquidity and strategies that are trying to capture liquidity premiums." That is true, but such strategies tend to exhibit jump risk, and I query their appropriateness for fiduciary investors.

You certainly want to have plenty of paper backing up your theory that this hedge fund, or a collection of hedge funds, reduce the risk of your portfolio, and hence its return, because that is where we came into this discussion. You certainly want to have a clear and documented paper showing that you understood the risks that you were taking. For that you may have to hire specialist due diligence consultants in the hedge fund world. Also, you would want documentary evidence of how the risks and the rewards of the hedge fund were integrated with your existing portfolio and added value to it.

**Professor A. J. G. Cairns, F.F.A.** (opening the discussion)**:** Given that I am not an expert on hedge funds, I was a bit hesitant to accept the invitation to open the discussion of this paper on hedge funds. Nevertheless, the topic is one in which I was interested to build up a greater knowledge, so I agreed to take up the challenge.

The paper gives an excellent overview of the subject of hedge funds, and I quickly realised that there was much more to hedge funds than I thought. My previous knowledge of hedge funds focused on the following three possible characteristics: high return; possibly high risk; and low correlation with conventional assets. None of these is a prerequisite. For example, low correlation, as we see in the paper, is a good reason, in its own right, for a hedge fund to be attractive, because it is good for diversification of risk. Other hedge funds may be attractive because they use sophisticated techniques to deliver high returns, albeit, normally, with associated high risk. This, along with possibly low correlation, allows investors to increase their expected returns without increasing their aggregate risk.

However, the paper tells us much more about the additional characteristics, benefits and pitfalls of hedge funds. These three points are what to me are the main ones:

(1) Short positions are allowed, and funds can borrow to gear up long positions.
(2) The look of the portfolio can vary substantially over time. For example, the fund will choose to go long in a specific investment only when it is thought that the expected returns are high.

(3) Most hedge funds have restricted access, and place constraints on how quickly investors can get out.

The infamous case of Long Term Capital Management (LTCM) came to mind here, as an example of a hedge fund with these three characteristics. Indeed, its downfall was closely linked to the highly leveraged position that had been taken. Fortunately, LTCM is not a typical example, but it reminds us of the potential pitfalls. The paper tells us how we can avoid some of these pitfalls.

Section 3 develops the ideas behind why one would want to invest in a hedge fund. A pension fund manager has the opportunity to place funds with a variety of managers. The traditional managers A and B are closely correlated, and specifically A and B have their worst monthly returns typically at the same time. It is concluded that there is no real gain to be had from splitting funds between A and B. In contrast, the currency hedge fund has a much lower degree of correlation with manager A, and so the pension fund is able to reduce risk and possibly also increase expected returns.

A second issue raised in this section is the topic of FRS 17 valuation. The principle behind this is that the value of a set of liabilities is equal to the value of the portfolio which best matches the liability. Here we mean the portfolio with the minimum risk, and typically this is performed in a mean variance framework. The relevance of hedge funds to this issue is a very interesting one. The potential benefits of a hedge fund are twofold:

(1) It allows more accurate *theoretical* matching in combination with traditional pension fund assets.
(2) It achieves this within a portfolio that has a higher expected rate of return than before.

The result is that the FRS 17 liability value is reduced.

The example in the paper of the valuation side is quite striking. However, I do feel that the circumstances have been exaggerated for effect. Specifically, in the original set up, pre-hedge fund, the minimum risk fund is actually much more risky than could be achieved in practice. This means that, when the hedge fund is introduced, it forms a substantial percentage of the minimum risk fund. In reality, even without hedge funds, the minimum risk funds consist mainly of fixed-interest and index-linked bonds, and the portfolio risk is much lower.

If we now introduce a hedge fund, then its impact on the minimum risk portfolio is typically going to be very small. So, there will be only a very small change in the FRS 17 liability value. The real value of hedge funds is when we move a little further up the risk/return scale. Most pension funds do not go for the minimum risk position; they go for a more risky investment strategy. It is clear that the benefit of diversification using hedge funds comes into its own as we move up this scale. The more risk that we are prepared to tolerate, the more beneficial are hedge funds, allowing us, it is to be hoped, to achieve significantly higher expected rates of return for the same level of risk.

Modelling of risk has moved on a long way in recent years, from modelling returns on different asset classes using the traditional multivariate normal, with constant means, variances and covariances. This paper highlights the need for some of the more advanced models in portfolio theory.

Some of the features highlighted are common to all *market* data, rather than just hedge fund data:

(1) The empirical distribution of market returns is often skewed and *always* has fat tails.
(2) Volatility is stochastic over time rather than constant.
(3) Recent advances in theory have allowed us to move away from traditional to much more complex dependency structures.

I now illustrate these points with a mixture of real and simulated data. Figure D.1 shows the distribution of daily returns on the S & P 500 over the period 1960 to 1993, compared with the closest fitting normal distribution. The empirical data are clearly more peaked and have fatter

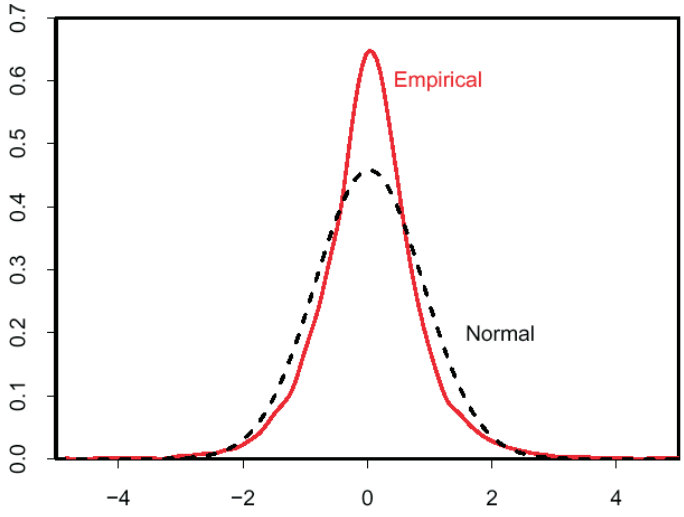


Figure D.1. S & P 500 index; daily log returns; empirical density versus normal

tails. In Figure D.2 we have daily changes in the index plotted against time. I have also plotted against this the RiskMetrics historical volatility, and you can see that this varied considerably over the period which we are considering. This stochastic volatility goes a long way — but not all of the way — to explaining the fat tails in Figure D.1.

