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TAX-EFFICIENT PENSION CHOICES IN THE UK

By Paul Sweeting

ABSTRACT

The special tax treatment of United Kingdom pensions means that the decision on how to use pension assets is particularly involved. In particular, the ability to take up to 25% of pension assets as a tax-free cash lump sum at retirement, offers retirees opportunities to enhance their pension above that possible through the purchase of a compulsory purchase annuity ("CPA"). The tax-free cash lump sum can be used to buy a tax-efficient purchased life annuity ("PLA"), or in a phased retirement strategy. Income withdrawal can also be used to defer the purchase of an annuity until age 75 and, potentially, to generate a higher income. In this paper I compare the options available to retirees using stochastic modelling. I compare the expected excess pension and expected shortfall, both relative to the alternative risk-free pension available, to assess the various options. I find that if the maximum amount of tax-free cash is available to be used to enhance retirement income, then phased retirement offers the best risk/reward trade off. The advantage is greatest for higher-rate tax payers. As the level of tax-free cash falls, income withdrawal becomes more attractive to those wishing to take greater risks.

KEYWORDS

Pensions; Compulsory Purchase Annuity; Purchased Life Annuity; Stochastic Modelling; Income Tax; Income Drawdown; Phased Retirement

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1. Introduction

The decision as to if and when to annuitise has been covered in detail by a number of authors from Yaari (1965) onwards, as discussed in section 3. However, much of the work assumes a 401(k), or at least non-UK-pension, framework where there are no requirements for annuitisation, or opportunities to take tax-free cash lump sums. Given the special tax treatment of pension assets in the UK and the restrictions surrounding their use, additional analysis of the issue of annuitisation in the UK context is worthwhile.

2. The UK Pensions Market

In the UK, an individual retiring with defined contribution pension assets

has a number of choices open to him. At the most basic level he can take up to 25% of those assets as a tax-free cash lump sum, and then use the remainder to buy a compulsory purchase annuity ("CPA") from a life assurance company. The payments from this annuity are taxed at the investor's marginal rate.

However, if the investor so chooses, he can defer the purchase of the annuity, invest the assets that have not been taken as cash, and make periodic withdrawals (up to a maximum specified amount), these withdrawals also being taxed at the marginal rate. This approach, known as income withdrawal, can continue until age 75 when, in most cases, an annuity must be purchased.

These two alternatives assume that the investor has no tax-free cash available to use. This situation would arise if the tax-free cash lump sum was needed for some other purpose, such as the repayment of a mortgage. However, if the individual has no need of a tax-free cash lump sum, then several further options present themselves.

The tax-free cash lump sum can be used to buy a voluntary or purchased life annuity ("PLA"). A proportion of each payment from such an annuity, representing the return of capital to the annuitant, is exempt from tax; the remainder of each payment is, again, taxed at the investor's marginal rate. Such an approach can be combined with either the purchase of a CPA or an income withdrawal strategy.

There is, though, another way of utilising the tax-free cash lump sum. The pension plan can be turned into many small, discrete, pension plans. The investor can then cash in one or more pension plans each month receiving a payment of tax-free cash and a tranche of annuity income, thus integrating multiple payments of tax-free cash into an income stream. At age 75, any remaining pension plans are then converted into CPAs, after the payment of a final tax-free cash payment if required.

However, since the pension simplification provisions of the Finance Act 2004 and the Pensions Act 2004 came into force on "A day", 6 April 2006, it is no longer necessary to buy an annuity or commence drawdown at the same time as taking a cash lump sum from a pension plan. This means that prior to age 75, pension payments can be made up solely from tax-free cash. The remaining funds, which can be used either to buy a CPA or for drawdown until age 75 followed by the purchase of a CPA, can be left to accumulate until the tax-free cash has run out.

3. Previous Analysis

Despite their theoretical attractiveness, annuities are not a popular form of investment. Yaari (1965) shows that because of the certainty that they provide in terms of a guaranteed income for life, the demand for annuities at

retirement should be high. A number of explanations have been advanced to explain the fact that, in the absence of compulsion, they are not. Friedman & Warshawsky (1990) propose that annuities are unpopular because they are not fairly priced due to expense loadings present in annuities but absent from self-managed funds. Brugiavini (1993), on the other hand, suggests that if investors can choose not to buy annuities, then only the healthy will buy them, the subsequent adverse selection forcing the price up. This theory is supported by the findings of Finkelstein & Poterba (2002) who look at the adverse selection in the UK PLA and CPA markets. Cannon & Tonks (2006) suggest that in the UK at least the presence of generous state benefits might limit the appetite for PLAs. They also point out that people are bad at estimating probabilities, so might overestimate the (low) probability of dying soon after an annuity is purchased and underestimate the (significant) probability of outliving non-annuitised assets. However, the most widely held view, expressed again by Friedman & Warshawsky (1990), is that the purchase of an annuity limits the opportunity to leave a bequest. Indeed, Bernheim (1991) finds empirical evidence that a significant fraction of total saving is motivated by the desire to leave bequests, and that these bequests are not just to children but also to other relatives.

