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**Abstract**

Actuaries will lose defined contribution (DC) business to other consultants unless we find new and innovative ways of adding value in this area.

This paper argues that there is a need for actuarial advice to be given to members of a DC plan, and this is therefore an opportunity that actuaries cannot afford to let pass by.

It then discusses one tool which is often used to provide advice to DC plan members - deterministic benefit illustrations - and points out the weaknesses of that approach. It goes on to discuss suitable criteria for more effective DC benefit illustrations, and to measure stochastic benefit illustrations against these criteria, concluding that they offer a number of advantages compared to the deterministic approach.

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## **1. DC plans and actuarial advice**

### **1.1. Introduction**

DC plans represent a challenge to us as actuaries. Our skills lie in assessing future financial risks, as summarised by the UK actuarial profession's sound bite: "making financial sense of the future". As our client base evolves from almost entirely defined benefit (DB) plans to include many DC plans, so those people who require actuarial advice change from plan sponsors to plan members. This is because the key financial risks associated with pension provision are shifting from sponsors to members.

With a DB plan, it is the benefits that are known and the cost that is unknown. Traditionally, this has meant that administrators and consultants (often non-actuaries) have been involved in the calculation of benefits, and actuaries have been involved in funding and related calculations – typically advising the sponsor on most pension related matters.

However, with a DC plan - at a first look - it is the contributions that are known and the benefits that are unknown. Therefore, the pension administrators and consultants can relatively easily replace an actuarial consultant as advisor to the sponsor. There is anecdotal evidence that this is happening in the UK. Therefore, unless the actuarial profession finds opportunities to provide actuarial advice in the context of DC plans, we are likely to find that other professionals take an increasing market share in the DC consultancy market.

A recent paper produced by a working party set up by the Pensions Board of the UK Institute of Actuaries on the “role and responsibilities of actuaries in the defined contribution environment”<sup>1</sup> drew very similar conclusions. To quote: “The challenge to the profession will be to demonstrate the unique added value that actuaries can bring to the [DC] process”.

## **1.2. DC plans as a group of one-man DB plans**

It is my assertion that DC plans should, from an actuarial perspective, be viewed as a group of one member-DB plans.

Whether or not he realises it, a DC member has to make the same key decisions that are required of a DB plan sponsor. In particular:

- a DC member has to decide how much to contribute to a DC plan, incorporating the implications of his chosen investment vehicle, his preferred pace of funding and his final benefit requirements;
- a DC member has to decide where to invest his (and probably his employer’s) contributions, incorporating the implications of his final benefit requirements, his risk/return profile and any short term investment preferences he may have; and
- a DC member therefore needs to make decisions (which he is likely to monitor as his requirements develop over his lifetime) about the retirement benefits he is targeting. For example: chosen retirement age, level of pension, level of contingent spouse’s pension and level of post-retirement pension increase requirements.

Although many DC plan members will not think about the decisions they are faced with in such detail, the reality (as you will know by your own thought processes if your personal pension provision is DC based) is that it is these decisions that need to be thought through in order for there to be effective management of a member's pension provision. Sometimes there may be overriding factors which simplify the process (eg "I can't afford to contribute anything at the moment") but usually a degree of flexibility exists in each of the key areas.

Of course, each of these three key issues interact, making the decision process more complex. For example, a higher pension benefit requirement will lead to a higher contribution requirement, whilst a more aggressive investment risk profile may lead to a lower contribution requirement (at least at first). It does not make sense to divorce these issues from each other - they cannot be sensibly addressed separately.

Each of these key issues has a DB plan parallel. A DB plan sponsor must first decide the level of benefits it wishes to provide for its employees. It will monitor the levels of those benefits to ensure continuing compatibility with:

- legislative requirements;
- macro economic factors – eg inflation;
- micro economic factors – eg what the sponsor can afford to provide;
- state provision; and
- competitor provision.

The sponsor will then hire professionals – typically an actuary - to provide regular funding and investment advice. The advice given is often very comprehensive,

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recognising the complex interaction of the sponsor's requirements and (generally) investment in non-matching assets. The advice in the UK is generally revisited, in full, every three years and less formally every year. Investment performance reports would normally be reviewed at least annually and often quarterly.

