Default Funds in UK Defined Contribution Pension Plans

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Abstract:

Most defined contribution (DC) pension plans give their members a degree of choice over the investment strategy for their contributions. Many plans also offer a 'default' fund for members unable or unwilling to choose their own investment strategy. We analyse the range of default funds offered by UK 'stakeholder' DC plans, which by law must offer a default fund. We find the default funds are typically risky, but also that they vary substantially across providers in their strategic asset allocation and in their use of lifecycle profiles that reduce investment risk as the planned retirement date approaches. We use a stochastic simulation model to demonstrate that the differences can have a significant effect on the distribution of potential pension outcomes experienced by plan members who adopt the default fund as the path of least resistance. We also analyse the fees charged for the default funds.

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Default Funds in UK Defined Contribution Pension Plans

Defined contribution (DC) pension plans are an increasingly common form of retirement income provision in the US, the UK and many other economies. Most DC plans allow members a degree of choice about how to invest their contributions. Typically, a range of mutual funds is offered in the plan and the member can choose one or more of them in which to invest. Many plans also have a default option that is automatically used if the member does not actively choose a fund.

Previous research shows that a large proportion, and often the majority, of employees are inclined to take the 'path of least resistance' and passively adopt the default arrangements that exist in their plan. For example, Choi *et al.* (2002) review US evidence on the tendency for members to accept plan 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. In the plans Choi *et al.* studied, between 42% and 71% of participants accept the default contribution rate and between 48% and 81% of plan assets are invested in the default fund, which is typically a money market fund. In the UK, consulting firm Hewitt Bacon and Woodrow estimate that more than 80% of members in DC plans accept the default fund choice (Bridgeland, 2002).

Default funds do bring a number of benefits, especially if they are well chosen with the needs of the pension plan members in mind. Where plan members have relatively little financial knowledge, default funds simplify the pension saving process, which in turn might raise participation rates. The default fund provides an 'obvious' choice for the uninformed member, seemingly endorsed by the sponsoring employer or pension plan provider, and helps them deal with an otherwise complex decision (Madrian and Shea, 2001).

However, the tendency of DC pension plan members to accept plan defaults does mean that the provider or plan sponsor's choice of these defaults has the potential to have a significant impact on the welfare of plan members. Put simply, well-chosen default funds will benefit members, while poorly-chosen defaults will impose a cost on uninformed members. Furthermore, to the extent that there is cross-sectional variation in default funds across pension plans that is not explained by differing membership characteristics, members will face something of a lottery. Financial analysts and planners have an important role to play in

helping pension providers and plan sponsors to put appropriate default arrangements in place. In this paper we investigate this issue by analysing the variety of different types of default fund offered by stakeholder DC plans in the UK. We document the range of different approaches in use and provide a quantification of what these differences mean in terms of the potential pension outcomes for plan members.

Stakeholder pension plans were introduced in the UK in April 2001 with the aim of providing a simple, carefully regulated and low cost savings product that could improve pension provision amongst low and middle-income employees. In essence, they are personal pension arrangements which operate on a DC basis and are offered by financial institutions. They share most of the features of other DC pension arrangements, for example, in terms of permissible contribution rates, the availability of benefits, and tax treatment. However, stakeholder plans also have a number of specific features intended to make them easy for inexperienced investors to use.[1] The feature of interest to us is that the regulations require each plan to have a default fund so that members do not have to make an active choice about how to invest (Statutory Instrument 2000:1403). The requirement to have a default fund and the public availability of data for most plans on the default fund used makes the stakeholder pension market an interesting area in which to study the investment strategies financial institutions offer to 'uninformed' pension plan members.

The stakeholder market is also a significant part of the UK pensions system. Stakeholder plans are offered by most of the major insurance companies and asset managers in the UK. While they can be sold as retail financial products, they are often used by companies for occupational pension provision. The employer 'adopts' a plan provider and its employees can then enrol in the plan. All employers with five or more employees, and who do not provide a qualifying occupational pension plan, must make a stakeholder plan available to their employees, but do not need to contribute to it (Blake 2003).

[1] Stakeholder plans must have a low level of minimum contributions (£20), no penalties for ceasing or reducing contributions, no penalties for transferring to another arrangement, and total charges were initially capped at 1.0% per annum. From April 2005 providers are allowed to charge a fee of up to 1.5% for each of the first ten years the pension product is held by a customer. After ten years the fee cap reduces to 1.0% (www.hm-treasury.gov.uk).

As at May 2006, over 2.7m stakeholder pension accounts had been opened since the launch in 2001 (DWP, 2006) Figures from HM Revenue and Customs (2006) show that 1.5m individuals contributed to stakeholder pension plans during the 2004/05 tax year and that total contributions were £2.4bn. The corresponding figures for employer-sponsored group personal pensions, which are similar to stakeholder plans in many respects including the investment strategies they use, were 1.8m contributing members and £4.0bn of contributions.[2] Assets under management in personal and stakeholder plans were estimated to amount to £300bn at the end of 2005, compared to an overall funded pension market, including defined benefit plans, of £1,400bn. (UBS, 2006)

Our analysis of the default funds in stakeholder plans finds that they are typically risky, with high equity content, but also that there are substantial differences across funds in terms of their asset allocation and the nature of their lifecycle profiles that automatically switch the member's pension fund assets to fixed-income investments and/or cash as the planned retirement date approaches.[3] These differences mean that an individual employed in one company accepting the default arrangements can end up with a very different investment product from a similar individual who happens to work for a different employer, which has selected a different pension plan provider. We also find that fees vary substantially across the various fund offerings, although many plans do charge at the 1.0% original fee cap.

We use a stochastic simulation model to illustrate the distributions of possible pension outcomes that the different fund structures generate for plan members accepting the default arrangements. The results of these simulations suggest that the choice of default fund can

[2] We emphasise that although our analysis is based on stakeholder pension plans in the UK, it can be generalised to other DC pension arrangements where there are similar default options.

[3] Lifecycle asset allocation profiles are used to attempt to reduce the risk that a fall in equity prices close to the planned retirement date reduces the member's retirement income. Bodie *et al.* (1992) argue 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 work effort to make up for any shortfall generated by losses in financial assets.

have a major impact on likely pension outcomes. High equity strategies have the obvious benefit of higher expected pensions in payment. However, this comes at the cost of greater variability and members of plans with equity-based default funds may receive lower pension outcomes than those using more cautious strategies if their retirement happens to coincide with a period of equity market weakness. Our analysis of the actual historical performance of a subset of funds confirms the potential for members to receive substantially different outcomes depending on the nature of the default fund in their pension plan.[4]

These results are of potential concern, especially in light of the evidence that most members of DC pension plans passively accept the default fund chosen by the plan provider. Unless the different choices of default fund made by different providers are somehow correlated with the characteristics of the members of the different plans – and we know of no evidence to this effect – then plan members face an effective lottery: their choice of investment strategy is driven by the provider's choice of default fund rather than their own circumstances and attitude to risk.

