The Stakeholder Pension Lottery:
An Analysis of the Default Funds in UK Stakeholder Pension Schemes

David Blake, Alistair Byrne, Andrew Cairns and Kevin Dowd[1]

Abstract: We analyse the range of default funds offered by UK stakeholder pension schemes, against the background of research that shows the majority of pension scheme members passively accept the default arrangements offered by the scheme sponsor. We find the default funds vary substantially in their strategic asset allocation and in their use of lifestyle profiles that switch the member's assets to fixed-income investments as the planned retirement date approaches. We use a stochastic simulation model to demonstrate that the differences have a significant effect on the distribution of retirement income outcomes. We also find a wide range of outcomes for each type of fund, and that with commonly observed contribution rates defined-contribution pension schemes appear unlikely to replicate the levels of retirement income produced by typical defined benefit schemes.

Key words: pension schemes; defined contribution; default funds; strategic asset allocation; lifestyle profile; stochastic simulation.

JEL Classifications: G11, G23.

David Blake
The Pensions Institute
Cass Business School
London EC1Y 8TZ
United Kingdom
Tel. +44 (0) 20-7040-5143
Fax. +44 (0) 20-7040-8881
d.blake@city.ac.uk

Alistair Byrne
Department of Accounting and Finance
University of Strathclyde
Glasgow G4 0LN
United Kingdom
Tel. +44 (0) 141-548-3939
Fax. +44 (0) 141-552-3547
alistair.byrne@strath.ac.uk

Andrew Cairns
Department of Actuarial Science & Statistics
Heriot-Watt University
Edinburgh EH14 4AS
United Kingdom
Tel. +44 (0) 131-451-3245
Fax. +44 (0) 131-451-3249
a.cairns@ma.hw.ac.uk

Kevin Dowd
Centre for Risk and Insurance Studies
Nottingham University Business School
Nottingham NG8 1BB
United Kingdom
Tel. +44 (0) 115-846-6682
Fax. +44 (0) 115-846-6667
kevin.dowd@nottingham.ac.uk

---

[1] Pensions Institute, Cass Business School, University of Strathclyde, Heriot-Watt University, and Nottingham University Business School, respectively. The corresponding author is Alistair Byrne, Department of Accounting and Finance, University of Strathclyde, 100 Cathedral Street, Glasgow G4 0LN. Email: alistair.byrne@strath.ac.uk. The authors are grateful to Debbie Harrison and Stephen Titterington for help in collecting data and to participants at seminars at Copenhagen Business School, IDEI Toulouse, and Watson Wyatt LLP for helpful comments on earlier versions of the paper.

The Stakeholder Pension Lottery:
An Analysis of the Default Funds in UK Stakeholder Pension Schemes

Abstract: We analyse the range of default funds offered by UK stakeholder pension schemes, against the background of research that shows the majority of pension scheme members passively accept the default arrangements offered by the scheme sponsor. We find the default funds vary substantially in their strategic asset allocation and in their use of lifestyle profiles that switch the member's assets to fixed-income investments as the planned retirement date approaches. We use a stochastic simulation model to demonstrate that the differences have a significant effect on the distribution of retirement income outcomes. We also find a wide range of outcomes for each type of fund, and that with commonly observed contribution rates defined-contribution pension schemes appear unlikely to replicate the levels of retirement income produced by typical defined benefit schemes.

Key words: pension schemes; defined contribution; default funds; strategic asset allocation; lifestyle profile; stochastic simulation.

JEL Classifications: G11, G23.

1. Introduction

Stakeholder pension schemes were introduced in the UK in April 2001 with the aim of improving the pension provision of low- to middle-income earners. In essence, they are personal pension arrangements operating on a defined-contribution (DC) basis and typically provided by an employer, financial services company, or membership organisation such as a trade union (Blake 2003).[2]

Many features of stakeholder pension schemes – such as permissible contribution rates, the availability of benefits, and the tax treatment – are the same as for other DC pension arrangements. However, stakeholder schemes also have a number of specific features. They must be flexible, have a low level of contractual minimum contribution (£20), no penalties for ceasing or reducing contributions, no penalties for transferring the fund to another arrangement, and total charges on the fund must be capped to 1% per annum.[3] In addition, each scheme must offer a default fund so that "no member is required to make any [explicit] choice as regards the investment" of the contributions (Statutory Instrument 2000:1403). The idea behind the default requirement is to protect uninformed scheme members by giving them an 'obvious' option to select based on the presumption that the default is likely to be a reasonably good choice.

There is a substantial literature that shows most pension scheme members are inclined to take the 'path of least resistance' and passively accept the default arrangements that exist in their scheme. For example, Choi *et al.* (2002) review US evidence of the tendency for members to accept scheme defaults for key features such as the contribution rate and the investment fund. Even though employees are free to opt out of default arrangements, very few actually do so. In the schemes studied, between 42% and 71% of participants accept the default contribution rate and between 48% and 81% of scheme assets are invested in the default fund, which is typically a money market fund. A similar tendency to accept the

[2] Employers who have five or more employees, and who do not provide a qualifying occupational pension scheme, must make a stakeholder scheme available to their employees, but do not need to contribute to it.

[3] From April 2005 stakeholder pension providers will be allowed to charge a fee of up to 1.5% for each of the first ten years the pension product is held. After ten years the fee cap reduces to 1.0% (www.hm-treasury.gov.uk).

default is found in the UK. Consulting firm Hewitt Bacon and Woodrow estimate that 80% of members in UK DC schemes accept the default fund choice (Bridgeland 2002).