And yet a typical DC plan member essentially has the same decisions to make - decisions that will have a dramatic impact on the level of his retirement income - and he does not have access to such advice. Instead, sometimes, these decisions may be made based on the little understanding that the member can glean from the written material supplied to him by the DC plan sponsor. However, one suspects that the decisions are often based on misinformation such as:

- “cash is safer than shares”;
- “the stock market always goes up over a long period”; or
- “I need to contribute 10% to have a good pension” (or some other figure borrowed from the popular press).

Therefore, there is great scope for actuaries providing what is essentially actuarial advice to members of DC plans to enable them to plan effectively for their retirement. Ideally, a regular (say, triennial) “actuarial investigation” into a member's pension provision position should be undertaken with discussion of benefit requirements, contribution patterns and investment strategy, based on the investment performance achieved to date and the member's latest expectations for the future.

### **1.3. A key difference between DC plans and DB plans**

There is one difference between a DB plan and a member of a DC plan, which arguably means that a DC plan member's benefits have an even greater need for ongoing actuarial monitoring. This is the fact that a DC member only has one chance to "get it right", whereas a DB plan sponsor can smooth the plan's experience through time and across members. (This is illustrated very clearly by the figures in section 1.4 below.)

It is sometimes argued that a DC plan member has some flexibility in when his benefits are drawn, and so can "choose" a "suitable" retirement date, so that he does not retire, for example, immediately following a stock market crash. However, the counter arguments to this are strong:

- a high proportion of DC plan members in many countries are heavily reliant on state provision in retirement, and so have little choice but to time their retirement to coincide with their state pension age;
- many DC plan members retire at their employer's "normal retirement age", or are "early retired" with little notice – ie they retire at a time that is out of their control;
- even those DC members who choose their retirement date may have little appreciation of the potential impact that the precise timing of retirement can have; and
- although easy in hindsight, it is difficult, if not impossible, to assess whether it is a "good" time to retire before the event (who is to say whether the stock market will recover?).

## **1.4. DC plan benefits historically**

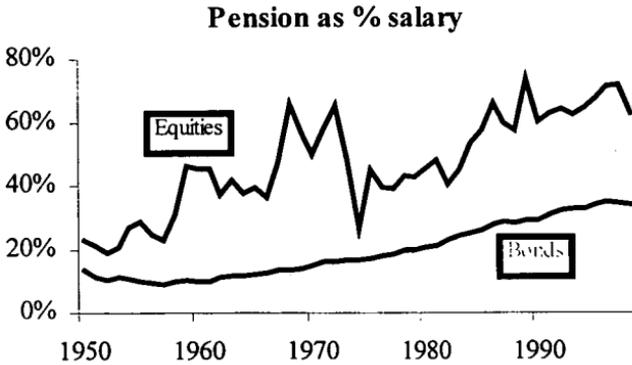
The purpose of this section is to illustrate some of the key risks that DC plan benefits are subject to.

The following chart shows the pension benefit position of a string of DC plan members who retired from a UK DC plan in each of the years 1950 through 1998. In each case, the members are assumed to have contributed 10% of salary for 30 years prior to age 65, and purchased a non-increasing annuity with 50% contingent spouse's provision at that age. Salaries are assumed to increase at 2% above inflation (in line with the experience of most long term periods in the UK), and a management charge of 1% per annum is deducted.

Therefore, the only items that are varying are the year of retirement (or, if you prefer, the members' years of birth), and the selected investment median.

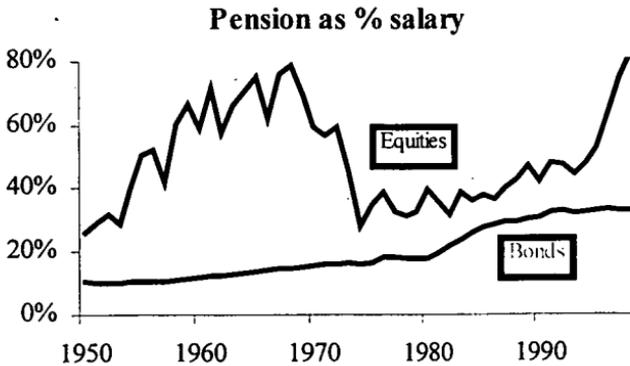
Results are shown as a percentage of salary at retirement. The impact of inflation after retirement is ignored. This could easily be incorporated, and would show a similar picture.