Whilst these explanations as to how people behave are interesting, they do not remove the need to continue analysing how people ought to react to the options that are open to them.

An important contribution on this front comes from Milevsky (1998, 2001). Milevsky (1998) points out that there are effectively two sources of return from an annuity: the return from the bonds underlying the investment (which can be obtained by holding these underlying investments directly), and a mortality bonus representing, assuming the annuity holder survives, payments forgone by those annuitants that have not survived. Since mortality rates increase with age, so does the mortality bonus. Milevsky proposes an investment strategy whereby annuitisation is deferred until the mortality bonus from the annuity exceeds the excess rate of return of risky assets over the risk-free assets used to price the annuity. Milevsky (2001) calculates that most individuals should eventually annuitise between the ages of 75 and 80, although such analysis is irrelevant in a UK pensions context given the requirement to annuitise by the age of 75 (uncertainty surrounding "Alternatively Secured Pensions" — ways in which some groups are exempt from compulsory annuity purchase — notwithstanding). In his analysis, Milevsky uses the probability of shortfall to assess the effectiveness of annuitisation deferral strategies. However, an important limitation of shortfall probabilities is that they give no information on the extent of shortfalls. They also limit the extent to which optimal asset allocations can be calculated, since in any simulation small changes to asset allocations might leave the shortfall probability unaffected, meaning that an infinite number of portfolios can share the same risk level. Neither of these

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shortcomings are relevant to Milevsky's analysis, since he considers only one asset allocation (100% equities), but both are crucial if a variety of investment strategies are considered.

Blake *et al.* (2003) do indeed allow for more than one investment strategy, assuming two assets: risk free bonds and equities. They consider three distribution programmes: buying a non-profit annuity; buying an annuity with payments linked to varying proportions of equity investment; and drawing down assets with varying proportion of equity until age 75, then buying an annuity. Value is measured using a discounted lifetime utility function. In their analysis, Blake *et al.* assume that the risk- free bonds are truly risk-free, in that the rate is fixed. This means that it is possible to invest in assets which exactly match annuity rates, something which investors cannot do in practice. Blake *et al.* find that the greater an individual's risk appetite, the greater his preferred exposure to equities. This is similar to earlier analysis from Khorasanee (1996), who compares annuitisation and equity-based income drawdown, finding that each strategy might be attractive to an individual depending on his risk appetite.

4. The Annuitisation Choice — An Alternative Approach

In my analysis, I consider four assets, defined as indices: the FTSE UK All Gilt Index (All Gilts); the FTSE UK Over 15 Year Gilt Index (Over 15 Year Gilts); the DataStream Clearing Banks Base Rate (Cash); and the FTSE All-Share Index (UK Equities). The reason for choosing these asset classes is that they provide a range of investment options that broadly represent the choices available to individual investors. I also create a synthetic asset, a 10 Year Gilt, although as discussed later this bond is not used for investment. I create the return series for this asset by calculating the hypothetical return from investing in a par bond with a yield equal to that on the Bloomberg benchmark 10 Year UK Government bond.

I model the monthly returns on these variables using 1,000 stochastic projections assuming that the returns have correlated normal distributions. Each projection extends 10 years into the future with monthly data points. In order to parameterise the distribution, I calculate a variance/covariance matrix based on 20 years of historical monthly data. This information is given in Table 1.

For expected returns it is not appropriate to use historical data. For example, Over 15 Year Gilts performed very well as redemption yields came down, but are therefore unlikely to do as well going forward given that yields are currently so low. I therefore assume a return of 4% per annum on all Gilt asset classes, which is the approximate yield on Gilts of all maturities as at 31/12/05 since the yield curve was then flat. For Cash, I assume a return of 3% per annum. This allows for a 1% per annum term premium, close to

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Table 1. Annualised statistics for monthly financial data for the 20 years to 31 December 2006

Standard deviation	13.4%	5.3%	8.5%	6.8%	0.9%
Correlation matrix	FTSE all-share index	FTSE UK all gilt index	FTSE UK over 15 year gilt index	Synthetic 10 year gilt index	UK clearing banks base rate
FTSE all-share index	100.0%	11.2%	13.3%	12.6%	3.3%
FTSE UK all gilt index	11.2%	100.0%	94.6%	97.4%	14.0%
FTSE UK over 15 year gilt index	13.3%	94.6%	100.0%	92.3%	5.9%
Synthetic 10 year gilt index	12.6%	97.4%	92.3%	100.0%	13.0%
UK clearing banks base rate	3.3%	14.0%	5.9%	13.0%	100.0%

the 0.9% historical premium given by Dimson *et al.* (2006). For UK Equities I assume a return over Cash of 3.5%. Dimson *et al.* (2006) find that the historical UK Equity risk premium over cash was 6.1% per annum. However, Dimson *et al.* (2002) point out that the prospective risk premium should be lower than the historical one to allow for unanticipated cash flows and a fall in the required prospective premium. They suggest a downward adjustment of around 2.8% to allow for these factors. Rounding to the nearest 0.5% gives a prospective premium of 3.5%. Fama & French (2002) arrive at a similar value using an even longer time series. This is by no means the only estimate of equity risk premium, and many higher and lower estimates have been obtained, from 2% to 13% according to Welch (2000). However, as equities are the only risky asset used, a change in the risk premium would only act to scale the results rather than to change the inferences.