The strong tendency of DC pension scheme members to accept scheme defaults means that the provider or scheme sponsor's choice of defaults has the potential to have a very significant impact on the welfare of scheme members. In this paper we investigate this issue further. To do so, we first analyse the variety of different types of default fund offered by UK stakeholder pension schemes, and document significant differences across funds in terms of their asset allocations and their use of lifestyle profiles that automatically switch the member's pension fund assets to fixed-income investments and/or cash as the planned retirement date approaches.[4] We also show that the dispersion of certain key characteristics of the default funds is so wide that the provider's choice of them can be considered to be random. We then use a stochastic simulation model to illustrate the different distributions of likely retirement income outcomes that the different fund structures generate for scheme members accepting the default arrangements.[5] The results of these simulations suggest that the choice of default fund can have a major impact on likely retirement income outcomes.

Our findings are therefore sobering: the vast majority of pension scheme members appear to passively accept whatever default fund the pension provider has chosen, but there is little consensus amongst providers as to what the appropriate characteristics for a default fund are, despite the importance of the choice in determining pension outcomes. In this sense, stakeholder pension schemes can be characterised as a lottery for the members.

These findings raise important questions for employers and pension providers about their choice of default investment strategy for DC pension schemes and about the levels and

[4] Lifestyle profiles are used in practice to attempt to reduce the risk that a fall in equity prices close to the planned retirement date reduces the member's retirement income. Various justifications for them have been provided in the academic literature. For example, if asset class returns are mean reverting then a strategy of investing in high-risk assets (i.e. equities) when retirement is some way off and a strategy of shifting to lower risk assets (i.e. bonds) as retirement approaches can be justified (Samuelson 1992). Bodie (2003) also argues that if an individual's human capital (i.e. future labour income) is less risky than equity, then at younger ages this capital will constitute a relatively high proportion of total wealth and thus can be balanced by investing a greater proportion of the individual's financial wealth in risky assets. As time moves on the share of wealth accounted for by human capital declines and it makes sense to reduce the risk attached to financial wealth. Furthermore, younger individuals have more scope to increase their labour supply (i.e. how much they work) to make up for any shortfall generated by losses in financial assets.

[5] We also emphasise that although our analysis is based on stakeholder pension schemes, it can be generalised to all defined contribution pension arrangements where there are similar default options.

variety of retirement income that can be anticipated from such schemes. They also raise worrying questions about the due diligence procedures currently being carried out by providers of stakeholder schemes.

This paper should be seen in the context of earlier studies of the effects of alternative investment strategies on the anticipated outcomes of DC pension schemes. For example, Booth and Yakoubov (2000) used historical return data from the annual Barclays Capital *Equity-Gilt Study* to investigate the retirement income implications of five different investment strategies. The 'standard' fund was assumed to involve a constant 70% equity / 20% bonds / 10% cash split. This standard fund is combined with four lifestyle strategies – a switch to gilts over the ten years preceding retirement; a switch to cash in the final year before retirement; a switch to cash for the final three years; and a switch to bonds for the final three years. They found limited support for lifestyle approaches, and that an equity-based fund in the ten years preceding retirement 'stochastically dominates' the cash– and fixed-income–based strategies – principally because of the higher expected return.

Blake *et al.* (2001) investigated similar issues using the 'PensionMetrics' stochastic simulation model. Amongst the asset allocation strategies they investigated were a pension-fund-average approach – invested across a range of asset classes in proportions typical of UK pension funds in the late 1990s – and a lifestyle strategy that switches from the pension fund average into a 50% gilts / 50% T-bills portfolio over the final ten years before retirement. They found that the overall distribution of potential outcomes is very wide. In line with Booth and Yakoubov, they also found that a well-diversified, high-equity strategy (i.e. the pension-fund-average strategy) produces the best overall outcomes and that, while the lifestyle strategy avoids some of the worst potential outcomes, it does so by significantly reducing the expected level of pension.

A third study, Hibbert and Mowbray (2002), used a stochastic model to investigate the outcomes from a variety of asset allocation strategies (including all-cash, all-bond, and all-equity asset allocations, and various forms of lifestyle strategy as well). They also found that the all-equity strategy produces the highest expected value of annuity, albeit with a fairly wide range of potential outcomes. The lifestyle strategies significantly narrow the range of

potential outcomes, but at the expense of reduced expected value, particularly where the lifestyle switch begins 15 years from retirement.

It is clear from these studies that the asset allocation strategy of a pension fund can make a major difference to prospective retirement income outcomes. All three previous studies found that equity-dominated strategies produce the highest expected outcomes, but with considerable dispersion in potential outcomes. They also found that lifestyle strategies can reduce this dispersion, but only at the cost of reducing the expected outcome.

Our work differs from the papers discussed above principally in that it focuses more directly on the fund structures actually offered as the default in UK stakeholder pension schemes.

The remainder of the paper is organised as follows. Section 2 describes the data on the range of fund types offered as the default in UK stakeholder pension schemes. Section 3 presents some analysis on the randomness of key characteristics of stakeholder default funds. Section 4 outlines the simulation methods we use to assess the likely retirement income outcomes from the default funds, and Section 5 presents the results of the simulations. Section 6 concludes.

2. Data on Stakeholder Default Funds

UK legislation requires stakeholder pension schemes to be registered with the Occupational Pensions Regulatory Authority, which makes the register available to the public. As at June 2004, 46 schemes were listed on the register and these schemes form the universe for our analysis.

Of the 46 schemes, we excluded two schemes on the grounds that they are replicas of other schemes on the register offered by the same provider, and a further nine schemes no longer accept new members and so no longer provide public information on their fund structures. This leaves 35 non-trivially distinct schemes on which we were able to collect data. The key variables of interest are the basic asset allocation of the default fund and the nature of the lifestyle profile used by the fund.