## Range of historic pensions for a member of a UK DC Plan



The following chart shows the same results, but for the US.

## Range of historic pensions for a member of a US DC Plan



The chart shows a similar pattern to the UK, although US pensions were higher in the 1960s, and lower in the 1980s.

The following points may be noted from the charts:

- for members who have invested in equities, there has been a significant variance in the pensions achieved from DC plans – from around 20% to 80% of salary – depending on the “pot luck” of when a member was born;
- there has been a steady trend upwards in the level of DC plan emerging benefit over the last twenty years, which can be attributed to improving real investment returns over the same period;
- although annuity rates have recently been at historically high levels (causing, in the UK, a significant amount of lobbying of the government to relax the requirements to purchase annuities), recent years have actually been relatively good times to retire; and
- investment in domestic government bonds would have produced a lower pension than investment in domestic equities over all periods, but a far more predictable and stable pension, as one would intuitively expect.

These results illustrate the risks associated with DC pension plan benefits. I am sure that the vast majority of DC plan members do not appreciate the extent of these risks. In particular:

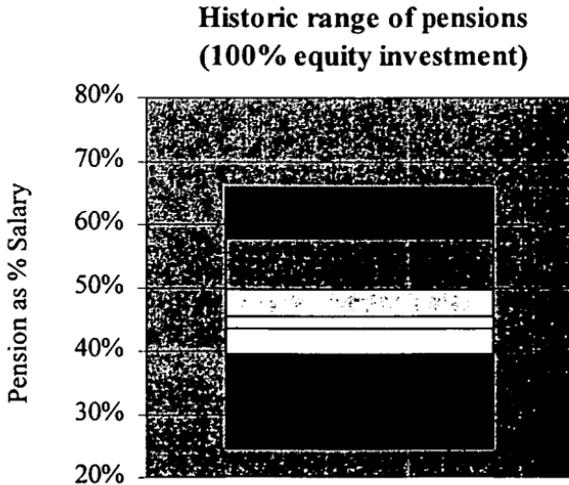
- the (surely increasing) risks associated with equity investment (given the run of real returns achieved in recent decades);
- the interaction between bond investments prior to retirement and any requirement to purchase an annuity;

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- the importance of timing retirement (or a switch from equities to bonds) to perfection to ensure an adequate retirement income.

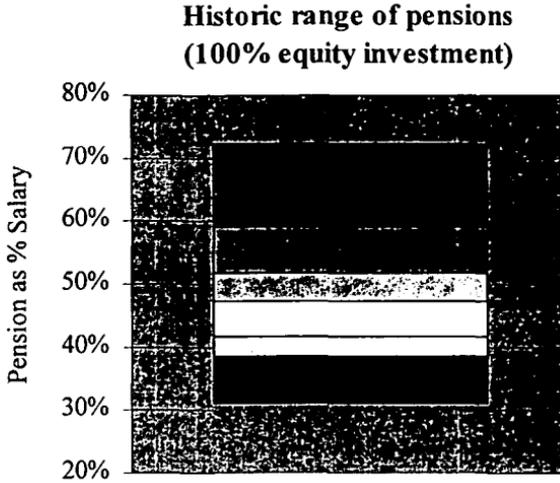
The results shown in the above charts can also be illustrated in a different way, as shown below. The charts show the distribution of the range of pensions (as a percentage of final salary) that would have been achieved historically. Each coloured band represents 10% of results (the highest and lowest deciles are not shown). We will take a further look at this type of representation later.

### **Range of historic pensions for a member of a UK DC Plan**



The range for the US is shown overleaf.