Having projected the returns for all of the asset classes forward, this allows me to create an infinite combination of investment strategies using the above asset classes, and to assess the return profiles of those strategies.

The reason for projecting the hypothetical 10 Year Gilt is to derive the 10 year yield going forward, since the duration of the 10 Year Gilt is close to that of annuities for ages 65 to 75. I use the prior period yield to calculate the duration and convexity of the 10 year bond, and hence use the change in bond price to derive the new yield. This yield is then used to evaluate the price of an annuity. There is, therefore, an implicit assumption that annuities are priced using Gilt yields rather than corporate bond yields. This is consistent with comments in the Pensions Board UK Actuarial Guidance Note GN9 (2006) which includes discussion on the calculation of pension scheme solvency and securing benefits with an insurance company.

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The mortality basis I use for the CPAs is PMA92 (year of birth = 1941) with the medium cohort projection basis; for PLAs I use IMA92 (year of birth = 1941) with the same projection basis. The base tables PMA92 and IMA92 are derived from the mortality experience in the UK of CPA and PLA annuitants respectively, as collated by the Continuous Mortality Investigation ("CMI"). The use of a year of birth of 1941 means that all mortality rates are appropriate for an individual born in this year, so aged 65 in 2006.

Pensions are assumed to be paid annually in advance. I therefore calculate the value of an annuity for an individual whole age evaluated at interest rate using the formula:

$$\ddot{a}_x(i) = \sum_{t=0}^{\infty} \frac{l_{x+t}}{(1+i)^t l_x} \tag{1}$$

where l_{x+t} is the number of lives aged $x+t$ in the relevant mortality table, t is the number of years forward from the date of calculation and i is the yield on the 10-year Gilt. Given that the projections are monthly, I approximate the monthly pension as being one-twelfth of the annual amount. For annuities payable at non-integer ages, I interpolate between annuities calculated for whole ages.

I carry out most of the projections assuming a marginal tax rate of 40%, the current higher rate of taxation in the UK. The strategies being discussed here are sufficiently involved that this is likely to be the marginal rate of tax for most of the investors that would be able to utilise them. Furthermore, since the scenarios for a 0% tax rate are trivial, it is relatively straightforward to give an indication of the likely situation of basic rate taxpayers based on these upper and lower bounds. However, I do comment on the scenarios applicable to investors currently taxed at the basic rate of income tax (currently 22%).

I assume that the policyholder being analysed is a male aged 65 who has just reached his retirement age. I assume that he wishes to buy (or replicate) a non-increasing single life pension with no guarantee, payable monthly in advance.

When considering the various asset allocations, I assume that these allocations are static over time and rebalanced on a monthly basis.

I assume that the fees implicit in the purchase and payment of a PLA or CPA have the same present value as those involved in the running of a portfolio of assets. I also assume that the fees are the same regardless of the size of the fund held or annuity purchased. Cannon & Tonks (2006) find some non-linearity in annuity prices, particularly for smaller amounts, but Finkelstein & Poterba (2004) state that in relation to fees, annuity pricing is broadly linear. I therefore ignore fees.

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In order to assess the various strategies, I first determine the risk-free monthly net-of-tax pension that can be purchased at age 65 with a fund of £500,000. If no tax-free cash is available, the annual pension is simply calculated as £500,000 divided by the price of a CPA paying £1 per annum for a 65-year-old male at an interest rate of 4% per annum. This is converted to a net monthly amount by multiplying by 60% (for a tax rate of 40%) and dividing by twelve. The result is a level monthly net-of tax pension of £1,785 payable from age 65.

If tax-free cash is available, then the calculation of the risk-free monthly net-of-tax pension is slightly more involved. Although the full £500,000 fund could still be applied to purchase a CPA, there is a risk-free alternative. The portion of the £500,000 that may not be taken as cash (£375,000, if the 25% maximum of tax-free cash is taken) would still be used to buy a CPA and the result is converted to a monthly net-of-tax amount as before; however, the remainder (£125,000) can instead be used to purchase a PLA. The potential advantage comes from the fact that part of each annuity payment from a PLA is treated as a return of capital and is tax-free; the only question is whether the effect of selection on mortality expectations — people buy PLAs because they think they are likely to live longer than average — outweighs any tax benefits.

The question of adverse selection and annuities is covered extensively in the literature. For example, Finkelstein & Poterba (2002) look at adverse selection in the PLA and CPA markets. They find evidence of adverse selection in both markets and find that the difference from population mortality is greater for PLAs than CPAs. They estimate that adverse selection in the compulsory market is around half of that in the voluntary market. Finkelstein & Poterba (2004) also find systematic relationships between ex-post mortality and annuity characteristics in UK life office data, suggesting adverse selection. No difference is found by annuity size.