Table 1 shows the range of default funds in terms of fund type and lifestyle profile. Most schemes (19 of the 35) offer a 'balanced managed' type fund which is typically invested 50% to 60% in UK equities, and 20% to 30% in overseas equities, 10% to 20% in bonds, and up to 5% in cash. Most of the balanced managed funds are actively managed, but two use a passive approach. A further 13 schemes offer an all-equity fund as default - seven of these are UK-only and six are invested globally. The global funds typically have a split of 70% UK equities and 30% (capitalisation-weighted) overseas equities. The vast majority of these funds use passive management. The remaining three schemes offer a with-profit type fund as the default, where the insurance company providing the fund uses reserves to smooth the investment returns from year-to-year. The with-profit funds are actively managed with an average underlying asset allocation of 50% UK equities, 10% overseas equities and 40% fixed-interest.

[Table 1 about here]

Some form of automatic lifestyle asset switching is the default for 17 of the 35 schemes. A further 7 schemes offer lifestyle investing as an option, and 11 do not offer lifestyling at all. Table 2 shows the range of lifestyle arrangements across the various stakeholder schemes where a lifestyle profile is part of the default arrangements. It is more common for lifestyling to be part of the default arrangements where the initial asset allocation has a high proportion of equities. For example, lifestyling is the default in six of the seven 100%-equity strategies, but not for any of the three With-profits strategies. This can perhaps be justified on the basis that the funds with lower equity weightings already offer members a degree of protection against market volatility.

[Table 2 about here]

UK pension legislation requires that the benefits from DC pensions be taken via an annuity with the option to take up to 25% of the value of the fund as a tax-free lump sum at retirement.[6] As a result many lifestyle products switch from equities to a final pre-retirement

[6] Technically, it is possible to defer buying an annuity to age 75 by drawing an income directly from the pension fund, but in practice only those with substantial assets will be in a position to do this.

allocation of 75% long (i.e. over 15 years maturity) bonds – to hedge the interest rate element of the annuity purchase[7] – and 25% cash to protect the portion of the fund likely to be taken as a lump sum. The most common structure (involving 10 of the 17 schemes with lifestyle defaults) is to start switching from the equity or balanced fund five years prior to retirement, moving progressively to a final year allocation of 75% long bonds and 25% cash. A further four schemes use the same 75:25 final year allocation, but begin switching either eight or ten years prior to retirement. Other schemes use different final-year asset allocations: one scheme starts switching ten years prior to retirement with a final allocation of 100% long bonds, and the remaining two schemes offer lifestyle profiles that have a final year asset allocation of 100% cash.

It is apparent from these data that an individual joining a stakeholder pension scheme and passively accepting the default investment arrangements can get a substantially different asset allocation and lifestyle profile depending on which provider he, or his employer, has chosen: the dispersion of default fund characteristics is very wide indeed.

3. Analysis of the Dispersion of Defaults

In fact, some of the key characteristics of the default funds are so widely dispersed that one has to question the process by which they are selected. Individual scheme providers can be expected to take care in choosing the default fund characteristics for their scheme, but if they use markedly different approaches and judgements the resulting range of funds across the stakeholder pension market may appear random. In this section, we show that the dispersion of default fund characteristics is indeed wide enough in most cases to be consistent with the choices effectively being made at random.

To make the discussion concrete, suppose we have q possible default choices, and observe that the most common default choice, the mode choice, is favoured by x out of n schemes. We could say that the selection of schemes is 'purely random' (i.e. does not involve any

[7] Retirement annuities are priced on the basis of prevailing long-term interest rates and assumptions about the likely longevity of the person buying the annuity. Other things being equal, a given level of annuity will become more expensive to purchase as long-term interest rates fall. This can be hedged by holding a portfolio of bonds that will increase in value as long-term interest rates fall.

common deterministic factor) if x is such that we can reasonably accept the null hypothesis that each possible default is selected with the same probability (equal to $1/q$). Given values of q, x and n, we can test for pure randomness (or randomness for short) by using Monte Carlo simulation to estimate the prob-value that these given values are consistent with the null just described.[8]

Table 3 provides some simulated prob-values of some specific null hypotheses associated with different types of randomness:

- The first one relates to the hypothesis that the choice of an actively (vs. passively) managed strategy is random: more precisely, the null specifies that there is probability equal to $1/q = 1/2$ that a scheme provider selects an actively managed default. In this case, there are 22 active schemes out of 35, and we find that the probability of at least 22 active schemes out of 35 under the null is 0.1724. Hence, we can accept the null and conclude that the choice between an actively managed vs. passively managed strategy is random.

- The second hypothesis is that the selection of a lifestyle default is random, where the assumed alternatives are to offer lifestyle as an option or not to offer lifestyle at all. In this case, there are 17 lifestyle defaults out of 35, the probability of selecting a lifestyle default is $1/q = 1/3$ under the null, and the prob-value of at least 17 lifestyle defaults is 0.1350. This means that we can accept the null at any reasonable significance level, and can conclude that the selection of a lifestyle default is random, given the assumed alternatives specified in this test.

- The third null is that the choice between lifestyle as the default and lifestyle as an option is random, once a decision is made to offer a lifestyle strategy of some form. In this case, there are 17 lifestyle defaults out of 24, the probability of selecting a lifestyle default is $1/q = 1/2$ under the null, and the prob-value of at least 17 lifestyle defaults is 0.0637. Again, we would accept the null at conventional significance levels.

[8] More specifically, we simulate a large number of trials under the null for given values of q, x and n. We then use the simulation results to estimate the frequency of occasions where we get a mode at least equal to the sample mode frequency, and then take this to be the prob-value.

- Finally, we consider the null hypothesis that the timing of the lifestyle switch is random. Suppose we assume that the options are to start the switch anytime between three and ten years before retirement. This gives us eight options. Under the null, the probability of selecting any option is $1/q = 1/8$. The probability of a mode at least equal to the sample value (10) out of the 17 choices made is 0.0002. Hence, we can reject the null,[9] and can conclude that the selection of a starting time five years before retirement is not random.