## Range of historic pensions for a member of a US DC Plan



Each of the four charts in this section illustrate the risks associated with DC provision at the macro level. If one adds to this a member's micro requirements of, for example:

- funding patterns (eg the ability to contribute less when one is younger);
- the profile of salary increases throughout his career;
- preparation for "unexpected" early retirement ,

then it is easy to see that complex actuarial type advice is required by each DC plan member, and that this advice needs regular review.

## **1.5. The difficulties**

Those of you who have got this far will probably be thinking “nice idea, but he obviously doesn’t live in the real world - who is going to pay for all this?”. There are indeed some significant hurdles which need to be addressed before DC plan members’ requirements can be met, some of which are set out here.

### **1.5.1. Complexity and cost**

Complexity is linked to cost. As outlined in earlier sections, in order to provide good effective advice to DC plan members, there needs to be consideration of a large number of interacting and personal factors. Such individual actuarial advice is not cheap to provide. However, the use of well written computer systems is one way in which the costs associated with more complex advice can be reduced significantly.

### **1.5.2. Low level of understanding**

The average “man on the street” knows very little about pensions, let alone DC plan issues and how they impact on him as a DC plan member. Further, the principles that he has managed to grasp, often from reading the popular press, may well not be entirely correct, and there may be a number of misunderstandings that need to be unravelled before effective advice can be given.

As an aside, I believe that there is significant scope for good pensions and general financial education in today’s complex financial environment, and this is another area where actuaries could be far more proactive.

### **1.5.3. Low level of interest**

Coupled with a low level of understanding, there is often a low level of interest in pensions matters. This is, in part, a culture issue and I suspect that the UK and Europe have a bigger problem in this area than the US.

The main reasons for the low interest seem to be a combination of members not appreciating the importance of the decisions made during (often early on in) their career, and the mentality of “I have never understood financial things and I never will, so I won’t bother”. This latter attitude is widespread in the UK and is exasperated by the fact that most financial products are delivered by “salesmen”, whom the public mistrust, and whom often do not fully understand the products they themselves are selling.

## **1.6. Conclusions**

There is considerable scope for actuarial advice to be given in the context of a DC plan. To date, little work has been done in this area (other than for high net worth individuals) mainly because of the high costs associated with giving personalised and complex advice. However, unless actuaries start seizing opportunities in this area through innovative use of modern technology, I believe that other pensions professionals will quickly become the main consultants to DC plans, leaving pension actuaries to serve a slowly decreasing DB plan industry.

## **2. A traditional DC advice tool (using the UK as an example)**

### **2.1. Deterministic pension illustrations**

Traditionally, if any advice at all has been given to DC members, it has usually been done off the back of deterministic pension illustrations. Although not strictly actuarial work, it has generally been actuaries who have prepared these illustrations on the grounds that they have the necessary data processing and calculation skills. An actuary may also be involved in selecting the assumptions underlying the illustrations. (Note that a non-actuary can perform these tasks, especially if provided with a statutory assumption set to be used for projection as will be shortly the case in the UK.)

The practice of providing DC benefit illustrations varies widely in the UK.

Personal pensions, which are one-man DC plans arranged with an insurance company, must provide illustrations at specific times (eg when contributions change) on a statutory set of assumptions. These are the same illustrations that are used to sell such products by independent financial advisors and insurance salesmen. The assumptions, and hence illustrations, are in nominal terms creating “telephone number” illustrations which are meaningless to the policyholder (although, unfortunately, it is likely that the recipient will attach undue significance to them). Three illustrations are given on “prudent”, “aggressive” and “middle of the road” investment returns and pension conversion terms.

Some company sponsored DC plans provide no illustrations on the grounds of cost, or because of the perceived risk associated with illustrating a pension that then does

Another example relates to investment. If a member receives the same illustrations whether they are invested in a bond fund or an equity fund, then they are not likely to realise the importance of making the right investment choices.

There are significant dangers in the provision of illustrations because of this. It is quite easy to envisage a scenario where a member demonstrates that he suffered financial loss as a result of basing his decisions on poor quality illustrations that did not demonstrate to him the consequences of different actions. As the recent UK Institute of Actuaries paper<sup>1</sup> commented: “The actuarial profession needs to take its responsibilities seriously in ensuring that this does not become the next pensions scandal”.