Now, one of the central aims of the paper is to look at how hedge fund returns are correlated with returns on more traditional investments. The paper describes a number of simple techniques for checking correlation, such as the two-by-two matrix in Table 3.6. This is certainly a useful initial check, but the author could have spent further time developing this important theme. It would have been useful, for example, to see a full scatter plot of the monthly returns. This would

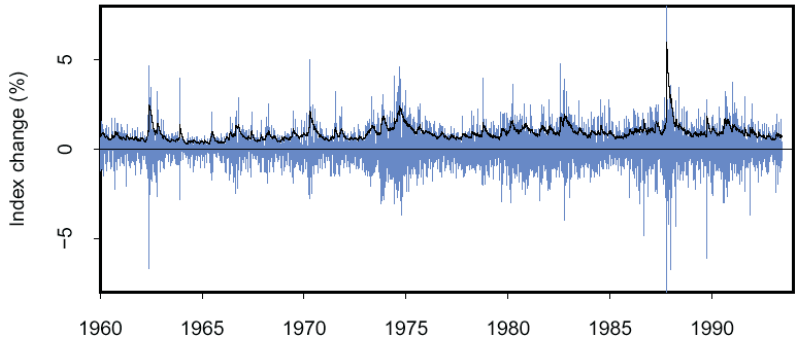


Figure D.2. S & P 500; daily price changes and estimated volatility

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have immediately shown up the lack of strong correlation between fund A and the currency fund. Unfortunately, I was not able to get hold of all the data to illustrate this, because the hedge fund data are apparently proprietary.

This is rather disappointing. First, I believe that readers should be able to reproduce the results in a Faculty paper; and second, is not this lack of transparency at the most basic level precisely what hedge fund managers want to avoid in order to encourage more investors? It is a well known economic theory that lack of information will reduce demand.

In the last few years there has been considerable research into how we can describe the relationship between different investments. This has been led by the research group at ETH in Zurich, headed by Professor Paul Embrechts. They have been investigating how different dependency structures can significantly alter the answers to some of the questions being addressed in the paper. Unfortunately, there is no time to discuss the technicalities, but I illustrate my point with two simulation examples.

The left plot in Figure D.3 can be thought of as representing the simulated returns on two traditional managed funds. In contrast, the right plot in Figure D.4 represents a traditional fund versus a hedge fund, with the dependency structure simulated using the non-central $t$ (NCT) copula, rather than the normal copula. These plots look quite different. However, there are some very important similarities which will certainly not be obvious to the eye:

(1) In both cases the individual investments have, *in isolation*, a normal distribution. We can easily incorporate fat-tailed distributions if we want to.
(2) If we calculate the traditional linear measure of correlation, both come out at 0.42.

This illustrates, very nicely, my point that linear correlation can be a fairly useless measure. In Figure D.3 it works quite well, because this is a traditional bivariate normal distribution. In Figure D.4 it works very poorly, because I have used a very different dependency structure to simulate joint returns. Thus, we can see here that returns look strongly positively correlated when they are both positive. In contrast, we can almost detect that, when the return on the traditional fund is negative, then the hedge fund return might be negatively correlated.

It is interesting to estimate the proportion of pairs of outcomes where both funds are in the bottom 5% (Region A). In Figure D.3 this happens just over 1% of the time. In the more complex plot, on the right, this disaster scenario is much less likely. In contrast, a pair of extremely good returns (Region B) is much *more* likely with the hedge fund example than with the traditional one.


Figure D.3. (Z1, Z2) bivariate normal with correlation 0.42

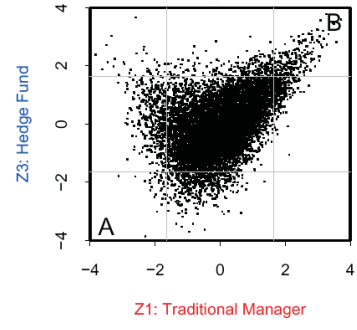


Figure D.4. (Z1, Z2) NCT copula; normal marginals with correlation 0.42; DF = 3, NCPI = 1, NCP2 = 4

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I do not have any real data to back up this example, but I would not be surprised if there are some hedge funds which do exhibit this type of behaviour. For example, some hedge funds trade in volatility. These can be structured so that returns are positive if there is either a large positive or negative return on the main stock market index. I have digressed a little, but I think that this is a very important topic which needs to be properly discussed.

I now come back to the modifications that we need to make to portfolio theory. At the hedge fund level we have to modify things further still, and this is amply and very nicely discussed in the paper. A given fund will often have a time varying strategy, which takes advantage of perceived opportunities in the market. Generally speaking, this will only add to the stochastic nature of the fund's volatility compared with a traditional fund. Added to this, hedge funds have shorter histories than traditional funds, which means that there is considerably more uncertainty in parameter estimates. *Everything else being equal*, greater parameter uncertainty should mean lower investment in a hedge fund.

The paper discusses these issues in great detail. The overwhelming message coming out of the paper is that you should only invest in a hedge fund if you have made considerable enquiries in advance. These are given in detail in the paper, and should be essential reading for potential investors. For example, you must ask the hedge fund managers to give broad information about their *modus operandi*. Do they rely on four or five big trades each year, or do they make their money from lots of small trades? Is the manager reward structure optimal from *your* point of view? Does the nature of the fund mean that the returns distribution will be positively or negatively skewed? These questions should allow you to refine your returns' distribution.

So, it may well be that a hedge fund has a higher expected return, but it is difficult to be sure of this. In contrast, the low correlation that a hedge fund will typically have with a traditional fund is easier to establish. For me, this is the main selling point on hedge funds.

To sum up, I found that many questions were raised in the paper and some were not answered. However, that is not a bad thing, because I found that the paper was a very interesting and stimulating read.

**Mr C. McLean, F.F.A.:** As possibly the only actuary in Scotland managing hedge funds, my first point — apart from congratulating the author who has delivered a very erudite paper which works at a number of different levels — is that, while this would appear to cover only hedge funds, many of the points about risk, market efficiency and some of the other issues apply equally to conventional funds. Indeed, I think that the boundaries are gradually becoming blurred. Many life assurers now, whether they are running endowments or investment trusts, or just trying to manage gearing actively, use futures and other more sophisticated instruments. So, hedging strategies are used day in and day out by some of the very conventional savings media with which we are all familiar, and I think that there is widespread application, and not just to hedge funds.