Looking at the data from the PMA92 and IMA92 tables, which are calculated from CPA and PLA mortality respectively, it is clear that PLA policyholders do have longer life expectancies than holders of CPAs; however, the best way to see whether the tax advantage outweighs the adverse selection effect is to calculate the annuity that can be bought.

I calculate the net-of-tax payment using the approach outlined by HMRC in the Insurance Policyholder Taxation Manual (2006), although for consistency I use IMA92 (year of birth = 1941) rather than the IM80 (calendar year = 2010) as specified by the 1991 regulations. The manual defines the tax-exempt proportion of each payment as $\ddot{a}_x(i)/\ddot{a}_x(0)$, where $\ddot{a}_x(0)$ is the expectation of life. Tax is payable only on the remainder of each payment from the PLA. Using the more recent mortality tables means that I am making an implicit assumption that mortality rates will at some stage be updated to reflect recent developments. It is also more conservative than

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using the tables specified in the regulations, since assuming lighter mortality results in a lower tax-exempt proportion.

Using this approach, the effect of adverse selection appears to be minimal, and certainly not large enough to outweigh the tax advantages of the purchase of a PLA. In fact, based on my assumptions, income tax rates would need to be below 5% for the mortality difference to make it uneconomical to purchase a PLA from tax-free cash rather than to forgo the tax-free cash and to purchase a larger CPA.

For a fund of £500,000 the total net-of-tax monthly pension payable if the maximum 25% of the fund available as tax-free cash were used to purchase a PLA would be £1,964, compared with £1,785 if all funds were used to purchase a CPA.

Having arrived at the risk-free pension available, the next stage is to assess other approaches to generating retirement income against the risk-free strategy. To do this, I use each strategy in turn to generate over time an identical net monthly pension over the period from age 65 to age 75. At age 75 I then determine the amount of net-of-tax pension that can be bought with the remaining fund (which may be negative if the fund has been exhausted — I assume that funds will be required from elsewhere to maintain the spending power and that this can be translated into negative pension provision from the fund) in each of the 1,000 scenarios. I do this by dividing the fund by the CPA annuity factor applicable at age 75 evaluated using the interest rate at age 75 from the appropriate scenario, then deducting tax at the appropriate rate, dividing by twelve to obtain a monthly amount, and adding to any pension generated through the course of the strategy. In each scenario, I then determine the difference between the total pension receivable at age 75 from the strategy under investigation and the total pension that would have been receivable under the risk free approach.

The assumption that individuals will borrow from elsewhere if their pension assets are exhausted, giving a negative fund value, is not particularly realistic. However, this is in essence a proxy to allow consistent comparison of scenarios at age 75. If the fund value had a floor of zero, so once pension assets were exhausted no income was taken, a scenario resulting in fund exhaustion at age 74 would be viewed the same as one resulting in the assets being gone by age 66. The latter is clearly worse than the former, and one way of expressing this is to assume that the fund value can become negative.

In assessing any strategy relative to the risk-free approach, there are two aspects to consider: how much better (or worse) on average is the strategy than the risk-free approach; and how risky is the strategy. In order to measure the relative success of the various strategies, I look at the expected excess monthly pension generated by each strategy, defined as the difference between the total pension receivable at age 75 in each simulation and the pension that would have been received if an annuity had been bought,

averaged over all simulations. Risk is measured as the expected shortfall, also known as the tail value at risk ("tVaR"). This is calculated as the expected difference between the pension at age 75 and the pension that would have been payable from an annuity given that this figure is negative, multiplied by the probability that this figure is negative. This has the advantage that it reflects not only the probability but also the extent of any shortfall. It is also a figure that lends itself to optimisation in the search for an efficient set of portfolios.

There are, in fact, an infinite number of outcomes that can be obtained from the various strategies, through carrying the asset allocation used in each strategy. I therefore determine a set of efficient strategies. An efficient strategy is defined as one where no higher level of expected excess pension can be obtained for a given level of expected shortfall. The highest returning portfolio is always an allocation of 100% to the asset class that gives the highest expected excess pension; the lowest is an allocation to a number of asset classes. I also consider the scope for separation theorem-type allocations, as described by Tobin (1958), involving combinations of the risk-free strategy (investment in CPAs and PLAs) and some portfolio on the efficient frontier.

Unlike some of the analysis discussed above, there is no explicit allowance for any bequest motive in this analysis. However, one would expect similar portfolios to dominate, since a desire for a higher bequest and the fear of a smaller bequest can to an extent be regarded as capitalisations of variations in pension amount.

5. Retirement Options for Higher Rate Tax Payers

As mentioned earlier, most of the analysis I carry out assumes a tax rate of 40% for investors, the current higher marginal tax rate in the UK. Most of the analysis also assumes that 25% of the fund value is available to be taken as tax-free cash, the maximum available, meaning that the risk-free alternative against which strategies are compared is the use of 25% of the fund to purchase a PLA and of 75% to purchase a CPA. This assumption is relaxed later in the paper.