### **2.3. Requirements for deterministic illustrations**

In the UK, there are currently no requirements for a DC plan sponsor (or for an advisor to a DC plan member) to provide illustrations, nor requirements as to the assumptions that must be adopted for those illustrations.

However, change is on the horizon.

Firstly, a recent UK government Green Paper<sup>2</sup> stated their intention that:

- “all money purchase schemes [DC plans] should be required to provide annual statements showing the projected value of the individual’s fund at retirement age and the amount of pension it might buy at today’s prices;
- the statement must be as simple and straightforward as possible. It must also be clear that it is only an estimate which depends on unknown variables that will inevitably change over time; and

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- there will also have to be clear and evident warnings about the actuarial and economic assumptions used in the projections.”

The UK Faculty and Institute of Actuaries are working with the government to agree a set of assumptions that will have to be used for all such illustrations.

Secondly, in response to concerns raised by members, the UK actuarial profession have published a draft guidance note<sup>3</sup> setting out the principles that must be followed when producing DC benefit illustrations. The spirit of the draft guidance can be summarised by the following quotation:

- “Sufficient information should be given to enable the recipient to appreciate the risks involved in a defined contribution arrangement.”

I believe that both of these developments are to be applauded. It is time that DC plan members were given the information they need to enable them to make informed decisions about their retirement provisions. However, this is a challenge to UK actuaries and DC plan providers. We will no longer be able to bury our heads in the sand on the grounds that the provision of illustrations is too risky. Further, we will have to ensure that the illustrations provided – even those required by the new legislation – adequately communicate the risks to the members.

In the light of the risks illustrated in section 1.4 above, these developments represent a major challenge to the profession.

## **2.4. Weaknesses of the traditional approach**

The traditional approach to DC benefit illustration has a number of weaknesses that are readily identifiable. Some of these weaknesses could be addressed quite simply,

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for example by choosing better assumptions. Other weaknesses can only be addressed by supplying comprehensive written information and/or a face-to-face meeting in addition to the provision of the illustration. Unfortunately, face-to-face meetings are expensive, and written information usually remains unread by members.

Key weaknesses are as follows.

#### **2.4.1. Allowance for inflation**

Many deterministic DC plan illustrations in the UK make no allowance for the impact of expected future inflation, resulting in meaningless illustrations that encourage younger members not to make additional pension contributions. This weakness can, of course, be addressed by a more appropriate choice of assumptions.

#### **2.4.2. Not member specific**

Most deterministic DC plan illustrations make no allowance for the personal expectations of the member. For example, there is no illustration of the impact of different retirement ages, or of the consequence of purchasing (or not purchasing) a contingent spouse's annuity at retirement.

A further area that can have a dramatic impact on the level of benefits obtained from a DC plan, assuming contributions are maintained as a percentage of salary, is the incidence of salary growth throughout a member's career. (Consider two otherwise identical members who start their careers on a salary of £20,000 and end their careers on £40,000. The

first member receives his salary increases up to the £40,000 level very early in his career, whilst the other is promoted towards the end of his career. The first member will have a DC benefit almost twice the size of the second member.)

Again, this weakness can, of course, be addressed by a more appropriate choice of assumptions, specific to each member. However, this would be an expensive process, and is generally not done.

One has to query the usefulness of an illustration that can easily be 50% incorrect relative to an illustration based on basic factual information and expectations that most members could supply to their DC plan sponsors very easily. Unfortunately, the member may often reasonably assume that this information has been taken into account.

### **2.4.3. Reduction to key parameters**

Deterministic projections tend to hide the complexity of the interaction of all the factors that make up a DC benefit. They wrongly give the impression that the risks associated with DC pension provision can be reduced to one or two key parameters. For example, the real return achievable on their investments and the conversion terms available at retirement.

The assumptions made for these parameters are generally stated, and the member is expected to be able to make a value judgement as to the likelihood of them being obtained.

#### **2.4.4. Impression of certainty**

The provision of one, or sometimes three, deterministic illustrations gives an impression of certainty. Although a member may read the small print, which hopefully warns him that the illustrated benefits are not a guarantee, the provision of one number gives him an impression that his DC plan benefits can be predicted with a reasonable level of accuracy. The figures in section 1.4 above illustrate that this is not the case.