I begin with some of the caveats about the data analysis. As the author has rightly pointed out, modern portfolio theory is a useful construct, and much useful analysis can be derived from it, but it is increasingly found wanting in some particular areas. It is important to remember that stock pricing is not just a numerator or performance problem, it is also a denominator or risk problem. In fact, as is set out in Section 2.3, you cannot rely on past performance information. That applies, not only to hedge funds, but also to all other funds, and also it does mean that stock prices on any particular day do not capture correctly all the information on value. It equally flows from that that they do not capture all of the risk information. Here are some examples of this. Rolls-Royce, for example, a FTSE 100 company, moved 15% in one day last week. I could point to other companies over the last year which, despite a very stable share price, have then seen dramatic moves. Adecco and Goshawk recently each suffered 50% share price falls, without any real prediction at all before in their price behaviour. So, the fact that there are some failings in modern portfolio theory impacts some of the risk analysis, and it is those particular failings that, very often, hedge fund and other active managers are trying to exploit.

The analysis that the author starts off with and the matrix of correlations make very good points. A point that has been picked up, both by the opener and in the paper, is how unstable some of these correlations can be. One of the unfortunate factors is that correlations tend to converge at times of extreme market moves. We saw this in 1998. Already there has been a mention of LTCM. It was not only what was happening in terms of volatility premiums that impacted LTCM, but also simultaneous moves in the Japanese yen and in Russian bonds. Many different issues converged at the same time.

Just to digress; at LTCM the problem was a previous return of capital, and, indeed, the banking system is now much more working on inter-relating capital employed and risk. However, some of the failings, like Barings and LTCM, could be seen as primarily an issue of having insufficient capital. By contrast, Adam Bank, following losses, was very promptly restored with an injection of capital. So, I think that the capital employed is very closely inter-related with the risk. That was where LTCM failed, having returned capital.

Not only do we not necessarily understand all the correlations, but we do not quite know how they all inter-relate. In fact, the author uses an algorithm, in Section 4.2.1, to relate annual and monthly deviations. I think that it is important to remember that this is just a rule of thumb. It is a convention rather than something that has a real statistical meaning. Ultimately, it relies on the linkage that we have between different time periods. Monitoring daily observations, even real-time, and observations on our own hedge funds, do not relate in that automatic way to monthly returns. Clearly, the periods are not independent.

So, I think that the link between monthly and longer periods has quite important consequences for drawdown in hedge funds and also in how you manage risk. One example of this would be when you manage banking risk, where there is an assumption that you do not link success or failure in successive periods, because a trader who fails or runs over loss limits would immediately have his desk closed down. Of course, we know that that desk would be reopened. There must be some linkage to another event, and drawdowns do not necessarily stop where predicted by these algorithms.

The correlation coefficients that are pointed to by the author in Section 4.3 are, indeed, often unstable over time, and it is also very common that there are not sufficient data to assess these extreme events. Extreme events are rare, and are very difficult to derive from normal times. There are reasons why long/short funds change their correlation. Some of the pressures put on funds by the owners of the funds, as funds of funds, does encourage a market correlation, and I think that the author makes the point well that sometimes looking pictorially at data is quite useful. Sometimes, if you look at just the pattern of returns of some of the funds of funds that focus almost entirely on long/short, they look very similar to some of the individual funds that you can see, and most salesmen can see that without understanding kurtosis. They can actually see, pictorially, that, in time, these individual long/short funds are converging with the fund of funds, and the fund of funds is encouraging a convergence between managers. It is important to remember, also, that many of those managers do not operate too far from each other in the West End of London, and they do compare notes from time to time or, at least, their brokers do.

One example of this type of convergence is when the market has risen strongly, as happened in 1993, 1999 and again in 2003. There is a tendency then for the successful model of long/short funds to start to move and to change to become more like a long fund. The successful model of a long/short fund last year would have to have been at least 50% net long. So, this change over time does cause increasing correlation, and reduces the risk management that you might see from past data.

The role of prime brokers is described in Section 5.2.1, and certainly these are functions that many prime brokers carry out. Some will even do some more things, like capital raising. I think that it is important to note that some prime brokers do less, so that it is possible for hedge funds to pick from that menu and have fewer things. As the author pointed out, about 25% of hedge funds are now regulated, and some hedge funds have moved onto a model where there is separate administration, perhaps separate capital management, and, in that way, quite a lot of risk

reduction. They have moved much more to a mutual fund type model rather than to the former model on which the prime broker did pretty much everything, including generally telling you that anything that you bought was worth exactly what you paid for it. It is a bit like buying jewellery — it is worth exactly what you paid for it in the same shop where you bought it, but not elsewhere.

In Section 5.3.1.3 there is some talk about liquidity and jump risk. Again, this is really interrelated, but not necessarily with information that you can capture in the past. It depends on investor behaviour. One attribute of the market's behaviour is it does tend to search out — and hedge fund managers in particular do this — discontinuities and asymmetry.

The real risk in the type of example which the author showed of the option strategy is that it is not just a problem if the market moves beyond the level at which the options are triggered. By the time when the market has started moving quite close to that level, the gamma effect will have changed the option pricing, so that you are forced to act. If you have any risk control mechanism, you are forced to close down that trade or close down one side of it. The market tends to move around and to exploit these particular inefficiencies. That is why we end up with stocks like Rolls-Royce moving 15% in a day. If a stock moves 5% or 10% in a day, it is likely to repeat the behaviour.

In that way, sometimes, Value at Risk can actually add to total risk, because Value at Risk is a system for closing down positions or setting limits, and the market will work that out. It can even impute that without knowledge, by seeing the way in which stocks behave. However, of course, many hedge funds operate within a prime broker structure that is really acting as judge and jury on these things at the same time. Prime brokers have full transparency, can see the trades, and can almost close down a trade as soon as they recognise that there is too much risk. So, there is some danger in some of those very full prime broker relationships and using entirely a Value at Risk system.