Previous Literature

A number of previous studies investigate the effects of alternative investment strategies on the anticipated outcomes of DC pension plans. For example, Booth and Yakoubov (2000) used historical return data from the annual Barclays Capital *Equity-Gilt Study* for the UK to investigate the retirement income implications of five different investment strategies. They assumed the 'standard' fund had a constant 70% equity / 20% bonds / 10% cash mix. This standard fund is combined with four lifecycle strategies – a switch to bonds 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 the superiority of lifecycle approaches, and also 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-

[4] The results of the analysis of historical performance are available in the online appendix.

fund-average approach – invested across a range of asset classes in proportions typical of UK occupational pension funds in the late 1990s – and a lifecycle strategy that switches from the pension fund average into a 50% bonds / 50% T-bills portfolio over the final ten years before retirement. They also found that the overall distribution of potential outcomes is very wide. In line with Booth and Yakoubov, they found that a well-diversified, high-equity strategy (i.e. the pension-fund-average strategy) produces the best overall outcomes and that, while the lifecycle 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 100% cash, 100% bonds, and 100% equity asset allocations, and various forms of lifecycle strategy). They too found that the 100% equity strategy produces the highest expected value for the pension annuity, albeit with a wide range of potential outcomes. The lifecycle strategies significantly narrow the range of potential outcomes, but at the expense of reduced expected value, particularly where the lifecycle switch begins 15 years from retirement.

Our work differs from the papers discussed above principally in that it focuses directly on the fund structures actually offered as the default in UK stakeholder pension plans. The following section describes these fund structures in detail.

Data on Default Funds

UK legislation requires stakeholder pension plans to be registered with The Pensions Regulator, which makes the register available to the public. As at December 2006, 45 plans were listed on the register and these plans form the universe for our analysis. Of the 45 plans, 14 are closed to new business, e.g. because of mergers between providers, and so no longer provide public information on their fund structures, leaving 31 plans on which we were able to collect data. This sample, in effect, represents all of the stakeholder plans actively marketed in December 2006. The key variables of interest are the basic asset allocation of the default fund and the nature of the lifecycle profile used by the fund.

It is important to stress that the term ‘plan’ here refers to a pension arrangement offered to the marketplace by an insurance company, asset manager or, in some cases, a membership organisation such as a trade union. An employer can ‘adopt’ a plan and offer it to its employees. Thus each of our plans will likely be used by many different employers and groups of employees. Equally, many of the plans are offered on a retail basis and any individual can join, either arranging this themselves or via a financial adviser.

In the occupational context, the employer chooses a financial institution to offer a stakeholder pension product to its employees. The choice will be made based on factors such as brand, track record and cost. Each financial institution will have a ‘standard’ default fund that it typically uses when implementing a plan for an employer. It is open for the employer to accept this standard plan or to ask that the financial institution uses another fund as the default for that employer’s employees. An employer might do the latter if it felt the standard default fund was inappropriate, e.g. too risky, for its employees, but our industry contacts suggest few employers actually do so. So, in most cases the financial institution’s choice of default fund prevails.

Example: Widgets Inc chooses Byrne Investments to offer a stakeholder pension plan to Widget’s employees. Byrne Investments usually nominates its FTSE 100 Index Tracking Fund as the default for stakeholder schemes. The management of Widgets can either accept the usual default fund from Byrne Investments as the default for their employees, or they can ask Byrne to implement an alternative default for their employees. Widget’s management may be reluctant to override the judgement of the financial institution, even though they know their employees better than Byrne Investments does.

With the financial institution’s standard default fund likely to be implemented in most cases, the fact that these stakeholder plans are, in most cases, generic plans offered to the whole marketplace rather than tailored for any specific group of employees suggests that the default funds across plans should be similar. Put simply, the default funds should be suitable for the average employee in the economy who randomly chooses, or is randomly allocated, one of available default funds. However, our data do not show this. In fact, we find substantial variation, both in terms of the basic strategic asset allocation and in terms of the use of lifecycle strategies.

Default funds are potentially less important in the retail setting. Where an individual joins a pension plan under the guidance of a financial adviser, it is likely that the adviser will guide the individual towards a fund choice that is consistent with his or her financial circumstances and degree of risk tolerance. In addition, individuals approaching a pension provider directly (i.e. doing business on an execution-only basis) are more likely to be financially knowledgeable and prepared to make their own fund choice. Nonetheless, there is the potential for relatively uninformed consumers to deal directly with the plan provider and be inclined to accept whatever default fund is proposed.

Table 1a shows the range of default funds in terms of fund type and style of management. The '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, is used by 13 of the 31 plans. Most of the balanced managed funds are actively managed, but four use a passive approach. A total of 18 plans offer a 100% equity fund as default - 13 of these are invested globally and five are invested only in domestic UK equities. The most common asset allocation for the global funds is 60% UK equities and 40% (capitalisation-weighted) overseas equities, although 50:50 and 70:30 splits are also in use. The majority of these 100% equity funds use passive management.

[Table 1a about here]

Since April 2005, all stakeholder default funds have been required to use some form of lifecycle asset allocation profile.[5] While all default funds must use a lifecycle approach, Table 1b shows that there is variation in the manner in which providers implement it. The most common structure (involving 13 of the 31 plans) 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-dated bonds and 25% cash. A further 11 plans use the same 75:25 final year allocation, but begin switching between six and ten years prior to retirement.

[5] A previous version of this study found that in 2004 prior to the regulation change approximately 50% of stakeholder plans had default funds that used a lifecycle profile, while an further 20% had it as a feature that members could choose,

[Table 1b about here]

UK pension legislation requires that the benefits from DC pensions be taken via a (taxable) life annuity with the option to take up to 25% of the value of the fund as a tax-free lump sum at retirement.[6] This explains why many lifecycle products switch from equities to a final pre-retirement allocation of 75% long bonds and 25% cash, the former to hedge the interest rate risk in the annuity price[7], and the latter to protect the portion of the fund likely to be taken as a lump sum.

The Table shows, however, that is not the only approach in use. Some plans use different final-year asset allocations: two plans switch to a final allocation of 100% long bonds, and four plans offer lifecycle profiles that have a final year asset allocation of 100% cash.