#### **2.4.5. No illustration of impact of investment choices**

Deterministic projections are usually based on the same assumptions regardless of the member's chosen investment fund. It would be possible to do otherwise, but it is usually considered not sensible to provide a higher illustration for the equity fund compared to the bond fund, as this only tells half the story.

This feature gives the message to the recipient that it does not matter what investment funds he chooses, the professionals will still project his pension using the same assumptions.

Further distortions can occur if the illustrations are based on a "net of expenses" figure. For example, if the cash fund has lower expenses than the equity fund, then the cash fund will give a higher illustration.

Deterministic illustrations also give little, if any, information about the issues surrounding matching investments as a DC member approaches retirement. For example, it is very unlikely that a DC plan member will

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appreciate the risks he is running by remaining in equities all the way up to a predetermined retirement date, if annuity purchase is required.

These weaknesses are significant. In many cases they result in DC illustrations being misinformation, rather than being helpful and informative.

### **3. Criteria for effective DC illustrations**

Traditional approaches to DC benefit illustration have a number of weaknesses. The provision of such illustrations can therefore involve considerable risks for the provider. I outline in this section criteria by which one can measure the effectiveness of a DC benefit illustration or, more generally, of any educational material given to DC members.

#### **3.1. Easy to understand**

Illustrations should be easy to understand. Usually this would involve the concentration of the key information into a simple picture, or the provision of no more than three numbers. Additional backup information should be provided for those who require it or who are interested, but the key message should be obtainable from the front page. Ideally, it should be difficult for a recipient not to readily appreciate the key messages that need to be given (in particular, the message of uncertainty).

#### **3.2. Meaningful figures**

All illustrations should be in real terms.

Ideally, illustrations should take into consideration as much personal data and expectations as the member can readily supply. This should include, for example:

- the member's expectation of salary growth if contributions are maintained as a percentage of salary;
- the member's expectation of retirement age;

- the member's expectation for the purchase of a contingent annuity.

### **3.3. User friendly, quick and cheap**

The tools used to provide DC illustrations should be fully flexible, but easy to use by suitably trained staff, cheap to maintain, and produce the required illustrations quickly.

### **3.4. Communicate the key issues**

The illustrations should communicate all the key issues, including:

- expected pension, including likelihood;
- risk and uncertainty;
- the impact of different investment choices on these two areas;
- the impact of annuity purchase at retirement, and the interaction of the result with the investment funds chosen as the member approaches retirement.

The communication of these issues (particularly risk) should be done in a positive way.

### **3.5. Reliance on assumptions**

Ideally, there should be little reliance on the underlying assumptions made when educating members and giving advice. Over-reliance on the absolute levels of assumptions means that advice can quickly become biased. There is a natural

## 4. Stochastic DC illustrations

### 4.1. Introduction

“Another option would be to develop a different form of projection whose primary purpose was not to compare one product provider with another [*the purpose of the personal pension statutory projections*], but to advise clients on the range of pensions which could be expected from a given contribution rate, taking into account inflation, and also how the expected pensions, and the variability of the expected pension, would depend on the funds selected.” This is taken from the previously mentioned Institute of Actuaries paper<sup>1</sup>.

One of the ways in which many of the criteria set out in section 3 above can be met is using stochastic illustrations of DC benefits.

With the computing power now available, illustration tools can be developed which:

- take a member’s personal data and expectations as inputs;
- stochastically project the member’s pensions;
- plot those projections on a chart to show the range of pensions, in today’s money, that the member can reasonably expect to obtain.

Of course, the value of the results depends crucially on the economic model used for projections. Specifically, the key assumptions are extended to cover the variability and correlation of the key investment parameters, not just the mean. However, the use of widely available stochastic models which have been calibrated with history in

some way, enables statements to be made to members such as “this represents the range of pensions that you may expect, within a suitable band of certainty (eg 90%), if history repeats itself in some way”.