I disagree with the opener that there are not sufficient data to assess many hedge funds. I think that the fact that there may not be transparency publicly is designed to ensure that only sophisticated investors are capturing this information. However, many hedge funds will do what the author has suggested, and provide daily information. What is described by the author as the intuition that hedge fund managers seem to have, I do not think is innate in any way. It comes from hedge fund managers — typically as we do with both hedge and conventional funds — who monitor contributions on a real-time basis, which gives much more information about how a portfolio of individual stocks behaves almost minute by minute. You collect, over the course of months or a year, much different behavioural information. So, it comes back to the economics example of the expert snooker player, who does not need to work out the angles with a protractor, but does collate many observations, and ends up with an intuitive expert feel of how the ball behaves. There are usually many more data points available in hedge funds. I think that that is why those who invest generally believe that they offer lower risk.

There is another interesting aspect of hedge funds that relates to conventional funds. It is the convenient symbiosis that exists between conventional funds — particularly those which are passive funds, index driven or closet index driven. They, by themselves, tend to make the market less efficient. They behave in inefficient ways in buying stocks, because they have gone up irrespective of fundamentals. One example would be a stock like Antofagasta, now the 89th biggest in the United Kingdom. It trades very little; has almost doubled in the past seven months; but will be bought by index funds as it enters the FTSE, as undoubtedly it will next month, irrespective also of having one of the lowest corporate governance scores in the U.K. So, there are inefficiencies and anomalies being created, and some of the hedge fund managers are just more astute at spotting them. However, they both need each other, because the operation of the hedge fund manager removes some of these anomalies and helps to create more market efficiency, and, to an extent, I think that there is an optimum level of activity between the two. Undoubtedly, a couple of years ago there were too many long/short managers, but now we have investors passively holding some of the largest under-performing companies, and there are asymmetries in the market as well. Where companies are likely to raise more money, whether it is

convertibles, bonds or equities, hedge fund managers can be quite astute in laying off that risk and spreading it around. At times we can see signs of that in the market.

A couple of years ago a new issue by the pub operator Punch Taverns was pulled, and immediately a number of the other pub businesses went up in price. It was clear that the IPO risk had been laid off elsewhere. Hedge managers can spot these discontinuities in fund raising, and generally lay the risk off in correlated stocks. The same would apply to public offerings coming off lock-ins, or any other discontinuity in the market. Hedge managers are generally able to exploit behavioural anomalies by dealing more flexibly.

**Mr I. Collier, F.I.A.:** This paper gives our profession the opportunity of talking about this form of investment where, in the past, maybe, our profession has been slow to move. It is not just our profession, but our country as a whole, which is slow to embrace hedge funds, compared to the U.S.A., some parts of Asia and many parts of Europe. Why, I am not too sure, but maybe the members of our profession have had something to do with that.

I am a former investment banker. I ran teams of proprietary traders. What is a proprietary trader within an investment bank? Basically, he is taking market exposures and he is trying to make as much money out of the marketplace as he can, given the risk restraints placed on him by his employers and by the capital limitations, the size of the trades, that he can do. He looks a little bit like a mini hedge fund. Of course, banks do not call them hedge funds, but they trade in similar ways. There are differences, but I shall not go into them now.

Having run a team of proprietary traders, and understanding the language which they use, I probably understand the spin that a hedge fund manager can put on dealings. For my own particular portfolios, I put a great deal of my portfolio into hedge funds or, more accurately, funds of hedge funds.

I actually believe that the hedge fund industry is paid and rewarded to take its own view and to be proactive. That does not necessarily mean, of course, that it is going to make any money. However, if we assume — and it is a wide assumption that we cannot always take — that the hedge fund manager does have ability and can add value, then, in my own mind, I have no doubt that he will perform better than a traditional long-only manager.

Despite that, I would not attempt to select an individual hedge fund for my own particular portfolio. I do not think that I can keep on top of it. I think that it is a specialist skill, and, for what it is worth, I would go for a specialist fund of funds manager. The author talks about funds of funds. All actuaries are very concerned about fees, and people are scared about the prospect of fees on fees, but I am not. I believe that, if they are performing a function and performing a skill, then why will we not pay them a fee to do it?

I believe that hedge funds should not be considered as fund managers who can also short stocks or fund managers who can also use derivatives, but that each hedge fund is an operational business in its own right. If a hedge fund charges you a 2% management fee and up to 20% as a performance fee, and if you think that this is a high expense ratio compared to other operational businesses, then you are miles out. Actually, in terms of an expense ratio, it is rather low.

So, I would not invest directly in a single hedge fund. I would look for a fund of hedge funds, because I believe that the diversification within a fund of hedge funds, particularly a fund of hedge funds that has many different strategies, can reduce risk quite dramatically. There is compelling evidence of showing very good returns by funds of funds, but with a great reduction of risk.

I am also on the Working Party on Absolute Return Funds. We put forward a survey to all life office Appointed Actuaries, and mentioned surveys that had been conducted with pension schemes. It is quite clear that there is a great deal of cynicism around on hedge funds. In my mind, the cynics have not necessarily looked closely at the evidence. This paper is going to help to get people to talk about the subject, help readers to understand it, and allow them to feel less suspicious.

The surveys confirmed evidence which I have seen in my own business. Those people who have invested in hedge funds, or more particularly in portfolios of hedge funds, have only put

their toes in the water. They have found that the water is actually quite mild, and now they are looking to go ankle deep. If they follow the experience in other parts of the world, they will probably go knee deep in the not too distant future. So, my advice is not to invest directly into hedge funds, but to look at funds of hedge funds, because I think that they have enormous diversification attributes for all of us, whether we are individuals or working on behalf of an institution.

One of the things that people have told me about hedge funds is that there is a capacity constraint. This capacity constraint is that there can only be finite alpha, that element of added value from trading strategies or exposures in the financial and capital markets. Therefore, if you have twice as much money chasing the same alpha, then each hedge fund can only get half the reward. I do not necessarily believe that. I do not believe it, partly because I do not believe that every hedge fund manager is able to extract alpha, and you might find that the more money that comes into hedge funds, particularly the poor hedge funds, then the more other hedge funds and the rest of the market can take advantage of that.