By way of comparison, it is interesting to look at the extent of similarity between default funds in UK plans and those in use in other markets. In terms of the US 401(k) market, data from a small survey by the Profit Sharing/401(k) Council of America (2001) shows conservative strategies dominate US defaults. The survey finds 46% of plans using a stable value fund (or guaranteed investment contract) as the default, while 21% use a money market fund. Balanced funds, with holdings in stocks and bonds, are used by 21% of plans and lifecycle funds by 13%. Sweden's state-wide Premium Pension Scheme is another interesting point of comparison. As a national scheme there is only one default fund, which is allocated 82% equities, 10% bonds and 8% in alternative assets. (Cronqvist and Thaler, 2004) Interestingly, scheme members who actively chose their portfolio in the early years of the scheme tended to have portfolios with higher equity content, higher home bias, higher fees, and lower returns than the default structure. It appears that just as UK pension providers fail

[6] Technically, it is possible to defer buying an annuity until age 75 by drawing an income directly from the pension fund, but in practice only those with substantial alternative assets will be in a position to do this. Such people are typically not the target membership for stakeholder pension plans.

[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.

to agree on what constitutes an appropriate default fund, there is little consensus internationally.

The key point to take from the UK data is that an individual joining a stakeholder pension plan and passively accepting that plan's default fund can get a substantially different asset allocation and lifecycle profile depending on which provider he, or his employer, has chosen. In the following section we attempt to quantify the significance of these differences by using a stochastic simulation model to assess the impact of the different default funds on anticipated pension outcomes.

Simulation Method

The model we use is the PensionMetrics model of Blake *et al*. (2001). This model uses stochastic simulation to determine the anticipated distribution of pension outcomes for any given set of input parameters, such as asset allocation strategy, anticipated retirement age, and so on.

In a DC plan, pension contributions from the plan member and his or her employer are invested in a portfolio of assets. The returns on the assets will be stochastic and some assets will have more volatile returns than others. The DC pension fund will therefore grow in a stochastic fashion too. The PensionMetrics model uses Monte Carlo simulations to generate a range of outcomes (i.e., a probability distribution function) for the value of the accrued DC pension fund (and hence the pension) at any given future date, conditional on a set of assumptions concerning contributions, asset returns, mortality and other relevant factors. The model requires assumptions about both control factors and risk factors.

There are three control variables: variables that are set by either the pension plan member or the pension plan provider in each period of the model. The first is the pension fund contribution rate, which we assume to be a constant proportion of the plan member's income for the whole period, while the second control variable is the retirement age. For the purposes of our modelling we assume that the plan member is a male who joins the plan 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 plan. We use this figure

because the Pensions Commission (2004) reports typical contribution rates of this magnitude from surveys conducted in the UK by the National Association of Pension Funds (NAPF) and the Association of Consulting Actuaries. Average US contribution rates also appear similar, with Munnell and Sunden (2006) suggesting that 9% is the typical contribution rate for a 401(k) plan member (6% employee; 3% employer match).

The third control variable is the asset allocation which is the key control variable in the model, since previous research shows that it dominates the distribution of pension outcomes. In this study, we assume contributions are invested in the default fund and the fund allocations are based on the asset allocation profiles we found to be in use in the stakeholder pension marketplace.

We create a number of stylised strategic asset allocation profiles 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 (with a weighting of 81%), but also in fixed-income (16%) and cash (3%); 'Global Equity' – with a 60:40 split between UK and overseas equities; and 'UK Equity' – 100% UK equities. We use the median asset allocation of the relevant funds as the basis for the Balanced Managed profile. For comparison, we also show the results of a conservative, 100% bonds investment strategy, although none of the plans in our sample offer such a strategy as the default. The asset allocation profiles are shown in Table 2a.

[Table 2a about here]

For each initial asset allocation strategy with the exception of 100% bonds, there are four lifecycle variants: no lifecycle switch; 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 lifecycle profiles are shown in Table 2b. Together with the three initial asset allocation

profiles, these give us a total of 12 representative default fund asset allocation strategies plus the 100% bonds non-default option.[8]

[Table 2b about here]

The first risk factor in the PensionMetrics model relates to real (i.e., inflation-adjusted) asset returns. Some simulation models use historical realised returns to develop the distribution from which the simulated returns are drawn. However, in our main simulations we use alternative 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.[9] Some commentators argue that the historical equity risk premium is an upward biased estimate of the likely future risk premium. They claim 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 upon in future 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 3.5% relative to US Treasury bills, and Arnott and Bernstein (writing near the year-2000 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 expected inflation (2.5%). While some funds are actively managed, no allowance is made for any (positive or negative) excess returns generated by active management. The returns received are reduced by the pension fund annual charge, which is assumed to be 1.0% in line with the typical charge level on stakeholder pension plans. However, we also conduct a sensitivity analysis of the impact of fund charges in Table 6. While we do not use historical returns in our analysis, the volatility and correlation structure we use is taken from the historical data. We use data on key UK and international market indices over the period 1947 to 2003. The source for the data 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.

[8] 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 lifecycle profiles.

[9] An analysis based on parameters derived from historical returns is available in the online appendix.

non-UK) equities. The forward-looking return parameters are shown in Table 3 along with the volatility and correlation parameters derived from the historical data.[10]

[Table 3 here]

As an aside, it is worth noting that the UK Financial Services Authority's (FSA) 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 PricewaterhouseCoopers (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%. Our adjusted return parameters are therefore broadly consistent with the FSA analysis.

The second risk factor relates to interest rates. We need to model the evolution of interest rates over time in order to forecast the annuity factor at retirement (i.e. the expected present value of a pension of £1 per annum from retirement until death). When the plan 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 insurance companies. The pension at retirement is found by taking the ratio of the pension fund and the annuity factor. The interest rate model that we use is based on the Vasicek (1977) model which links bond returns and bond yields in a consistent manner.

[10] 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 (2005). In the context of financial planning, ignoring any mean reversion in investment returns can be considered a 'prudent' basis for analysis.