## **4.2. Example**

Some output from a stochastic DC illustrator developed by my firm is illustrated below. The illustrations are based on an example UK DC plan member whose details are as follows:

- Male aged 45, retirement at age 60;
- £20,000 per annum salary, 10% total contributions;
- £25,000 already in his DC retirement account; and
- entire fund used to buy an annuity at retirement (non-increasing, 50% contingent spouse’s pension).

The first chart shows the range of pensions that the member may expect if he invests 100% in domestic equities throughout his career. The chart is set out in the same format as the historical range chart in section 1.4. Each coloured band represents 10% of results. The lowest and highest deciles are not shown.

These illustrations can be used in the context of giving general education to DC plan members, giving specific advice to individuals, or as part of a benefit statement issued to members on a regular basis.

### **4.3. Meeting the criteria**

#### **4.3.1. Easy to understand**

Our experience is that in the context of presentations and face-to-face meetings, it is relatively easy to explain the meaning of a stochastic illustration to members. Once members have grasped what the picture is saying, which usually takes a few minutes, they are very comfortable with the messages it gives, and find it easy to work with a number of illustrations at the same time, showing the impact of changing various items.

#### **4.3.2. Meaningful figures**

Results can easily be represented in today's money.

The computer power now available means that it takes seconds to re-run a member with a change in their personal data or expectations, and to illustrate the consequences of doing so on their DC benefit.

#### **4.3.3. User friendly, quick and cheap**

As with deterministic projections, a suitable front end can be developed to ensure that the data and expectations can be inputted in a user friendly form. This ensures that the use of the systems can be passed down to

suitably trained non-senior staff, resulting in relatively cheap advice. The computer power now available means that a stochastic DC illustration need only take seconds to run.

There are further opportunities for such advice to be given cheaply by making use of multimedia training tools. It should be possible to incorporate a stochastic DC illustrator into a PC based training package which then removes the need for human trainers. This would dramatically bring down the price of the provision of DC education and advice to members.

#### **4.3.4. Communicate the key issues**

In my view, the key advantage that stochastic illustrations have over deterministic illustrations is that they communicate the risks associated with DC pension provision in an effective and positive way. In particular:

- a range of pensions is shown, immediately giving the message of risk and uncertainty, but in a positive way;
- the likelihood of achieving a particular level of pension is illustrated;
- the impact of different investment choices can be illustrated (see section 4.2 above); and
- the impact of the choice of investment fund prior to retirement on retirement income when an annuity is to be purchased can be illustrated.

#### **4.4. Difficulties associated with stochastic illustrations**

Stochastic DC illustrations have some clear advantages over deterministic illustrations.

However, there are a number of areas that need to be addressed when adopting such an approach, each of which needs very careful thought. These include:

- development of an appropriate economic model;
- the choice of key assumptions, for example the difference between the mean investment returns expected on domestic equities and bonds;
- the maintenance of the economic model in a changing world;
- the development costs associated with developing a complex computer system with a suitable user friendly front end, to ensure that the provision of advice can be kept cheap;
- the extent to which account of current market conditions is taken;
- compliance issues.

## **5. Conclusions**

In this paper I have argued that:

- DC plans should be viewed as a collection of one-man DB plans;
- as such, DC plan members need actuarial advice as much as DB plan sponsors;
- there are a number of difficulties to overcome before such advice can be provided effectively, but this is an opportunity that actuaries cannot afford to let pass by;
- traditional deterministic DC illustrations, which have often been used as a vehicle to give such advice, have many weaknesses;
- the use of stochastic DC illustrations combined with modern computer power meets many of the criteria for more effective DC illustration and education tools.

## **6. References**

- <sup>1</sup> The role and responsibilities of actuaries in the defined contribution environments in the United Kingdom, MA Stocker, SD Dudley, GE Finlay, HJ Fisher, OC Harvey Wood, MHD Kemp, W Lumb, MW Miles and SL Wasserman : Presented to the Institute of Actuaries, 26th April 1999.
- <sup>2</sup> Green Paper : A New Contract for Welfare : Partnership in Pensions (Cm 4179), The UK Government, Published December 1998.
- <sup>3</sup> Exposure Draft No. 37 : Illustration of Defined Contribution Pension Benefits, The Institute and Faculty of Actuaries, September 1999.