What do we mean by capacity? I am told that you can put only so much money into hedge funds, but, of course, there are insatiable amounts that you can put into equity markets. Let me tell you that, yes, you can always put money into equity markets. You can put money into equity markets until the FTSE Index gets to 6,800, and you could have put in more, but what have you bought? You have bought something which is simply overpriced.

So, you can always buy more equities. There is never a capacity constraint in equities, but you can lose half of your money in equities, because all that you have done is to buy something which is overpriced. You can never buy an overpriced hedge fund, because the hedge fund trades at its net asset value, so, at any moment in time, you are buying the value of that fund. Perhaps too much money chasing hedge funds will reduce the absolute returns that they provide, but you are not going to buy something which is overvalued. Thus, I do not swallow the capacity argument.

I now comment a little on the closed ended structure for hedge funds that the author mentions at the end of his paper. Most hedge funds are open ended. They are a little bit like unit trusts, as we know them, but there are disadvantages. For a life office, you will know that hedge funds are considered by the FSA as being inadmissible. Why are they inadmissible? It is because they are full of derivatives, and, on a look through test, those derivatives do not satisfy the rules of IPRU (INS).

A closed-ended structure, which we used to call an investment trust, should be considered as a security, and hence should be admissible if it is correctly listed. A closed-ended structure should be admissible in life office portfolios.

Where U.K. taxpayers are buying funds of hedge funds, there is a taxation issue. Because it is an unauthorised collective investment scheme, we would be taxed on income. The closed ended structure for private individuals — and any of you who manage money for high net worth individuals will know — would be, as a security, taxed on capital gains. That, in itself, is a great advantage. As a closed-ended structure it will also be authorised by, maybe, the UKLA, and should have an independent board, which would ensure that the company is managed correctly. It should also have daily liquidity, as the stock price is made by market makers on the London Stock Exchange. As a London listed instrument, life offices may also be able to link listed hedge funds to life policies. Perhaps we can now get the retail sector into this form of investment through linked life policies. So, there are clear advantages of the closed-ended structure.

**Mr I. H. Beattie, F.F.A.:** I work for a consultant whose job is to give advice to pension funds. We are very strong proponents of hedge funds for pension funds where they have sufficient governance resources in terms of time and expertise. Our primary aim, in terms of recommending hedge funds, is not for increased returns. I remain unconvinced that you will get increased returns from hedge funds compared to equities (after deduction of fees, and allowing for the impact of fund closures, for whatever reasons). It really is a risk reduction strategy through lower volatility and lower correlation with equities.

Towards the end of his introduction, the author, when talking about a fund of funds, put up alternatives, such as making up your own portfolio. I think that this would be impractical for most institutions. Certainly, when we have talked to investment banks, they believe that you need about 30 different hedge funds to give you the diversification across the various classifications of hedge funds, such as: event risks; hedge funds; long/short funds; relative value funds; or macro-strategy funds. It is a fact that the monitoring and the initial investigation into hedge funds would be too much for most institutions. However, the main task of people like ourselves is to educate the trustees about hedge funds. I should like to thank the author, because a paper like his will help us in doing so.

**Professor A. D. Wilkie, C.B.E., F.F.A., F.I.A.:** There are two points that struck me, one a technical one and one of a different sort. On the purely technical one, I think that the author's description of the statistical analysis is very useful. The additions of the opener to that are also helpful. A couple of points within that: Mr McLean mentioned the point about shifting from monthly to annual, multiplying the standard deviations by $\sqrt{12}$. That, of course, is quite correct if they are independent, but, if the returns from day to day are correlated, then the appropriate multiplication factor may be quite different. Nowhere does the author discuss analysing the returns from day to day, which may, or may not, be informative, but it is certainly worthwhile having a look. You could look at the autocorrelations on a daily or monthly basis, and see whether you can learn anything from that. Typically, in the market, you expect them to be independent from day to day, but not necessarily so, and the hedge fund might not be in that position.

Secondly, within the statistical analysis is the question of extreme values or outliers. Very often, when you are carrying out a statistical analysis, the outliers are a bit of a nuisance. The opener showed a couple of scatter diagrams with correlation coefficients. Now, imagine another one, where most of the items are pretty much clustered in a circle in the middle, but there are one or two extreme outliers at far distant corners. These can have a disproportionate effect on the numerical correlation coefficient, and can push it up to quite a high value, certainly of the order of 0.3 or 0.4 that the opener mentioned, but you know that it is all being done by these extreme values. Typically, one might want to discount those values. A way of doing it is by pulling in extreme values and not counting them as bigger than two standard deviations, or just missing them out altogether.

On the other hand, with the hedge fund, that may be precisely what you want, an extreme negative correlation in unusual circumstances. An example is the value of my household insurance policy, which would not be very well correlated, probably with a zero correlation, with the value of my house — unless I have a fire. On the one occasion when I do have a fire, I want to be sure that there is the right sort of very large negative correlation that compensates me. The extreme outliers may be just what you want in some circumstances.

Now, on a different point, the type of investments that go into hedge funds are, in principle, the kind of things that a large investing institution, like a life office, could, if it were not for many other constraints, do on its own account. I think that it is worth while thinking through the pros and cons of a large life office running its own hedge fund. Mr Collier mentioned some aspects of that; the managers doing special little things. There are various things that one would need to consider about this. Regulation and whether the assets are admissible are relevant, but you could set up a subsidiary company, and run it through a subsidiary. If you have your own hedge fund, you have different fees to pay, you have to employ staff and make sure that they do the right thing. On the other hand, if you do not have the fees to pay to the hedge fund managers, then the conflicts of interest would be different ones. It may, or may not, be worth it. Taxation and limited liability would need to be thought about.

Do the investors in hedge funds have limited liability?

**Mr Caslin:** If you invest through what is called a managed account, you do not have limited liability. If you invest through a limited liability vehicle, you have limited liability. So, you can structure the method of investing to have limited or unlimited liability.

**Professor Wilkie:** It may be all very well employing your own staff to do things, but if they are called Nick Leeson you might be a little worried if you have unlimited liability. That could be a disaster. Equally, it is uncomfortable for a life office if it has a subsidiary company which runs into serious debt, and it then has to say: "Sorry, this was a subsidiary. We are not paying the bills.'' That could be embarrassing.

The whole point about long and short funds is that it is extremely easy for the aggregate value of such a fund to become negative. I do not know how often it happens with hedge funds, and possibly they are run cautiously enough for this not to happen. However, a long only investor cannot end up with negative values; a long and short investor can.