Taken together, these results indicate that it is 'as if' the provider's choices relating to an active (vs. passive) asset allocation strategy and relating to the selection (or otherwise) of a lifestyle default are random. The selection of these defaults, from the perspective of a member in any given pension scheme, does indeed look like a lottery. The only defaults that are apparently not purely random are those relating to the starting times of lifestyle strategy switches into safer assets: many more scheme providers choose to switch five years before retirement than we would expect by chance. The explanation, presumably, is that scheme managers are taking their lifestyle strategies from the same sources (e.g. the same textbooks).

We have established, therefore, not only that there are major variations across scheme defaults, but also that some of the more important default characteristics are effectively random. The following section attempts to quantify the significance of these differences by using a stochastic simulation model to assess the impact of different defaults on anticipated retirement income outcomes.

4. Simulation Method

The model we use is the PensionMetrics model described in detail in Blake *et al*. (2001). This model uses stochastic simulation to determine the anticipated distribution of pension outcomes, measured in terms of the ratio of actual pension to some proportion of final salary,

[9] Of course, we can select a narrower range of options, which will soften the rejection, but even then the sample value is significant, at least at the 5% level, for any reasonable range of choices (e.g., assuming q=4 , which is as low as we could reasonably go, we still get a prob-value of 0.02, which is significant at the 5% level).

for any given set of input parameters (such as asset allocation strategy, anticipated retirement age, etc.).

For the purposes of our modelling we make the following illustrative assumptions. The scheme member is a male who joins the scheme at age 25 and retires at 65 – the current state pension age for a male in the UK. We also assume that he contributes 10% of his salary each year to the stakeholder pension scheme and that the contributions are invested according to the strategic asset allocation of the default fund. A 10% contribution rate is close to the average rate observed in UK DC pensions – the NAPF Annual Survey (2003) reports an average employer contribution of 6.8% and a corresponding average employee contribution of 3.8%. The scheme member's wage growth experience is assumed to match that of a typical male employee in the UK and to simplify the analysis we assume that there is no risk to the accrual of pension benefits arising from unemployment or future work disability.[10]

When the scheme member reaches the retirement age of 65, the accumulated fund is converted into a single life annuity that provides a level income to him until he dies. The annuity rate is based on a long-term interest rate consistent both with the investment returns earned by the fund prior to retirement and with the 'PMA92' survival probabilities at age 65 taken from the mortality tables published by the Institute and Faculty of Actuaries: these reflect the mortality experience of males buying pension annuities from UK life offices.

To facilitate comparison with defined benefit (DB) pension schemes, we take a DB pension of 2/3rds of final salary[11] as the benchmark against which we measure the outcomes delivered by the DC scheme. Our simulation results are expressed in terms of the ratio of the DC pension to the DB pension that would be achieved with the same salary experience and duration of membership - the 'pension ratio'. A pension ratio of unity implies that the DC pension scheme has replicated the pension at retirement that would be provided by a typical DB scheme.

[10] The impact of differing career salary profiles, by gender and by type of occupation, on the retirement income from DC pensions is discussed in detail in Blake *et al*. (2004). For simplicity, in this paper we only consider one career wage growth profile, namely that of a typical male.

[11] This is the maximum available from a final salary scheme to a member with a full service record.

In terms of the investment of the pension contributions, a number of stylised strategic asset allocation profiles are created based on our analysis in the previous section of the types of default fund offered in the UK. These are: 'Balanced Managed' – invested mainly in equities, but also in fixed-income and cash; 'Global Equity' – with a 70:30 split between UK and overseas equities; 'UK Equity' – 100% UK equities; and 'With-profits '– assuming a 50:10:40 split between UK equities, overseas equities and fixed-income. We use the median asset allocation of the relevant funds as the basis for the Balanced Managed profile. The asset allocation profiles are shown in Table 4.

[Table 4 about here]

For each initial asset allocation strategy there are four lifestyle variants: no lifestyle; a move to 75% bonds and 25% cash that starts five years prior to retirement; a move to 75% bonds and 25% cash from ten years prior to retirement; and a move to 100% cash from five years prior to retirement. In each case the switch is assumed to take place in a linear fashion over the relevant time horizon. The lifestyle profiles are shown in Table 5. Together with the four initial asset allocation profiles, these give us a total of 16 representative asset allocation strategies.[12]

[Table 5 about here]

We rely on two alternative parameterisations of the return processes. The first parameterisation is based on historical data, and assumes that annual returns on the assets in the pension fund follow a multivariate normal stochastic process[13] that is calibrated according to the realised real returns on key UK and international market indices over the period 1947 to 2003. The source for the returns is the ABN Amro / LBS data set discussed in Dimson *et al*. (2001) and available commercially through Ibbotson Associates. US equities are used as a proxy for overseas (i.e. non-UK) equities. Descriptive statistics for the returns are shown in the Appendix. While some funds are actively managed, no allowance is made

[12] Not all of these strategies are observed in practice, but for completeness we have presented all possible combinations of the observed default fund types and default lifestyle profiles.

[13] This was the simplest of the seven asset return models used in Blake *et al*. (2001). That study showed that the model for asset returns had considerably less impact on the estimated pension outcome than did the strategic asset allocation strategy.

for any (positive or negative) excess returns generated by active management. The returns received are also reduced by the pension fund annual charge, which is assumed to be 1.0% in line with the maximum allowable under current stakeholder pension regulations.