Four strategies are compared against this risk-free alternative:

— The purchase of a PLA with 25% of the fund and income withdrawal with the remaining 75% of the fund;
— Phased Retirement;
— Phased Retirement with deferred annuitisation; and
— Phased Retirement with income withdrawal then compulsory annuitisation.

The first strategy involves using 25% of the fund to buy a PLA, with the

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rest being invested in one of a range of asset allocations, with a pension being withdrawn to replicate the risk-free level of income.

Phased retirement, the second strategy, involves the fund being divided into a large number of notional policies. In the first year, some policies are "cashed in" with 25% of the value being taken as tax-free cash and 75% being used to buy an annuity, the value taken being such that the combination of cash and annuity payment exactly matches the amount receivable under the risk-free scenario. In the second year the process is repeated allowing for the fact that income is already being received from the annuity purchased in the first year. This carries on until age 75.

The third strategy takes advantage of the fact that after "A day" it is no longer necessary to buy an annuity at the same time that tax-free cash is taken. This strategy therefore involves dividing the fund into a large number of notional policies and replicating the risk-free payments by taking the 25% cash component from each policy until these components are exhausted, then buying annuities.

The final strategy is the same as the third, but instead of annuities being taken when the cash is exhausted, income withdrawal is used until age 75 when compulsory annuitisation is once again assumed.

If the full level of tax-free cash is available, then phased retirement with compulsory annuitisation gives the combination of risk and return for all individuals except those with the highest risk tolerance, investing solely or at least very heavily in equities. These investors will prefer phased retirement with income withdrawal. As the level of tax-free cash available falls, one of two extreme solutions will be preferred: individuals with a high risk tolerance will continue to prefer phased retirement with income withdrawal, with full investment in equities being preferred, but lower risk investors will move straight to traditional phased retirement with a very low level of equity investment. The only exception to all of these scenarios is that individuals with a very low risk tolerance will continue to prefer the risk-free option. Income withdrawal in the absence of phased retirement, even in its most attractive form, is never an optimal choice.

Having given an overview of the results, I now explore the strategies in more detail, looking first at income withdrawal. Following on from Milevsky (1998), it is clear that if the assets in which you are investing cannot beat the risk-free rate invested in the annuity plus the mortality bonus, then they should not be used in income drawdown. This is because they will give no greater return but will increase risk, since no asset is a perfect match for an annuity (except an annuity). If annuities are assumed to be priced off Government bonds (and I do make that assumption), then this means that there is no point in holding Government bonds in an income withdrawal portfolio. If holding 100% equities in an income withdrawal fund is thought to be too risky as an investment strategy, then the solution is not to combine the equities with bonds; on the contrary, the solution is to combine the

equity-backed income withdrawal fund with the risk-free alternative, in this case the combination of a PLA and a CPA. In fact, the tax benefits of a PLA are such that the approach that gives the highest expected return is not to use the entire fund for income withdrawal with 100% equities, but to use only 75% of the fund for this, using the remaining 25% to buy a PLA. The results are shown in Figure 1. The data for this chart are shown in Table 2.

However, a better solution even than this exists: this solution is phased

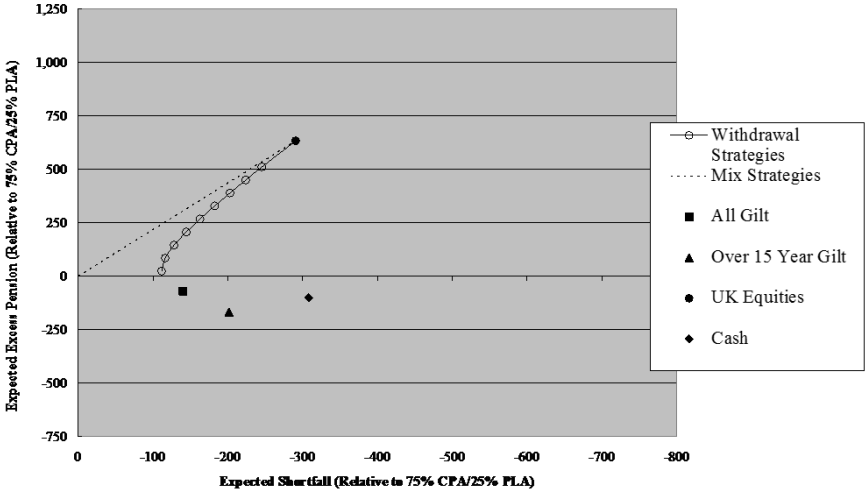

Figure 1. Income withdrawal plus PLA vs 25% PLA/75% CPA purchase

Table 2. Income withdrawal plus PLA vs 25% PLA/75% CPA purchase

	Minimum risk	Maximum pension	All gilt	Over 15 year gilt	UK equity	Cash
Expected excess pension	23	632	−71	−168	632	−101
Expected shortfall	−111	−291	−140	−201	−291	−308
Asset allocation (percentages may not sum to 100% due to rounding)						
All gilt	73%	0%	100%	0%	0%	0%
Over 15y gilt	11%	0%	0%	100%	0%	0%
UK equity	17%	100%	0%	0%	100%	0%
Cash	0%	0%	0%	0%	0%	100%
Probability of shortfall	57%	45%	72%	80%	45%	70%
Standard deviation of excess pension	204	1,013	167	137	1,013	436