I think that there are other considerations about having your own in-house hedge fund. The main one, probably, is that the expertise is in the hands of other people at present, and it is better to employ the experts elsewhere than to employ them yourself.

In the 1930s, life offices started buying investment trust shares as a good way of getting into equities. By the 1970s, they had a superfluity of investment trust shares, and were much bigger than the trusts whose shares they held. They really wanted rid of them, and they wound them up at that stage. There are cycles in this. Hedge funds are a good way of getting into a particular type of interesting investment, if that is the way that you want to go. We have heard the advantages of it. In years to come, it may be that life offices will swallow them up. Pension funds probably would not, because, typically, they run through managers in any case, and the trustees do not want to act as their own investment managers. That is a different consideration.

**Mr R. Burns** (a visitor)**:** I feel that the comments of Mr Collier on the expense of the operation passed rather lightly over an area which is close to my heart. It seems to me that the fees which are charged on these funds are quite egregious. Two and 20 seems an absolutely grotesque amount to look after other people's money. One and 20 is bad enough; two and 20 seems ridiculous.

The expenses are not just in what a manager may, or may not, get out of it in a good year. The turnover in these funds is far higher, in my observation, than in traditional funds. The relationship with the prime broker, as I understand it — and this is not on the basis of any personal knowledge — is such that it is an extremely profitable business for the major investment banks of this world, and that profit can only be coming out of the pockets of the hedge funds. No doubt the managers are extremely clever and able to make profits not available to the ordinary man, but they are sharing them to a considerable extent with the brokers — at least that is what appears, looking at it from the outside. From that point of view, it seems to me that the concept of the fund of funds is really ridiculous. I find it extraordinary to see how there can be successful investments for the ultimate investor, and the closed-end funds of funds, which were mentioned, in so far as these funds have been floated in the London Market, have not been noticeably more successful as investments than any other investment launched at that time. I am sceptical about the whole thing.

**Mr Beattie:** I think that Mr Burns is looking at this the wrong way. Like everything else, costs are one thing, but you have to look at the benefit to your client. If, at the end of the day, your net return is not reduced that much and your risk is reduced a lot, then it is still worth investing in certain hedge funds.

**Mr Burns:** Could you not get there just as easily by putting your money in the bank?

**Mr J. Hastings, F.F.A.:** I endorse what Mr McLean said. I think that the statistical techniques that are displayed in the paper can be used much more widely than purely in the analysis of hedge funds. I have a few concerns about hedge funds, which are not necessarily specific to that type of instrument alone. I believe that there is investment skill out there; I believe that you can find managers who can exploit that skill; and I think that you can find them both in relation to long-only managers and also in relation to managers of alternative asset classes.

However, I believe that capacity is a huge issue, and I do not think that it is merely an issue for hedge fund instruments, for long-only managers capacity is also an issue. Managers who are prepared to constrain the amount of assets which they manage will, I believe, be shown, over time, to be able to demonstrate better and higher returns than managers who are just asset gatherers.

I have some concerns about the charges embedded within many hedge funds, not only fixed and performance fees, but the amount of money that is spent in broking fees, either in terms of the trades in which they are engaging or in terms of the amount of money that is paid away to prime brokers.

That raises quite a lot of agency risks. There are also big concerns about the talent drain that is taking place within the industry. Certainly, there are a number of people with talent who prefer to work in a more loosely regulated environment, not necessarily poorly regulated, but less bureaucratic and probably where there is a much more direct level of salary or reward that can be obtained by working in a smaller enterprise. Nevertheless, I think that people who manage long-only funds successfully can quite easily come unstuck if they are operating in an environment with looser risk controls, or where they are called to run short positions, or to manage and exploit the risk/reward trade-offs required within the hedge fund industry.

I am alarmed by the number of hedge funds and the rate at which they wind up. Something like 40% of hedge funds do not last five years, which seems a bit alarming.

There have been some discussions about whether the U.K. regulatory authority has been remiss in not opening up this market. I do not believe that it has been remiss with relation to the retail market. I know that retail hedge funds are very popular in many parts of the world, but I would be concerned if the FSA were to award some flag of appropriateness by making hedge funds open to the wider retail community. I definitely think, however, that we need to do something to bring the industry on-shore into a more regulated environment. For a professional investor class of funds, I think that it is entirely appropriate.

**Mr McLean:** Picking up on what Mr Hastings has said, I think that it is important to remember that, very often, in trying to project past records or fund analysis into the future, the personnel may have changed. Among mutual funds, we estimated recently, using the Fidelity website, that no more than 5% of individual managers had a ten-year record with specific funds. So, in the conventional industry the linkage and continuity of personnel is actually quite limited. On hedge funds, while it is true that there is a high level of fund mortality, the survivors are usually linked with the same trading individuals.

I enjoyed the comments earlier from Mr Burns. I had not thought that we would actually discover a manager here tonight who did not own Shell or Glaxo. Conventional funds can have risks and overpay managers as well. Conventional managers can earn fees for buying some FTSE 100 stocks that prove very risky — just like hedge funds.

**Mr G. M. Bagot, F.F.A.** (closing the discussion)**:** I found this paper was very well laid out, and I liked the examples provided throughout. I think that there is one thing that can aid understanding in the first place: simple, but effective, examples, and they are provided in the paper.

It is particularly useful and practical, and is a good introduction for any member of the profession wanting to know something about hedge funds and how they work.

At the beginning of the paper was the definition of a hedge fund. I agree with all the characteristics specified, but, almost inevitably, this is exposing a conflict that exists between hedge fund managers and trustees, consultants and all the advisers, which has been hinted at in the discussion. That is something called transparency, and it is one of a number of pressures on trustees of pension funds. They need to know more rather than less. Unfortunately, some of the hedge funds are offshore, where they can be less transparent than might be required. For the avoidance of doubt, transparency to me means full disclosure of holdings and transactions, timeously.

We are now in an environment where there is more regulatory supervision, and there will be even more, so the fact that some hedge funds are offshore will limit their usefulness to those in the U.K. The other thing hinted at in the discussion is that pension funds and insurance companies now have to be invested in much more marketable securities, with an eye on payment dates and maturities, for liability matching, etc. The use of hedge funds with limited time horizons may make them less appropriate for some of these funds.