We also run alternative simulations using forward-looking investment return assumptions to account for the possibility that the historical realised equity risk premium is larger than can reasonably be expected in future. We do so because some commentators argue that the realised (i.e., past) equity risk premium is an upward biased estimate of the likely future risk premium; they argue that high historical equity returns were in part due to unexpectedly strong dividend growth and to a fall in the level of the required risk premium, neither of which can be relied on to boost future equity returns (e.g. Arnott and Bernstein 2002, and Dimson *et al*. 2001). Dimson *et al*. conclude that the best estimate of a global equity risk premium is about 3.4% relative to US Treasury bills, and Arnott and Bernstein (writing near the recent peak of the equity markets) make the case for an even smaller premium. We use the equity premium suggested by Dimson *et al*. to produce an alternative set of forward-looking nominal return parameters, which we adjust for pension scheme charges (1.0%) and expected inflation (2.5%). We leave the volatility and correlation structure unchanged as that derived from the historical data.[14] The return parameters are shown in Table 6.

[Table 6 about here]

As an aside, it is worth noting that UK Financial Services Authority rules require customers buying financial products to be issued with deterministic projections of the future value of their investment based on assumed investment growth rates of 5%, 7% and 9%. A review of these projection rates by the consulting firm PwC (FSA 2003) argued – partly based on Dimson *et al*. – that a reasonable forecast for the mean annual return for equities is 7.5% (nominal, pre-charges) and for bonds 4.5% in an environment where inflation is forecast to average 2.5%. These figures are consistent with the FSA's median projection rate for funds with asset allocations of approximately 85% equities and 15% bonds. Our adjusted return

[14] See Table A1. We use standard deviation and correlation figures based on annual returns. We do not take account of the possibility that the structure of risk and correlation over longer holding periods differs from that of a one year holding period, as argued by Campbell and Viceira (2004). It can be argued that in the context of financial planning, ignoring any mean reversion in investment returns is a 'prudent' basis for analysis.

parameters are therefore also broadly consistent with the median rate in the FSA projection rules.

The following section presents the results of our simulations for the various default fund strategies.

5. Simulation Results

Table 7 shows the results of our historical-data-based simulations. We give the median and mean pension ratios for each of the 16 default fund strategies, together with measures of the dispersion of the results. All results are based on 5000 simulations using the PensionMetrics model.

[Table 7 about here]

Consistent with prior studies (Booth and Yakoubov 2000, Blake et al 2001, Hibbert and Mowbray 2002) the key conclusions are that the anticipated pension ratio varies significantly across asset allocation strategies, and that there is a wide range of possible pension outcomes for any given strategy.

The median pension ratio for the initial asset allocation strategies – i.e. without any lifestyle profile – ranges from 0.93 for the With-profit (WP) strategy (1) to 1.49 for the Global Equity (GE) strategy (5). Put another way, the WP strategy has a 50% chance of producing a pension of at least 93% of the DB benchmark (of 2/3rds of final salary), while the GE strategy has a 50% chance of producing a pension at least 149% of the DB benchmark. The Balanced Managed (BM) strategy lies in the middle with a median pension ratio of 1.25. The range of medians is, of course, largely explained by variation in equity content across the strategies considered.

While the median pension ratios for these strategies compare favourably against the DB benchmark, each strategy also generates a wide range of possible outcomes. The downside risk involved can be appreciated from the pension-Value at Risk (pension-VaRs) figures. The Table shows that the 5% pension-VaRs range from 0.35 for the UK Equity strategy to

0.44 for the BM strategy. The interpretation in the case of the UK Equity strategy, for example, is that there is a 1-in-20 chance of the pension turning out to be below 35% of the DB benchmark, an outcome that implies that the scheme member's private pension would amount to less than 25% of his pre-retirement income.[15]

It is also notable that the WP strategy – which with a high fixed-income content would conventionally be regarded as a low risk approach – produces a low median pension ratio and low standard deviation, but also has a 5% pension-VaR that is below that of some other strategies. This illustrates the potential 'reckless conservatism' associated with investing in low-risk–low-return assets over long investment horizons, with returns failing to keep pace with equity returns and / or long-term wage growth.

The lifestyle profiles used in several of the default arrangements are designed to reduce the risk that falling equity markets in the years immediately prior to retirement causes losses in the pension fund from which it would be difficult to recover. Table 7 shows that the lifestyle profiles (Strategies 5 – 16) do indeed have this effect. Each of the lifestyle strategies has a lower standard deviation of pension ratio and a higher 5% VaR than the corresponding strategy without lifestyling. However, the reduction in risk does come at a cost in the form of a reduced expected level of pension. For example, a ten-year lifestyling profile, switching towards bonds and cash, reduces the median pension ratio for the balanced managed strategy from 1.25 to 1.02.

The risk reduction benefits are, unsurprisingly, largest for strategies that have high initial equity contents (Strategy 2 vs. 8-10; 3 vs. 11-13) and lower for strategies that already have high fixed-income content (Strategy 4 vs. 14-16). The reduction in risk and in median pension ratio is greater when the lifestyle switch begins ten years from retirement rather than five years (Strategies 6, 9, 12, 15). Interestingly, for the five-year lifestyle profiles there is little difference between profiles with a final year asset allocation of 75% bonds and 25% cash (Strategies 5, 8, 11, 14) and those that end at 100% cash (Strategies 7, 10, 13, 16): the median pension ratios, standard deviations and 5% pension-VaRs are nearly identical in all cases. Though a switch to long gilts is usually recommended as a hedge for annuity rates, our

[15] The pension scheme member would, of course, be eligible for the basic state pension and, if total income was low, certain means tested state benefits.

simulations suggest that long gilts are of little more benefit than cash in protecting annuity purchasing power of the pension fund.