The third risk factor is earnings. Earnings are modelled using the lifetime earnings profiles for different types of occupation. These show how salary varies with age in the same occupation at a given point in time. We assume that an individual's salary over time follows the lifetime earnings profile of his or her profession, but also is subject to annual uprating in line with the real growth in national average earnings, which has averaged 2.1% over the post-war period. The plan member's wage growth experience in this case 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 disability.[11]

Having specified all of the risk and control factors, we use the model to perform thousands of simulations of the stochastic variables, such as the asset returns and interest rates, and then generate an empirical distribution of pension outcomes for the plan member's selected retirement date. We report the simulation results in terms of the replacement ratio, that is, the ratio of initial pension to the member's salary immediately prior to retirement. A replacement ratio of unity implies that the particular DC pension plan has generated a pension income equal to the member's pre-retirement salary Most final-salary defined benefit (DB) pension plans in the UK have targeted replacement ratios of two-thirds or one-half for a full contribution period of 40 years (i.e., they are based on either a sixtieths or eightieths annual accrual rate). However, in DC plans the generated distribution of possible replacement ratios will typically be quite wide. To make a suitable comparison, we need to specify one or more percentiles from the distribution. The i^{th} percentile of this distribution is also known as the value-at-risk (VaR) at the $(100 - i)^{th}$ confidence level. In this paper, we report the median and mean replacement ratios and use the 5% pension-Value at Risk (pension-VaR) as our measure of downside risk.

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

Simulation Results

[11] 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.* (2007). For simplicity, in this paper we consider only the career wage growth profile of a typical male employee in the UK.

Table 4 presents simulation results based on our forward-looking return projections, which incorporate a lower equity risk premium than is present in the historical data.[12] We give the median and mean replacement ratios for each of the 13 investment strategies, together with the 5% value-at-risk level as a measure of downside risk. All results are based on 5000 simulations using the PensionMetrics model.

[Table 4 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 replacement ratio varies in an economically significant manner across asset allocation strategies, and that there is a wide range of possible pension outcomes for any given strategy.

The median replacement ratios for the initial default asset allocation strategies – i.e. without any lifecycle profile – range from 0.39 for the UK Equity (UK) strategy to 0.43 for the Global Equity (GE) strategy. Put another way, the UK strategy has a 50% chance of producing a pension of at least 39% of the pre-retirement salary, while the GE strategy has a 50% chance of producing a pension at least 43% of pre-retirement salary.

Each strategy also generates a wide range of possible outcomes. The downside risk involved can be appreciated from the pension-VaR figures. The Table shows that the 5% pension-VaRs range from 0.12 for the UK Equity strategy to 0.17 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 12% of pre-retirement income or less.[13]

All of the default strategies we investigate have high equity content, typically between 70% and 100%. It follows that very risk-averse investors ought to opt out of the default and make an active choice of a more conservative fund (although we know that inertia may prevent them from doing so). Table 4 also shows simulation results for a fund comprising 100% long-term UK government bonds. This can be considered the low risk benchmark. The median

[12] Results based on historical return parameters are available in the online appendix.

[13] The pension plan member would also be eligible for the basic state pension and, if total income was low, to certain means-tested state benefits.

replacement ratio for that strategy is 0.29, which, unsurprisingly, is much lower than the equity-based alternatives. Also as would be expected, the variability around the median is lower too – the 5% pension-VaR replacement ratio at 0.18 is closer to the median than is the case in the comparable equity-dominated strategies. However, it is also worth noting that the 5% VaR level for the cautious strategy is not much higher than that for the equity-based default strategies, while the reduction in return is substantial. In fact, several of the equity-based strategies with lifecycle features provide higher median replacement ratios *and* equal or higher 5% VaR levels than the conservative 100% bonds strategy. While equities are volatile, the high expected return limits the extent of the downside risk in the longer term. The cautious strategy, therefore, appears appropriate only for investors who cannot tolerate short-term volatility in their pension assets and are prepared to sacrifice long-term return to avoid it. For other investors, fixed income investment for the full pension plan tenure may be characterised as 'reckless conservatism'.

The lifecycle 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 cause losses in the pension fund from which there is too little time to recover. Table 4 shows that the lifecycle profiles (Strategies 4 – 12) raise the 5% VaR levels by only a marginal amount. This is partly because the lifecycle switch involves forgoing the higher expected return from equities for a number of years.

The risk reduction effect are, unsurprisingly, largest for strategies that have high initial equity contents (Strategy 2 vs. 7-9; 3 vs. 10-12) and lower for strategies that already have higher fixed-income content (Strategy 1 vs. 4-6). The reduction in risk and in median replacement ratio is greater when the lifecycle switch begins ten years from retirement rather than five years before (Strategies 5, 8, and 11). It is also interesting to note that for the five-year lifecycle profiles there is little difference between profiles with a final year asset allocation of 75% bonds and 25% cash (Strategies 4, 7, and 10) and those that end with 100% cash (Strategies 6, 9, and 12): the median replacement ratios and 5% pension-VaRs are nearly identical in all cases. Though a switch to long bonds is usually recommended as a hedge for annuity rates, our simulations suggest that long bonds are, on average, of little greater benefit than cash in protecting the annuity purchasing power of the pension fund.

The replacement ratios shown in Tables 4 are based on an assumed annual contribution rate of 10% of salary over 40 years of pension plan membership. On the basis of the low equity risk premium return estimates used in the simulations, the 10% contribution rate does not produce replacement ratios that many people would find attractive. This is important because, as noted above, 10% of salary is a common contribution rate in practice (Pensions Commission, 2004).

We calculate that the required contribution rates for a two-thirds replacement ratio (with 50% probability) after 40 years of membership range from 15.7% for a GE strategy with no lifecycle feature, through to 18.0% for a UK equity 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 occupational DB pension plans (see for example NAPF 2003). At these contribution rates, the 5% pension-VaR levels range from 0.20 for the UK strategy to 0.34 for the BM strategy with a 10-year lifecycle switch. So even with relatively high contribution rates, the default funds remain risky for the pension plan members. One way to reduce the risk is to opt out of the default fund and invest in a more conservative fund. However, that comes at a cost: an investor following a conservative 100% bonds strategy would have to contribute 23.2% of salary throughout their 40 year career in order to have a 50% probability of a replacement ratio of two-thirds or better, well above that required by the equity-based strategies.

Disturbing as these results might be, it is should be noted that the analysis we have performed is relatively *generous* to the stakeholder plans in comparison with traditional DB pension plans. The reason 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 plan 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 2.5% per annum, and for a 50% pension payable to the spouse after the death of the member. Replicating these benefits from the DC plan would raise the annuity cost by approximately 40% to 65% – either reducing the replacement ratio or requiring a corresponding increase in contributions.[14]

[14] For example, as at June 2006 a fund of £100,000 would buy a man aged 65 a level annuity of £6,840 on a single life basis; an RPI (retail price index) linked annuity of £4,656 on a single life basis; or an

Finally, the above analysis ignores the attitude to risk of the individual plan member. It is important to recognise that if the member is risk averse with a concave utility function, the dispersion of replacement ratios could have large welfare implications. The life-cycle feature may reduce the expected replacement ratio from a particular strategy, but to the extent that it also reduces the dispersion of outcomes significantly, it might well be an optimal strategy from the individual's point of view (see, e.g., Cairns et al. (2006)).