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retirement. In this context, "retirement" refers to the taking of pension, either through drawdown, annuitisation or some combination. Unlike the income withdrawal solution discussed above, optimal solutions for individuals with varying risk appetites do not simply involve combinations of the riskiest strategy with the risk-free approach. In fact, the asset allocation needs to be 80% All Gilts/20% UK equities, before mixing with the 75% CPA/25% PLA strategy is worthwhile.

This is shown in Figure 2, together with the single-asset strategies. I term the phased retirement portfolio tangential to the 25% PLA/75% CPA line, the efficient portfolio. The data for this chart are shown in Table 3.

There is, though, another tax-efficient option. As mentioned earlier, the provisions of "A Day" mean that it is no longer necessary to buy an annuity or commence drawdown at the same time as taking a cash lump sum from a pension plan, so pension payments can be made up solely from tax-free cash. Once the tax-free cash has been exhausted, there are two alternatives. The first is simply to buy a CPA. In order to draw comparisons consistently with other strategies, I assume that the CPA purchased initially is merely sufficient to match the pension being targeted, with another CPA being purchased at age 75 with any excess funds. The second approach is to draw down taxed income from the fund until age 75 and then purchase a CPA at that point.

Figure 3 shows the results for the first case, assuming a two-stage CPA purchase (at tax-free cash exhaustion and at age 75). The data for this chart

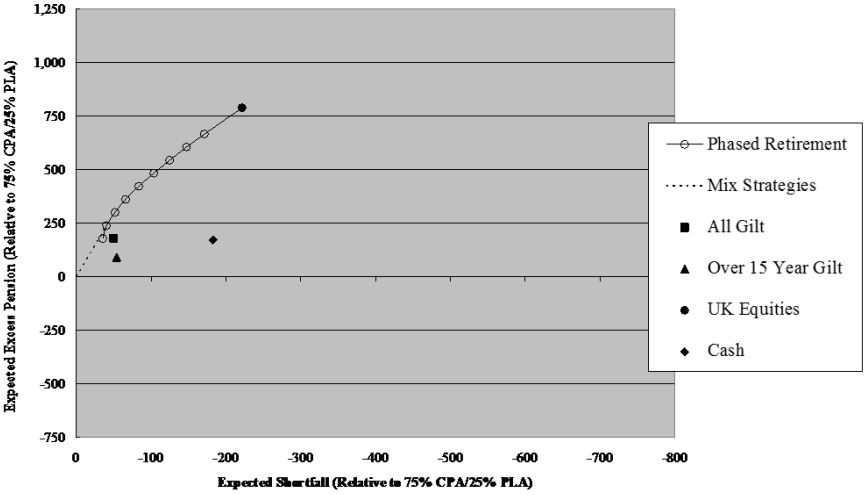

Figure 2. Phased retirement vs 25% PLA/75% CPA purchase

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Table 3. Phased retirement vs 25% PLA/75% CPA purchase

	Minimum risk	Maximum pension	All gilt	Over 15 year gilt	UK equity	Cash
Expected excess pension	177	788	179	90	788	171
Expected shortfall	−35	−221	−50	−54	−221	−183
Asset allocation (percentages may not sum to 100% due to rounding)						
All gilt	39%	0%	100%	0%	0%	0%
Over 15y gilt	52%	0%	0%	100%	0%	0%
UK equity	9%	100%	0%	0%	100%	0%
Cash	0%	0%	0%	0%	0%	100%
Probability of shortfall	30%	37%	34%	40%	37%	52%
Standard deviation of excess pension	331	1,759	419	266	1,759	899

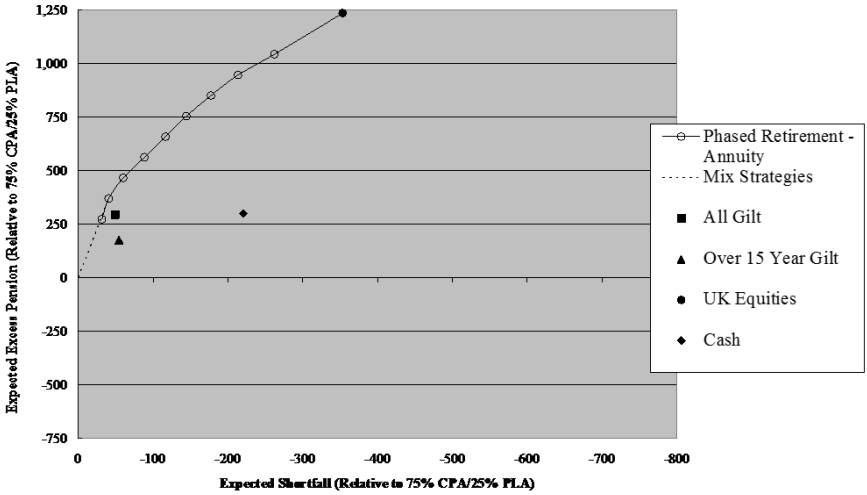

Figure 3. Phased retirement, all cash then CPA purchase vs 25% PLA/75% CPA purchase