The simulation results in Table 7 show that higher equity strategies generally lead to higher pension ratios. However, this is due in part to the high realised equity risk premium (of over 7%) that has been used to parameterise the model. To accommodate the possibility that this equity risk premium is too high, Table 8 presents simulation results based on our alternative, and arguably more realistic, forward-looking return projections, which incorporate a lower equity risk premium. The results of Table 8 indicate that a smaller assumed equity premium leads to a dramatic drop in both the median and mean pension ratio for all of the strategies, and also to a narrowing of dispersion across the different strategies. The range of pension ratios for strategies without lifestyling (Strategies 1, 2, 3, 4) now runs from 0.59 to 0.66 – indicating pension replacement rates of only 40%-45% of pre-retirement salary, which are below what many would consider to be necessary for a comfortable retirement. The 5% pension-VaRs are of yet more concern, ranging from 0.19 to 0.28 – corresponding to a 1-in-20 probability of pensions less than 13%-to-19% of final salary. Lifestyle profiling again produces reductions in risk, with lower standard deviations and higher 5% pension-VaRs, but the magnitudes of the differences are now smaller. There is still a cost to the risk reduction (in terms of a lower median pension ratio), but the percentage reduction is much lower than is the case of Table 7.

[Table 8 about here]

The pension ratios shown in Tables 7 and 8 are based on an assumed annual contribution rate of 10% of salary over 40 years of pension scheme membership. On the basis of the forward-looking (low equity risk premium) return estimates used in Table 8 – which are consistent with the FSA requirements – the 10% contribution rate does not produce replacement rates that many people would find attractive. This is important because, as noted above, 10% of salary is a common contribution rate in practice (NAPF 2003).

Table 9 presents the contribution rates that would be required, based on the lower-equity risk premium simulations, to produce a median pension ratio of one – in effect to have a 50%

chance that the DC pension will replicate the pension produced by a DB scheme accruing $1/60^{th}$ of salary for each year worked.[16]

[Table 9 about here]

The required contribution rates range from 15.2% for a GE strategy with no lifestyling, through to 17.9% for a WP fund that begins switching to bonds and cash ten years prior to retirement. It is interesting – but not surprising – to note that these rates are consistent with total contribution rates paid into DB pension schemes. (See NAPF 2003 p. 42.) At these contribution rates the 5% pension-VaR levels range from 0.31 (i.e. 20% of final salary) for the UK strategy to 0.55 (37% of final salary) for the WP strategy with a 10-year lifestyle switch. So even with relatively high contribution rates, these stakeholder pensions remain risky for the pension scheme members.

Disturbing as these results might be, it is should be noted that the analysis we have performed is relatively *generous* to the stakeholder schemes in comparison with traditional DB pension schemes. One reason for this is that we have assumed that the stakeholder pension fund is used to buy an annuity with a level stream of payments, payable only to the scheme member until death, and we ignore any further benefits that could be provided by the annuity. However, most DB pensions, at least as currently structured, allow for indexation of the pension in line with retail prices up to some specified maximum, such as 5% per annum, and for a 50% pension payable to the spouse after the death of the member. Replicating these benefits from the DC scheme would raise the annuity cost by approximately 35% to 60% – either reducing the pension ratio or requiring a corresponding increase in contributions.[17]

[16] These figures can be derived by dividing the initial 10% contribution rate by the median pension ratio in Table 8.

[17] For example, as at 19/07/04 a pension fund of £100,000 would buy a man aged 65 a level annuity of £6,996 on a single life basis; an RPI indexed annuity of £5,136 on a single life basis; or an RPI indexed annuity paying a 50% pension to the surviving wife (also age 65) of £4,428. Source: Standard Life figures in FSA comparative tables (www.fsa.gov.uk).

6. Conclusion

We have shown that a wide variety of different strategic asset allocation profiles are offered as the default fund in stakeholder pension schemes in the UK. Indeed, the range of defaults is so wide that we cannot dismiss the hypothesis that the choice of certain key characteristics for the default funds is effectively random. This is surprising because our simulations show that the choice of these characteristics can have a significant effect on the range of retirement incomes experienced by scheme members. Where scheme members passively accept the default arrangements, as behavioural economics research suggests the majority do, they face an effective lottery in terms of their subsequent retirement income.

These findings raise important questions about stakeholder pension provision. In particular, if scheme providers are conscientious about due diligence, how is it possible to get such a wide variation in the default options offered? We leave readers to consider what factors might influence an individual provider's decision on the appropriate fund structure. Differences in membership profiles between schemes, e.g. differing levels of risk aversion, may explain some of the differences, but the provider's own business considerations and other factors unrelated to the membership characteristics may also involved.

The wide range of different types of default funds in use in stakeholder pension schemes suggest further research to identify optimal investment strategies for DC pension schemes could be beneficial. Cairns *et al* (2004) provide one possible answer, based on a stochastic lifestyling approach where asset switching is determined by experienced returns rather than just time to retirement, but there are few signs yet of scheme providers switching to this type of strategy.

And where does this leave the pension scheme member? Unless he or she can switch to a defined-benefit scheme, their only really viable option is to save more by raising their contribution rate. Our results suggest that very substantial increases in contribution rates – increases of nearly 100% - are needed if they are to attain expected pensions similar to those attainable under DB schemes. And even then, their pensions would still not be safe because DC schemes embody a considerable degree of downside risk that DB schemes do not.

References

Arnott R. & P. Bernstein (2002) 'What risk premium is "normal"?' *Financial Analysts Journal*, March/April, pp64-85.

Blake D. (2003) 'The UK pension system: Key issues' *Pensions* 8:4, pp330-375.

Blake D., A. Cairns, & K. Dowd (2001) 'PensionMetrics: Stochastic pension plan design during the accumulation phase' *Insurance, Mathematics and Economics* 29 pp187-215.