Picking up and developing the points made earlier, I think that there is agreement that pension funds and insurance companies are generally *the* long-term investors in almost any country. Premiums from all of their individual customers provide most, if not all, of the capital for long-term returns. Long-term positive returns have always been delivered. The problem has generally been the shorter-term or intermediate valuation of assets versus the liabilities which can show up deficits. Witness the markets in the last three and a quarter years to March 2003. Also, I have to add that positive returns have to be earned, otherwise no one would invest. To date, all well diversified long-term investors have gained. Hedge funds, however, seek to enhance returns and avoid negative returns. They seek to reduce volatility of returns, not increase volatility. For every hedge fund investor gaining, it seems to me that the counterparty has lost. It appears to be a net zero-sum game. In fact, it is actually worse than that. There is a cost. Somewhere in all this hedging activity someone is extracting a fee.

When I was last in the business of examining funds in some detail, I came across some long-only funds which were active traders, with bond portfolios being traded ten times their market value in a day. That is, trading in the year amounts to over 2,000 times the market value. A typical long-only pension fund in the U.K. might trade its bond portfolio at a level of 100% of its market value. Somebody, somewhere, is extracting a great deal of money from that, even though the costs of each individual trade may be small.

Thus, I would have to say that any long-term investors, wanting to venture into this area of hedge funds, have to do so with their eyes wide open. They have to understand the nature of the product being contemplated in detail, including the anticipated trading levels and costs. The author has been very particular about this.

There is another shadow cast by Mr Paul Myners, in his report: 'Institutional Investment in the United Kingdom: a Review', and published by H.M. Treasury in March 2001. He has not been referred to during this discussion. He defined some ten principles for pension funds, codifying a model for best practice. The first principle was that decisions should be taken only by persons with the skills, information and resources to take them effectively. Where trustees elect to take investment decisions, they must have sufficient expertise even to be able to evaluate critically any advice which they take. Even with a consultant advising them about hedge funds, the trustees themselves have to be satisfied that they understand what the consultant is saying to them. I thought that they should have done that many years ago.

The third principle focuses on asset allocation, which would include hedging. Mr Myners says that a level of attention is required that fully reflects the contribution that it can make towards achieving the fund's investment objectives. Principle number eight is that performance measurement is required. Principle number nine covers transparency, including projected investment returns on each asset class and how the strategy was arrived at. These are all very demanding principles to adhere to, and it is difficult to see how hedge funds can be fitted into this framework, unless they actually take considerable steps to do so.

Coming back to the question of measuring performance, given my own background in performance measurement and analysing contributions to relative performance, measurement of hedge funds and derivatives of any sort has been a problem almost from the time when they were first issued. Given the pressure to measure, it seems to me that the measurement problem should also be resolved before investing in hedge instruments. The concept of calculating time-weighted rates of return (TWR) for conventional assets will not apply to hedge funds. The average capital employed on which returns are based can be both positive and negative. Generating a capital gain by going short (negative capital employed) produces a negative percentage return! It is difficult to assess whether money has been made or lost when results are

presented using TWRs. It cannot be done. The only way to assess results is to list the gains and losses in value terms. That, too, has been hinted at by some speakers.

Everybody is well aware, too, that past performance is a limited guide to the future. This is even more true with hedge funds. It is actually more relevant for them to explain how and why they have done it. It is this question of transparency again, and quite right too. I am a bit of a crusader as regards transparency. I think that all funds, particularly where they are offered to the retail public, should make their portfolios and trading history available over the internet to their investors. That does not mean to say that they have to do it on a daily basis. Trading information might be delayed three days, seven days, or a month in some circumstances, but I think that this is the most open way to do it. Hedge funds could, and perhaps should, take the lead.

It has already been mentioned what the FSA could, and should, do on transparency. I believe that, if full and timely disclosure or transparency had been in existence, then the problems with the split capital investment trusts would have been reduced. In fact, they may have been prevented altogether. The lesson is there for hedge funds.

Long-term funds are always being encouraged to maximise returns with little or no increase in the risk. One of the ways in which they have done so is to stock lend. Funds receive a small premium for allowing their stock to be borrowed. Pension funds and insurance companies could adopt such an approach with hedge funds. I refer you to Figure 5.1, where there is a small return from option premiums within this 2.5% standard deviation range, but there are unquantifiable losses outside the range. It seems to me that pension funds and insurance companies might forgo that small premium, even some of the upside, for that protection from unquantifiable losses.

This has been tried. I think it was called portfolio insurance. It did not work, because the counterparties could not deliver. The lesson for today is that, until investors really understand the nature of hedges in place, they should avoid hedge funds and derivatives. When they do, they should be used to advantage, and not just to produce liquidity for the hedge fund traders.

A further point made in the paper, and by a number of speakers, is that of the reviewing of risk measures over time. These numbers can, and do, change quite considerably, and the comments and advice in the paper and by speakers should be heeded.

This paper is required for our members. It has generated a considerable amount of discussion, and I am pleased that it has generally been favourable. It has, I hope, whetted the appetite of more members to learn about, and understand, derivatives and hedging, and to investigate the best ways to use them to maximise return and to reduce volatility. It is important to protect the capital values and income streams of the funds for which many of us are responsible in our professional lives. Our strapline says: 'Actuaries make financial sense of the future'. I think that we can say this if we understand derivatives, hedging, and their potentially beneficial application.

**Mr J. J. Caslin, F.I.A.** (replying)**:** I will try to summarise some of the points that arose in the discussion. On fees, let me give you an analogy. Supposing that you are a traditional fund manager and you are charging 0.5% to manage U.K. equities. If you think about it, most of the management is hogging the benchmark, because that is what you promised your investors. You are not doing anything wrong by this. You are taking a long position by, let us say, going long on pharmaceuticals (increasing your exposure to pharmaceuticals) and short on financials (reducing your exposure to financials), or something like that.

Effectively, what is the investor paying his 0.5% fee for? He could replicate 90% of the management that he is getting by buying an exchange traded fund, which might cost him something of the order of 10 basis points. Then, he is paying 40 basis points for the 10% extra management, so he is actually paying 4%, which is something in the region of what you pay when you pay one and 20 for hedge fund management.