are shown in Table 4. Here, it is assumed that tax-free cash is drawn equal to the alternative amount available if a PLA had been purchased with the tax-free cash and a CPA with the remainder. When the tax-free cash runs out, a CPA equal to the value of the PLA/CPA alternative is purchased. Any assets not required at this stage are allowed to roll up until age 75, at which point they are used to buy a CPA. The resulting total pension at age 75 is compared with the PLA/CPA alternative.

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Table 4. Phased retirement, all cash then CPA purchase vs 25% PLA/75% CPA purchase

	Minimum risk	Maximum pension	All gilt	Over 15 year gilt	UK equity	Cash
Expected excess pension	273	1,235	294	176	1,235	298
Expected shortfall	−31	−353	−49	−54	−353	−220
Asset allocation (percentages may not sum to 100% due to rounding)						
All gilt	39%	0%	100%	0%	0%	0%
Over 15y gilt	55%	0%	0%	100%	0%	0%
UK equity	7%	100%	0%	0%	100%	0%
Cash	0%	0%	0%	0%	0%	100%
Probability of shortfall	24%	38%	28%	32%	38%	50%
Standard deviation of excess pension	418	2,766	555	362	2,766	1,246

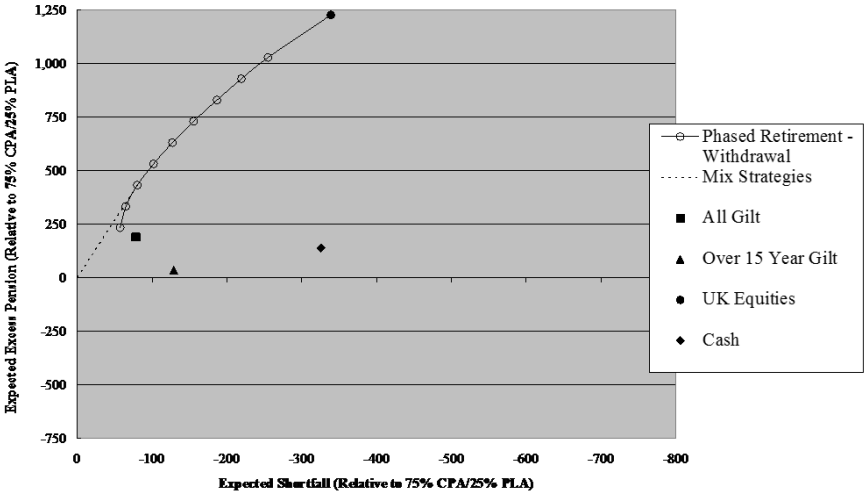

Figure 4. Phased retirement, all cash then withdrawal vs 25% PLA/75% CPA purchase

Figure 4 shows the results for the second case. The data for this chart are shown in Table 5. Here, it also is assumed that tax-free cash is drawn equal to the alternative amount available if a PLA had been purchased with the tax-free cash and a CPA with the remainder. However, when the tax-free cash runs out in this, taxed income is then withdrawn from the remaining

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assets up to age 75. At 75, any remaining assets are then used to buy a CPA and the resulting total pension at age 75 is compared with the PLA/CPA alternative.

The two post-A Day phased retirement strategies give similar results for the efficient portfolio. The reason for this is that the tax advantage is so great in the early years that by the time the tax-free cash has been exhausted it does not matter whether the pension up to age 75 is derived from drawn-down assets or from a CPA — the remainder of the fund is likely to be so large as to make the pre-75 choice unimportant.

The relative positions of the various phased retirement and income withdrawal strategies are shown in Figure 5. From this point on, I omit the various mix strategies, although it should be noted that there are many theoretical combinations of approaches, some involving and some excluding the purchase of annuities, which would give theoretically efficient retirement strategies.

The superiority of the various phased retirement approaches persists as the level of tax-free cash available falls; however, the results are not as straightforward as for the maximum tax-free cash scenario. As the amount of tax-free cash falls, post-A Day phased retirement plus CPA purchase tends towards traditional phased retirement, which itself tends towards the purchase of a CPA; however, post-A Day phased retirement plus withdrawal tends towards income withdrawal. This means that higher risk strategies will tend to be based around income withdrawal and lower risk ones around annuity purchase. This can be appreciated if the extreme position of zero tax-free cash is considered — income withdrawal is still possible, but phased retirement is not.