Blake D., A. Cairns, & K. Dowd (2004) 'The impact of occupation and gender on pensions in defined contribution plans' Working Paper, The Pensions Institute, London.

Booth P. & Y. Yakoubov (2000) 'Investment policy for defined-contribution pension scheme members close to retirement: An analysis of the "lifestyle" concept' *North American Actuarial Journal* 4:2, pp1-19.

Bridgeland S. (2002) 'Choices, choices' PMI Trustee Group News, December 2002.

Cairns, A., D. Blake, and K. Dowd (2004) 'Stochastic Lifestyling: Optimal Dynamic Asset Allocation for Defined Contribution Pension Plans' Working Paper, The Pensions Institute, London.

Campbell J. & L. Viceira (2004) 'The term structure of the risk-return tradeoff' *Financial Analysts Journal*, Forthcoming.

Choi J., D. Laibson, B. Madrian, & A. Metrick (2002) 'Defined contribution pensions: Plan rules, participant decisions, and the path of least resistance' in J. Poterba ed. *Tax Policy and the Economy* Vol. 16, MIT Press, Cambridge MA.

Dimson, E., P. Marsh & M. Staunton (2001) *Millennium Book II: 101 Years of Investment Returns* ABN Amro / London Business School, London.

FSA (2003) *Rates of Return for FSA Prescribed Projection* Financial Services Authority, London.

Hibbert J. & P. Mowbray (2002) 'Understanding investment policy choices for individual pension plans' *Pensions* 8:1 pp41-62.

NAPF (2003) *Annual Survey 2003* National Association of Pension Funds, London.

OPRA (2004) 'Stakeholder Registry' (www.opra.gov.uk).

Samuelson P. (1963) 'Risk and uncertainty: A fallacy of large numbers' *Scientia* 57, pp1-6.

Samuelson P. (1992) 'At last a case for long-horizon risk tolerance and for asset allocation timing' in Arnott R. & F. Fabozzi (eds) *Active Asset Allocation* McGraw-Hill, New York.

Samuelson W. & R. Zeckhauser (1988) 'Status quo bias in decision making' *Journal of Risk and Uncertainty* 1, pp7-59.

'The Stakeholder Pension Scheme Regulations 2000' Statutory Instrument 2000:1403.

Appendix A – Simulation Model Historical Return Parameters

Table A1 – Real Returns and Earnings Growth 1947 to 2003

	UK T-bills	UK Equities	UK Bonds	US Equities	UK Real Earnings Growth
Mean Return (Arithmetic %)	1.19%	9.18%	1.79%	8.71%	2.07%
Standard Deviation (Annual %)	3.99%	23.22%	13.31%	21.04%	2.00%
Correlation Matrix					
UK T-bills	1.000				
UK Equities	0.051	1.000			
UK Bonds	0.465	0.513	1.000		
US equities	0.136	0.576	0.253	1.000	
UK Real Earnings	0.049	-0.026	-0.347	0.045	1.000

Source: Returns from ABN Amro / LBS data from Ibbotson Associates (Dimson *et al*. 2001). Earnings data from the Office for National Statistics.

Table 1 – Stakeholder Pension Scheme Default Funds by Type

	Total	*Actively Managed*	*Passively Managed*	*Lifestyle Default*	*Lifestyle Option*	*No Lifestyle*
Balanced Managed	19	17	2	5	4	10
Global Equity	6	1	5	6	0	0
UK Equity	7	1	6	6	1	0
With-profits	3	3	0	0	2	1
Total	35	22	13	17	7	11

Notes: See text for a full description of each fund type.

Table 2 – Stakeholder Pension Scheme Default Lifestyle Profiles

	Years to Retirement When Lifestyle Switch Starts					
Final Year Allocation	3	4	5	8	10	*Total*
75% Bonds 25% Cash	-	-	10	2	2	14
100% Bonds	-	-	-	-	1	1
100% Cash	1	1	-	-	-	2
Total	1	1	10	2	3	17

Notes: This table only includes schemes where a lifestyle profile is part of the scheme default arrangements.

Table 3 – Prob-Values of Randomness Hypotheses

Hypothesis	*x*	*n*	*q*	*Prob-value*
Active management default is random	22	35	2	0.1724
Lifestyle default is random given alternatives of lifestyle option and no lifestyle option	17	35	3	0.1350
Lifestyle default is random given alternative of lifestyle option	17	24	2	0.0637
Date of lifestyle switch is random, given choices of 3-10 years ahead of retirement	10	17	8	0.0002

Notes: x is observed mode frequency, n is sample size, and q is number of choices to be made. The prob-values are obtained using Monte Carlo simulation with 20000 simulation trials.

Table 4 – Stylised Default Fund Asset Allocation Profiles

	UK Equities	*Overseas Equities*	*UK Gilts*	*Sterling Cash*
Balanced Managed ("BM")	56%	28%	13%	3%
Global Equity ("GE")	70%	30%	-	-
UK Equity ("UK")	100%	-	-	-
With-profits ("WP")	50%	10%	40%	-

Note: US equity returns are used as a proxy for overseas equities.

Table 5 – Stylised Default Lifestyle Profiles

Profile	*Switch Start Date*	*Final Year Allocation*
"NL"	None	As initial allocation
"BC5"	5 years prior to retirement	75% long bonds (15yrs+) 25% Cash
"BC10"	10 years prior to retirement	75% long bonds (15yrs+) 25% Cash
"C5"	5 years prior to retirement	100% Cash

Note: Each profile involves a linear switch from the initial allocation to the final year allocation over the period indicated by the switch start date.