Fund Charges

Our simulation analysis was carried out using an assumed 1.0% annual management charge. However, further analysis of fund charges is required because charges can have an important impact on the performance of a DC pension scheme. For example, Carhart (1997) shows that mutual fund charges have a near one-for-one impact in reducing mutual fund performance. Charges are particularly important in the context of default funds because passive members may pay little attention to the charges they are paying or may be unaware of the impact on performance. One particular concern is that a provider could exploit this inertia by nominating a high charge fund as the default.

The importance of charges is recognised in the regulations governing stakeholder pension plans in that there is a price cap. When stakeholder pensions were introduced in 2001 the cap was set such that total charges could not exceed 1.0% per annum. In 2005 this was changed as a result of industry lobbying and the new cap is 1.5% per annum for the first ten years of each customer account, falling to 1.0% thereafter. The higher cap in the initial years was designed to allow providers to recover the upfront marketing and set up costs.

From the mutual fund market and from the institutional pension market, we would expect charges to vary depending on the nature of the investments in the fund. Equity management typically costs more than fixed income management, and active management typically costs more than passive management. However, it is important to note that in the stakeholder market individual members pay bundled fees that cover marketing costs, including sales

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RPI linked annuity paying a 50% pension to the surviving wife (also age 65) of £4,068. Source: Standard Life figures in FSA comparative tables (www.fsa.gov.uk).

commission, and administrative record keeping as well as fund management. Industry contacts suggest the proportion of the charge that covers pure asset management is relatively small. That may explain the results in Table 5, which show that while there is some variation in the level of fees across default funds, most providers charge at the 1.0% level that was set out in the initial stakeholder regulations.

[Table 5 about here]

Table 5 shows that passively managed funds do, on average, charge less than actively managed funds. Across the full sample, the difference in the mean charge between active and passive is 20 basis points. However, the modal charge for both groups is 1.0% and some passive funds charge more than active funds. The government's initial 1.0% cap on charges seems to act as something of an anchor for providers – an officially endorsed charging level – which in a sense may be counterproductive. There is substantial variation in charging across the full sample, from a low of 0.6% to a high of 1.5%, although for any fund charging more than 1.0% the regulations require the charge to drop to 1.0% or below after ten years. Some of the variation reflects product type, for example balanced funds typically charge more than equity funds. However, after allowing for this there is still variation. Some of this may be explained by what is included in the bundled charge, e.g. the level of decision support given to members. Furthermore, the higher charging plans tend to have a more retail focus, while the lower fees are available for larger employer purchased arrangements. In some cases, plan providers say they may discount fees for larger schemes or those with higher earning employees, although few publicly disclose the level of discount on offer. Overall, the analysis shows that DC scheme members passively accepting their plan's default fund may face charges quite different from those paid by members of other similar schemes. However, there is no evidence of providers charging higher rates for their default funds than they do for comparable funds in their stakeholder pension ranges.

Given the variation in fund charges, it is appropriate to conduct a sensitivity analysis of our replacement ratio simulations. Table 6 shows the impact fees can have on replacement rates. In the standard case we use the 1.0% fee level set out as the maximum under the original stakeholder regulations. We conduct a sensitivity analysis where the fees are either 0.75% per annum or 1.25% per annum. The latter is higher than allowed by stakeholder regulations, but

could be charged by providers in non-stakeholder contracts. We assume that all funds earn the market return gross of fees, i.e. there is no superior performance by higher cost (e.g. active) managers. To conserve space, we show only the basic default fund strategies and ignore the variants of lifecycle. To the extent that active managers earn higher gross returns, this could offset some of the drag of higher fees. Overall, a plan with a 0.75% annual charge generates a median replacement ratio that is about 10% (or alternatively 4% percentage points of final salary) higher than a plan with annual charges of 1.25%.

[Table 6 about here]

Conclusion

We have shown that a wide variety of strategic asset allocation and lifecycle profiles are offered as the default fund in stakeholder DC pension plans in the UK. Our simulations show that the choice of profile can have a significant effect on the range of retirement incomes likely to be experienced by plan members. Where plan members passively accept the default arrangements offered to them, as behavioural economics research predicts the majority will do, then the provider's choice of default fund type will be a crucial determinant of their subsequent retirement income.

The main point of commonality amongst the default funds is that they are risky, with quite high (although still varying) allocations to equity. The simulations show the benefit of high equity strategies in terms of relatively high levels of expected pension. The simulations also reveal the cost in terms of relatively wide ranges of possible outcomes and the corresponding downside risk. The median replacement ratio in our simulations varies across strategies from 0.37 to 0.43 using a lower equity risk premium assumption, with the 5% value-at-risk replacement ratio of downside measure ranging from 0.12 to 0.19. It follows that the majority of plan members will do well from investing in an equity-based default fund, but some – perhaps simply due to the timing of their period of membership - will have a less positive experience and outcome. Furthermore, our analysis has used a relatively long planning horizon (40 years) and shortfall probabilities from equity based strategies would likely be higher over shorter periods of plan membership.

Our findings raise important questions about how providers select their default funds. It is possible that the selection is determined by membership characteristics (e.g., gender, age, occupation, salary profile, risk appetite, etc.). We do not have access to data that will allow us to test this conjecture. However, any attempt to explain differences between default funds along these lines would be complicated by the fact that the plans we have examined are generic arrangements that can be adopted by any employer and, in many cases, purchased by individuals through retail financial channels. This would suggest that providers should tailor their products for the requirements of the 'average' customer in the marketplace. Our data suggest that either they do not do this or that they take quite different views on the characteristics of the 'average' customer.

It is also possible that differences between default funds might be related to the characteristics of plan providers. In particular, if the marginal costs of production of particular types of fund differ between providers, then providers might be inclined to nominate their lowest cost fund as the default. For example, an asset manager with economies of scale in index funds might nominate an index fund as the default, while an insurance company with substantial balanced fund business might choose a balanced fund as the default. If this is the case, then so far as the typical plan member is concerned, the default fund has no obvious match with his or her characteristics.