On the point raised by Professor Wilkie about limited liability, some of the very sophisticated institutional investors, when they invest in hedge funds, do so through a vehicle known as a

protected cell company. The vehicle, itself, would have limited liability, but, for each hedge fund strategy, it is invested through a protected cell. If your long/short equity manager blows up, it does not affect the rest of the hedge fund portfolios that are within the umbrella of the vehicle through which you are investing. Each individual investment is locked up as a protected cell. You can do this in Ireland using unit trusts, or you can do it in Guernsey, using protected cell companies.

Professor Wilkie also spoke about extreme values. I like extreme values, because they give you an opportunity to talk to the hedge fund manager about how those extreme values occurred, that is days when you had really big returns or really small returns. There is a lot of information in those days about how the risk was managed on those days. It may give you hints about how the risk is managed on other days as well.

On the point about scaling up volatility from monthly to yearly, I could not agree more. In fact, I did not draw the statistical significance, but I have mentioned in the paper, in a number of places, that some hedge fund managers — and you have to look out for this, as it changes the risk of your hedge fund portfolio — let us say, start in February, and in the first five days of February they are up 6%. They may say: "Right, that is it for this month, let us close the book and we will just let the month roll on. We will put the money in cash." Then we come to March, and they open them down 3% after a few days. They say: "That is enough. We do not want to lose any more this month."

Those observations are not independent. That is definitely a case for not scaling using $\sqrt{12}$. I do not make that particular point in the paper, but I do make a point about asking the hedge fund managers if they close up the shop after they have made 6% for the month, or they go down 3%, or whatever are the particular numbers in which you are interested.

I agree with the opener on the point about linear correlation. I found correlation totally useless as a measure, because all that it is telling you, if you have high correlation, is that two managers are moving away from their average at the same time. This is a very difficult concept to understand. That is why I developed the two by two matrix, and also why I like to look at how the hedge fund performed on the best days and on the worst days. That is much more useful than linear correlation. I agree with the comments of the opener about the scatter diagrams.

On the issue that was raised by Mr Collier on the profession losing out, I know of at least one pension scheme that has over one billion euros under management, and two smaller ones that invest in hedge funds. As part of the process, they did not speak to the actuary. They sought out U.S. due diligence consultants. As a profession, we are beginning to lose out a little in that regard.

On the point about internal hedge funds, we already have them. The traditional balanced manager was an ETF with a long/short equity fund around it.

In relation to the issue of prime brokers, first of all, not all hedge fund managers have prime brokers. They tend to be dominant among equity type hedge funds. I could not agree more with Mr Hastings that, if you are a hedge fund manager, you really do need to manage the agency risks in relation to the prime broker. One of the problems, when you set up a hedge fund, is that you tend to have to persuade several prime brokers that one of them should take you on. The really smart guys always have two prime brokers. That way, it keeps them on their toes, and no prime brokers know completely what their positions are. It is very dangerous to have prime brokers knowing all your positions in the market. It also keeps them on their toes, and having two prime brokers eliminates some of the agency risks.

On the issue of capacity, the Yale Endowment Fund is a fund of about 25 billion dollars, which is about three-quarters of the size of the Irish pensions market in terms of assets under management. It has approximately 25% of its assets invested in alternative investments, including hedge funds without too much difficulty. However, I do agree that, if pension funds start to invest in hedge funds, what will happen — and I have mentioned this in the paper — is that the supply side of the hedge fund industry will be stimulated. Many of what might be described as star traders will emerge from the investment banks, and say: "I can do that, too, because I like the two and 20 aspect of the remuneration structure." In those cases, you have to

ask yourself a question: "How much of the proprietary performance that an investment bank received came from that individual 'star trader' alone, and how much of it was due to the team effort, and how much of it was seeing the flows on the other parts of the desk?" All these questions must arise in the analysis. I agree that, if pension funds start investing heavily, the supply side will step up and provide plenty more opportunities.

The closer mentioned the issue of the zero sum game, that, if one person makes some money, the other person loses it. That may be true. At the end of a claim free year on your household or motor policy, you could be regarded as having lost money, in terms of having 'got nothing' for the premium. Let me give you two examples of where it is not true. People sometimes do not mind losing money — I know it is hard to understand — if it realises other investment objectives for them. The simple case is a central bank. Take the Japanese central bank, which is defending the yen at somewhere around the 105 yen to the dollar at the moment. It does not care about losing money. It has a different objective. It will spend and lose money (that could have been spent on hospitals) to achieve its objective. A hedge fund manager who goes with the central bank can make money, too. Central bankers have a different objective. This is another example of where the objective is to make the outcome more certain. Hedging makes the outcome more certain, but it does not necessarily make it better.

Let us say that you have decided that a U.K. company is going to take over Microsoft, and it makes an offer to the shareholders of Microsoft. I do not know what the capitalisation of Microsoft is. Let us say that it is £200 billion. What the U.K. company wants to do is to fix the U.S. dollars amount of the takeover price in sterling. So, the U.K. company will hedge its dollar exposure, so that the amount is fixed in sterling. Hedging makes the outcome more certain. In hindsight, after the deal is done, the U.K. company may actually have lost or gained money on the hedging transaction, but, to the company, that is not the issue. I do not believe totally in the zero sum game. The zero sum game looks at the issues just from the narrow point of view of profits and losses, but different investors in the market have different objectives, like reducing risk or controlling a currency.

**The President (Mr T. M. Ross, O.B.E., F.F.A.):** Mr Caslin, thank you very much for all your work.

Whilst there have been some areas of disagreement, I think that everybody who has spoken has agreed that it is an excellent paper, with something of interest for everybody, from the experts to the novices. That is a tribute to the quality of the paper. We have heard that it has been well received elsewhere, too, and we are not surprised at that.

I cannot help thinking that, despite some reservations, hedge funds and the ideas behind them are here to stay. There will be formidable challenges in making them acceptable to the U.K. retail market, which is a heavily regulated one, but it is clear that they have much to offer. I particularly appreciate the final point that Mr Caslin made about a zero sum game. It is obviously right in some senses, but the important point is that different participants have different objectives, and therefore the sums added up do not necessarily have the same ingredients.

We are very grateful to the author, and I ask you to join me in thanking him, together with our opener and closer, for making this such an interesting discussion.