Table 6 – Forward-looking Return Parameters

	Nominal Annual Return	*Real Annual return*	*Real Annual Return Post Charges*
Equities (UK & Global)	7.5%	5.0%	4.0%
Bonds	4.5%	2.0%	1.0%
Cash	4.0%	1.5%	0.5%

Notes: Inflation is assumed at 2.5% in line with the RPIX target set for the Bank of England by the Government. The 1.0% charge reflects the maximum allowed under current stakeholder regulations. No allowance is made for any excess returns from active management. The cash return is derived by subtracting a 3.5% equity risk premium from the 7.5% expected equity return proposed by PwC (FSA 2003).

Table 7 – Simulation Results – Return Parameters Based on Historical Data

Strategy	*Median Pension Ratio*	*Mean Pension Ratio*	*Standard Deviation*	*5% pension-VaR*
Strategy 1: BM-NL	1.25	1.59	1.26	0.44
Strategy 2: GE-NL	1.49	2.08	2.11	0.43
Strategy 3: UK-NL	1.38	2.14	2.67	0.35
Strategy 4: WP-NL	0.93	1.10	0.69	0.40
Strategy 5: BM-BC5	1.13	1.41	1.06	0.45
Strategy 6: BM-BC10	1.02	1.22	0.84	0.45
Strategy 7: BM-C5	1.14	1.41	1.05	0.46
Strategy 8: GE-BC5	1.34	1.81	1.72	0.44
Strategy 9: GE-BC10	1.17	1.52	1.31	0.45
Strategy 10: GE-C5	1.35	1.80	1.72	0.45
Strategy 11: UK-BC5	1.26	1.86	2.18	0.37
Strategy 12: UK-BC10	1.11	1.56	1.65	0.39
Strategy 13: UK-C5	1.26	1.85	2.19	0.38
Strategy 14: WP-BC5	0.86	1.01	0.60	0.40
Strategy 15: WP-BC10	0.79	0.91	0.50	0.40
Strategy 16: WP-C5	0.87	1.01	0.59	0.41

Notes: See Tables 3 and 4 for description of the strategies. Results are based on 5000 simulations using the PensionMetrics model (assuming a multivariate normal distribution). The real return parameters are based on historical data from Dimson et al (2001) adjusted for an assumed 1.0% annual charge. All figures are expressed in terms of the pension ratio (i.e. DC pension to 2/3 final salary). There is a 1-in-20 chance that the strategy in question will produce a pension ratio below the level indicated in the 5% pension-VaR column.

Table 8 – Simulation Results – Return Parameters Based on Forward-looking Estimates

Strategy	*Median Pension Ratio*	*Mean Pension Ratio*	*Standard Deviation*	*5% pension-VaR*
Strategy 1: BM-NL	0.65	0.79	0.56	0.26
Strategy 2: GE-NL	0.66	0.88	0.77	0.23
Strategy 3: UK-NL	0.61	0.78	0.94	0.19
Strategy 4: WP-NL	0.59	0.69	0.39	0.28
Strategy 5: BM-BC5	0.62	0.75	0.49	0.29
Strategy 6: BM-BC10	0.61	0.71	0.42	0.31
Strategy 7: BM-C5	0.63	0.75	0.49	0.28
Strategy 8: GE-BC5	0.65	0.83	0.68	0.26
Strategy 9: GE-BC10	0.63	0.77	0.56	0.29
Strategy 10: GE-C5	0.65	0.83	0.67	0.26
Strategy 11: UK-BC5	0.60	0.82	0.82	0.22
Strategy 12: UK-BC10	0.59	0.77	0.67	0.26
Strategy 13: UK-C5	0.60	0.82	0.82	0.22
Strategy 14: WP-BC5	0.58	0.66	0.36	0.29
Strategy 15: WP-BC10	0.56	0.64	0.31	0.31
Strategy 16: WP-C5	0.58	0.66	0.35	0.30

Notes: See Tables 3 and 4 for description of the strategies. Results are based on 5000 simulations using the PensionMetrics model (multivariate normal distribution). The return parameters are based on forward-looking estimates net of an assumed 1.0% annual charge. The volatility and correlation structure is based on historical data from Dimson et al (2001). All figures are expressed in terms of the pension ratio (i.e. DC pension to 2/3 final salary). There is a 1-in-20 chance that the strategy in question will produce a pension ratio below the level indicated in the 5% pension-VaR column.

Table 9 – Contribution Rates Required to Achieve Median Pension Ratio of 1.0

Strategy	*Required Contribution Rate*	*5% Pension-VaR at Required Contribution Rate*
Strategy 1: BM-NL	15.4%	0.40
Strategy 2: GE-NL	15.2%	0.35
Strategy 3: UK-NL	16.4%	0.31
Strategy 4: WP-NL	16.9%	0.47
Strategy 5: BM-BC5	16.1%	0.47
Strategy 6: BM-BC10	16.4%	0.51
Strategy 7: BM-C5	15.9%	0.45
Strategy 8: GE-BC5	15.4%	0.40
Strategy 9: GE-BC10	15.9%	0.46
Strategy 10: GE-C5	15.4%	0.40
Strategy 11: UK-BC5	16.7%	0.37
Strategy 12: UK-BC10	16.9%	0.44
Strategy 13: UK-C5	16.7%	0.37
Strategy 14: WP-BC5	17.2%	0.50
Strategy 15: WP-BC10	17.9%	0.55
Strategy 16: WP-C5	17.2%	0.52

Notes: See Tables 3 and 4 for description of the strategies. Results are based on 5000 simulations using the PensionMetrics model (multivariate normal distribution). The return parameters are based on forward-looking estimates net of an assumed 1.0% annual charge. The volatility and correlation structure is based on historical data from Dimson et al (2001). Contribution rate is expressed as a constant proportion of the scheme member's salary. There is a 1-in-20 chance that the strategy in question will produce a pension ratio below the level indicated in the 5% pension-VaR column.