We have focused on default funds on the basis of evidence that most plan members use them. However, members have the option to choose funds other than the default, and this raises the question of whether providers give an appropriate range of choice. Some evidence on this is provided by Elton *et al.* (2006) in the context of the US 401(k) DC pension market. They find that in almost half of the 400 cases they investigate, the choice offered by the plan sponsor is inadequate to allow members to form portfolios on the efficient frontier and that the inferior fund range can have a significant impact on members' terminal wealth. They interpret their findings as suggesting that most sponsors carry out poor due diligence in selecting fund ranges. This is somewhat surprising given that employers would seem to be better placed to devote resources to fund selection than their individual employees. Consistent with this latter view, Langford *et al.* (2006) provide evidence from the Australian superannuation market that retail offerings, which are chosen by individuals, tend to have higher fees and lower returns

than wholesale funds used in an occupational context, which are typically selected by an employer on behalf of its employees.

The results in this paper show the potential lottery for DC scheme members passively accepting default investment arrangements when these defaults vary across providers in a manner not explained by the characteristics of scheme members. In terms of practical suggestions for reform, these are essentially two fold: choose better default funds and try to reduce members' reliance on default funds in the first case.

Choosing better default funds requires an in depth understanding of the characteristics of the particular employees where the scheme is going to be implemented. A literature exists linking risk tolerance to various demographic characteristics, e.g. Hallahan et al (2004), and employers and pension product providers could jointly assess the profile of employees before deciding on a default. Employers also need to be more proactive in asking for tailored defaults for their employees, rather than just accepting 'what everyone else has'.

More significantly, the problem of default funds lessens if we can reduce the, typically high, percentage of members relying on the default. The inertia that leads to default fund use is deep seated, but intelligent scheme design may be able to mitigate it to an extent. Few members are likely to be able or keen to build their own risk-tailored multi-asset strategy from asset class building blocks – as many DC scheme fund menus imply they will want to do – but they may be able to choose amongst a limited number of risk-graded multi-asset strategies that have been pre-packaged for them and labelled clearly, for example cautious, balanced and adventurous managed funds. Targeted communications may also be effective in engaging members in investment choice, for example a letter saying that the account balance has just passed £50,000 or $50,000 and noting that the member has yet to choose their own investment strategy for this sizeable 'pot' may provoke a response. In the UK, these approaches are just beginning to be tried and look like a step forward, albeit that the results are as yet unknown.

Overall, our results suggest employers sponsoring DC plans need to take great care in selecting the default fund, which in many cases will be the fund used by the majority of their plan members. Otherwise, plan members end up taking part in a lottery in which they have

only a low chance of being matched to a fund that reflects their characteristics. Financial analysts and planners have a key role to play in assisting plan sponsors with this important task.

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Table 1a – Number of Stakeholder Pension Plan Default Funds by Type

	Total	*Actively Managed*	*Passively Managed*
Balanced Managed	13	9	4
Global Equity	13	5	8
UK Equity	5	1	4
Total	31	15	16

Number of default funds that fall into each category. Balanced Managed funds invest in equities and bonds; Global Equity funds typically have a 60:40 split between UK and overseas equities, although some use 50:50 or 70:30; UK Equity Funds are 100% invested in UK equities. One of the Balanced Managed funds has a limited return smoothing mechanism included.

Table 1b – Number of Stakeholder Pension Plan Default Lifecycle Profiles

	Years to Retirement When Lifecycle Switch Starts						
Final Year Allocation	5	6	7	8	10	15	*Total*
75% Bonds 25% Cash	13	2	3	1	5	-	24
100% Bonds	1	-	-	-	1	-	2
100% Cash	3	-	-	-	-	1	4
Total	17	2	3	1	6	1	30

Number of default fund lifecycle profiles falling into each category. The lifecycle profile switches from the default fund strategic asset allocation to the final year allocation shown in the Table over the period shown. One fund, not shown in the table, is a “Target Date” fund where the manager manages the risk level with a specified year of retirement in mind, e.g. 2040.

Table 2a – Stylised Default Fund Asset Allocation Profiles (Percentages)

	UK Equities	*Overseas Equities*	*UK Bonds*	*Sterling Cash*
Balanced Managed ("BM")	52	29	16	3
Global Equity ("GE")	60	40	-	-
UK Equity ("UK")	100	-	-	-
100% Bonds	-	-	100	-

Strategic asset allocation of stylised default fund profiles used in our simulations. These are based on the actual default funds observed in the sample of stakeholder pension plans. The 100% bonds strategy is not actually offered as a default fund in the schemes in our sample, but is assumed to be a choice open to plan investors to choose.

Table 2b – Stylised Default Lifecycle 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

Stylised lifecycle profiles used in our simulations. These are based on the actual lifecycle profiles observed in the sample of stakeholder pension plans. Each profile involves a linear switch from the initial allocation to the final year allocation over the period indicated by the switch start date. In the simulations these profiles are combined with the strategic asset allocations shown in Table 2a, with the exception of the 100% bonds strategy.

Table 3 – Historical Real Returns and Earnings Growth: 1947 to 2003

Returns	UK T-bills	UK Equities	UK Bonds	US Equities	UK Real Earnings
Forward-looking nominal return assumption	4.0%	7.5%	4.5%	7.5%	N/A
Forward-looking real, post charges return assumption	0.5%	4.0%	1.0%	4.0%	N/A
Memo: Historical Arithmetic Mean nominal Return, pre-charges	1.2%	9.2%	1.8%	8.7%	2.1%
Historical Annual Standard Deviation	4.0%	23.2%	13.3%	21.0%	2.0%
Correlation Matrix					
UK T-bills	1.00				
UK Equities	0.05	1.00			
UK Bonds	0.47	0.51	1.00		
US equities	0.14	0.58	0.25	1.00	
UK Real Earnings	0.05	-0.03	-0.35	0.05	1.00

The forward looking return estimates are used in our simulations. Inflation is assumed at 2.5% in line with the Retail Price Index inflation target set for the Bank of England by the Government. The 1.0% charge reflects the typical charge level in stakeholder plans, although we also conduct a sensitivity analysis of this assumption in Table 6. 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).

The historical returns are from ABN Amro / LBS data from Ibbotson Associates (Dimson et al. 2001). Earnings data are from the Office for National Statistics. The historical correlation and volatility data are used in the simulations. US equity data is used in the simulation as the proxy for overseas equities.

Table 4 – Simulation Results – Return Parameters Based on Forward-looking Estimates

Strategy	*Median Replacement Ratio*	*Mean Replacement Ratio*	*5% Pension-VaR*
Strategy 1: BM-NL	0.41	0.50	0.17
Strategy 2: GE-NL	0.43	0.56	0.15
Strategy 3: UK-NL	0.39	0.56	0.12
Strategy 4: BM-BC5	0.40	0.47	0.18
Strategy 5: BM-BC10	0.39	0.44	0.19
Strategy 6: BM-C5	0.40	0.47	0.18
Strategy 7: GE-BC5	0.41	0.52	0.17
Strategy 8: GE-BC10	0.40	0.49	0.18
Strategy 9: GE-C5	0.42	0.52	0.17
Strategy 10: UK-BC5	0.38	0.52	0.14
Strategy 11: UK-BC10	0.37	0.49	0.16
Strategy 12: UK-C5	0.38	0.52	0.14
Strategy 13: 100% Bonds	0.29	0.31	0.18

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 replacement ratio (i.e. DC pension to final salary). There is a 1-in-20 chance that the strategy in question will produce a replacement ratio below the level indicated in the 5% pension-VaR column. Balanced Managed (BM) funds invest in equities and bonds; Global Equity (GE) funds have a 60:40 split between UK and overseas equities; UK Equity Funds (UK) are 100% invested in UK equities. NL means no lifecycle strategy is applied; BC5 means the strategy switches to 75% bonds and 25% cash over the last five years of plan membership; BC10 denotes a switch to 75% bonds and 25% cash over the last ten years of plan membership; while C5 denotes a switch to 100% cash over the last five years of plan membership.

Table 5 – Default Fund Charges by Fund Type

	All Funds		Balanced Funds	
	Active	Passive	Active	Passive
Mean	1.08%	0.88%	1.12%	0.78%
Mode	1.00%	1.00%	1.00%	No mode
Minimum	0.75%	0.60%	0.80%	0.60%
Maximum	1.50%	1.45%	1.50%	1.00%
No. of funds	15	15	9	4

	Global Equity Funds		UK Equity Funds	
	Active	Passive	Active	Passive
Mean	1.03%	0.88%	1.00%	0.98%
Mode	0.95%	0.75%	1.00%	1.00%
Minimum	0.75%	0.65%	1.00%	0.90%
Maximum	1.50%	1.45%	1.00%	1.00%
No. of funds	5	7	1	4

Mean, mode, minimum and maximum annual management charge for each category of default fund. In each case the charge is a bundled fee that covers administration and record keeping as well as asset management. It will also include an element to cover sales and marketing costs including adviser commission if applicable. Some funds offer discounts to larger schemes, but these are typically not disclosed publicly. Balanced Managed (BM) funds invest in equities and bonds; Global Equity (GE) funds typically have a 60:40 split between UK and overseas equities; UK Equity Funds (UK) are 100% invested in UK equities. One plan with a passive global equity default fund did not disclose its charges.

Table 6 – Sensitivity Analysis of Replacement Ratios at Varying Fund Charge Levels

Strategy	*0.75% Charge*		*1.0% Charge*		*1.25% Charge*	
	Median Replacement Ratio	*5% Pension-VaR*	*Median Replacement Ratio*	*5% Pension-VaR*	*Median Replacement Rati0*	*5% Pension-VaR*
Strategy 1: BM-NL	0.43	0.17	0.41	0.17	0.39	0.16
Strategy 2: GE-NL	0.45	0.16	0.43	0.15	0.41	0.14
Strategy 3: UK-NL	0.41	0.12	0.39	0.12	0.37	0.11
Strategy 12: All-Bonds	0.30	0.18	0.29	0.18	0.28	0.17

Results are based on 5000 simulations using the PensionMetrics model (assuming a multivariate normal distribution). The return parameters are based on forward-looking estimates net of the stated level of 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 replacement ratio (i.e. DC pension to final salary). There is a 1-in-20 chance that the strategy in question will produce a replacement ratio below the level indicated in the 5% pension-VaR column. Balanced Managed (BM) funds invest in equities and bonds; Global Equity (GE) funds have a 60:40 split between UK and overseas equities; UK Equity Funds (UK) are 100% invested in UK equities. NL means no lifecycle strategy is applied.

ONLINE APPENDIX

Simulations Based on Historical Returns

Our main simulations use forward-looking return estimates to account for the possibility that historical estimates of the equity risk premium are higher than can reasonably be expected in future. In this section we present an alternative set of simulations using return parameters derived from historical returns.

The parameterisation is based on the assumption that annual returns on the assets in the pension fund follow a multivariate normal stochastic process that is calibrated according to the realised real returns on key UK and international market indices over the period 1947 to 2003. The multivariate normal stochastic process 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. 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. We use the volatility and correlation structure from the historical data. We adjust the returns for fund charges of 1.0%. (Refer to Table 3 in the main text for the return, volatility and correlation figures.)

Table A1 shows the results of our historical-data-based simulations. We give the median and mean replacement ratios for each of the 13 investment strategies, together with the 5% value-at-risk level as a measure of downside risk. All results are based on 5000 simulations using the PensionMetrics model.

[Table A1 about here]

In comparison to the results in the main text derived using a low (and arguably more realistic) equity risk premium, the replacement ratios here are typically higher and there is more dispersion across strategies. The median replacement ratios for the initial default asset allocation strategies – i.e. without any lifecycle profile – range from 0.77 for the Balanced (BM) strategy to 0.95 for the Global Equity (GE) strategy. Put another way, the BM strategy

has a 50% chance of producing a pension of at least 77% of the pre-retirement salary, while the GE strategy has a 50% chance of producing a pension at least 95% of pre-retirement salary. The difference between the medians is, of course, largely explained by the variation in equity weighting across the strategies considered.

While the median replacement ratios for these strategies compare favourably with typical final salary pension plan replacement ratios, each strategy also generates a wide range of possible outcomes. The downside risk involved can be appreciated from the pension-VaR figures. The Table shows that the 5% pension-VaRs range from 0.22 for the UK Equity strategy to 0.29 for the GE 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 22% of pre-retirement income or less.

Table A1 also shows simulation results for a fund comprising 100% long-term UK government bonds. This can be considered the low risk benchmark. The median replacement ratio for that strategy is 0.28, which, unsurprisingly, is much lower than the equity-based alternatives. Also as would be expected, the variability around the median is lower too – the 5% pension-VaR replacement ratio at 0.17 is closer to the median than is the case in the comparable equity-dominated strategies. However, it is also worth noting that the 5% VaR level for the cautious strategy is actually *below* that for the equity strategies.

The lifecycle 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 cause losses in the pension fund from which there is too little time to recover. Table A1 shows that the lifecycle profiles (Strategies 4 – 12) raise the 5% VaR levels by only a marginal amount. The reason is that in these simulations using a high equity risk premium the downside outcomes under lifecycle strategies are affected by forgoing the higher expected return from equities for a number of years. This give up of potential return is also evident in the form of a reduced expected level of pension. For example, a ten-year lifecycle profile, switching towards bonds and cash, reduces the median replacement ratio for the balanced managed strategy from 0.77 to 0.63.

The simulation results in Table A1 show that higher equity strategies generally lead to higher replacement ratios. However, we would caution that this is due in large part to the high equity risk premium (of over 7%) used to parameterise the model. The simulations in the main text – using a lower equity risk premium – probably provide a more realistic view of the results that can be expected from these types of investment strategies.

Historical Fund Performance

Our simulations are designed to show the potential variability of outcomes across the different default fund strategies and within each strategy. It is also interesting to look at actual performance. Stakeholder pensions were introduced in 2001 so there is only a limited performance history available. Furthermore, some default funds have only been introduced in the past couple of years and lack any meaningful performance history. Nonetheless, we can look at the dispersion of returns across strategies, the risk of the strategies and the variation of return within each category for a subset of funds that have been in existence for three and five years (22 and 16 funds, respectively). We would caution, though, about over generalising the results from a small sample such as this.

Table A2 shows average performance, return volatility and Sharpe ratios for the various categories of default funds over both three and five year periods ending in December 2006. The Table also shows performance dispersion within each category by including the minimum and maximum annualised returns.

[Table A2 about here]

As the data cover a relatively short period, they must be interpreted with the market background in mind. The five year data include that later stages of the bear market following the technology stocks 'bubble' together with the subsequent market recovery, while the three year data cover mainly the recovery period. The Table shows substantial performance dispersion across all of the default funds, with a range from 10.60% to 17.56% annualised return over three years and from 5.00% to 9.51% over five years. Most of this dispersion is due to the differing asset mixes across categories. However, there is also dispersion within categories. In addition to fees and active management performance, the differences for the

balanced managed and global equity categories can be explained by the fact that asset mix varies within these groups, for example some global equity funds split 50:50 between UK and overseas markets, while others opt for 60:40 or 70:30. The returns for UK-only funds can vary on account of charges, stock selection performance and whether the fund follows a narrow (e.g. FTSE 100) or broad (e.g. FTSE All-Share) benchmark.

The data are generally unsupportive of active management. The average passive fund outperforms the average active fund in the balanced and global equity categories over three and five years. However, in some categories the active funds do have better Sharpe ratios than the passive funds, indicating better risk-adjusted performance. For UK equities, there is only one active fund, but it does outperform the corresponding passive funds.

Tables for online appendix

Table A1 – Simulation Results – Return Parameters Based on Historical Data

Strategy	*Median Replacement Ratio*	*Mean Replacement Ratio*	*5% Pension-VaR*
Strategy 1: BM-NL	0.77	0.96	0.28
Strategy 2: GE-NL	0.95	1.31	0.29
Strategy 3: UK-NL	0.88	1.36	0.22
Strategy 4: BM-BC5	0.69	0.86	0.28
Strategy 5: BM-BC10	0.63	0.75	0.28
Strategy 6: BM-C5	0.70	0.85	0.29
Strategy 7: GE-BC5	0.85	1.14	0.29
Strategy 8: GE-BC10	0.75	0.96	0.29
Strategy 9: GE-C5	0.86	1.14	0.29
Strategy 10: UK-BC5	0.80	1.18	0.23
Strategy 11: UK-BC10	0.70	0.99	0.25
Strategy 12: UK-C5	0.80	1.18	0.24
Strategy 13: 100% Bonds	0.28	0.30	0.17

Results are based on 5000 simulations using the PensionMetrics model (assuming a multivariate normal distribution). The real return, volatility and correlation 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 replacement ratio (i.e. DC pension to final salary). There is a 1-in-20 chance that the strategy in question will produce a replacement ratio below the level indicated in the 5% pension-VaR column. Balanced Managed (BM) funds invest in equities and bonds; Global Equity (GE) funds have a 60:40 split between UK and overseas equities; UK Equity Funds (UK) are 100% invested in UK equities. NL means no lifecycle strategy is applied; BC5 means the strategy switches to 75% bonds and 25% cash over the last five years of plan membership; BC10 denotes a switch to 75% bonds and 25% cash over the last ten years of plan membership; while C5 denotes a switch to 100% cash over the last five years of plan membership.

Table A2 – Three and Five Year Performance of Default Funds

Three Years	Number of Funds	Average Annualised Return	Average Annualised Volatility	Average Sharpe Ratio	Minimum Annualised Return	Maximum Annualised Return
Balanced - All	10	12.65%	6.71%	1.43	10.60%	15.85%
Balanced - Active	7	12.15%	6.02%	1.58	10.60%	14.37%
Balanced - Passive	3	13.81%	8.32%	1.09	12.56%	15.85%
Global Equity - All	8	15.22%	9.53%	1.11	11.78%	16.83%
Global Equity - Active	3	15.05%	9.18%	1.13	14.55%	15.73%
Global Equity - Passive	5	15.32%	9.75%	1.10	11.78%	16.83%
UK Equity - All	4	16.94%	7.95%	1.54	15.88%	17.56%
UK Equity - Active	1	17.14%	8.59%	1.45	17.14%	17.14%
UK Equity - Passive	3	16.87%	7.74%	1.57	15.88%	17.56%
Five Years						
Balanced - All	10	6.72%	9.40%	0.29	5.00%	8.42%
Balanced - Active	7	6.50%	8.50%	0.31	5.00%	7.87%
Balanced - Passive	3	7.22%	11.49%	0.24	6.47%	8.42%
Global Equity - All	3	7.83%	13.00%	0.27	6.81%	8.35%
Global Equity - Active	1	6.81%	12.73%	0.19	6.81%	6.81%
Global Equity - Passive	2	8.34%	13.13%	0.30	8.33%	8.35%
UK Equity - All	3	8.39%	12.55%	0.32	7.18%	9.51%
UK Equity - Active	1	9.51%	12.07%	0.43	9.51%	9.51%
UK Equity - Passive	2	7.83%	12.79%	0.27	7.18%	8.49%

Annualised performance, volatility and Sharpe ratios net of standard fees for the period to 31/12/06. Balanced Managed (BM) funds invest in equities and bonds; Global Equity (GE) funds have varying splits between UK and overseas equities; UK Equity Funds (UK) are invested 100% in UK equities. Includes only funds with the full three or five years of data respectively. Source: Financial Express Analytics (www.financialexpress.net) and company websites.