Looking first at the 20% tax-free cash scenario, post-A Day phased

Table 5. Phased retirement, all cash then withdrawal vs 25% PLA/75% CPA purchase

	Minimum risk	Maximum pension	All gilt	Over 15 year gilt	UK equity	Cash
Expected excess pension	233	1,227	189	35	1,227	139
Expected shortfall	−57	−339	−78	−129	−339	−325
Asset allocation (percentages may not sum to 100% due to rounding)						
All gilt	57%	0%	100%	0%	0%	0%
Over 15y gilt	33%	0%	0%	100%	0%	0%
UK equity	10%	100%	0%	0%	100%	0%
Cash	0%	0%	0%	0%	0%	100%
Probability of shortfall	33%	38%	41%	51%	38%	58%
Standard deviation of excess pension	488	2,623	545	395	2,623	1,274

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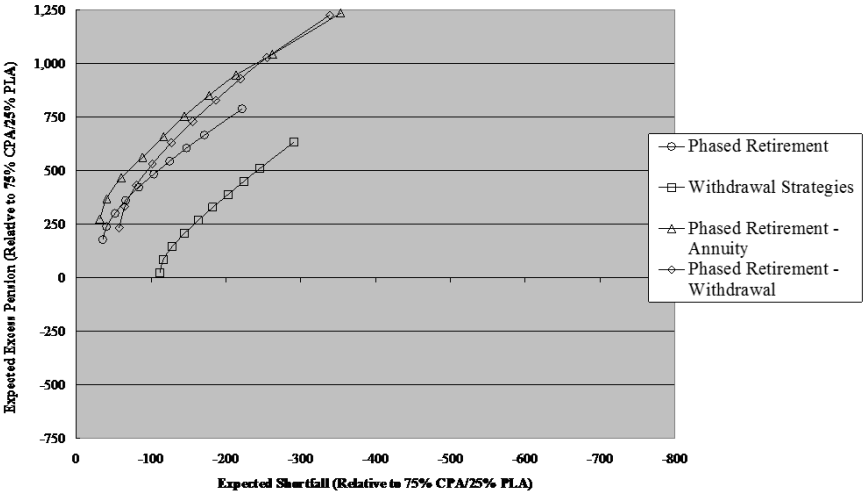

Figure 5. Phased retirement and income withdrawal plus PLA vs 25% PLA/75% CPA purchase

retirement combined with income withdrawal is now the clearly superior strategy for investors with a higher risk tolerance; however, for lower risk investors, post-A Day phased retirement with CPA purchase is preferable, and the risk profile of this strategy is very close to that of traditional phased retirement. Furthermore, for an individual with a moderate tolerance for risk, the optimal strategy would seem to be some combination of largely bond-based phased retirement with CPA purchase, and wholly equity-based phased retirement with income withdrawal. These scenarios are shown in Figure 6.

Figures 7, 8 and 9 show more extreme scenarios where only 15%, 10% and 5% respectively of the fund are available as tax-free cash. Post-A Day phased retirement with income drawdown remains the strategy of choice for high risk tolerance investors, but traditional phased retirement seems to be increasingly appropriate for the lower risk strategy. Furthermore, it appears that efficient strategies can be constructed by combining the equity-based withdrawal version of post-A day phased retirement with increasingly bond-based traditional phased retirement.

As mentioned earlier, in the absence of tax-free cash, income withdrawal is the only alternative to annuity (100% CPA) purchase. This scenario is simply a scaled version of Figure 1, given here as Figure 10. It also demonstrates the extent to which all other scenarios are driven purely by tax considerations.

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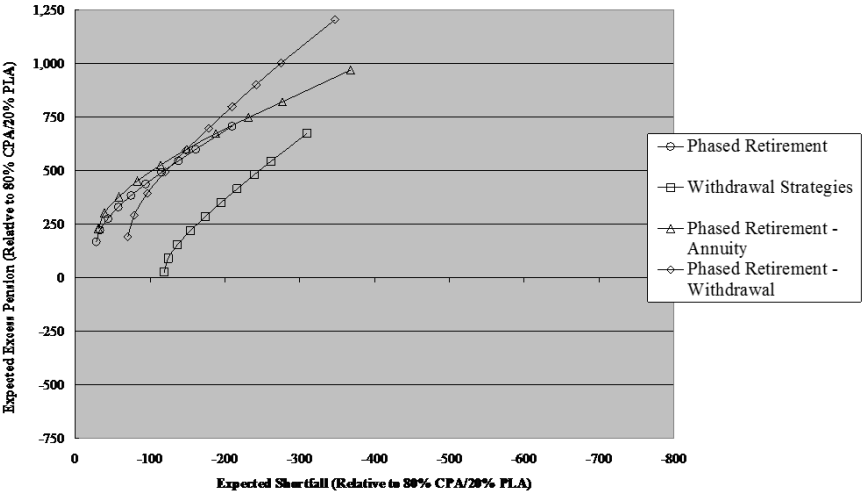

Figure 6. Phased retirement and income withdrawal plus PLA vs 20% PLA/80% CPA purchase

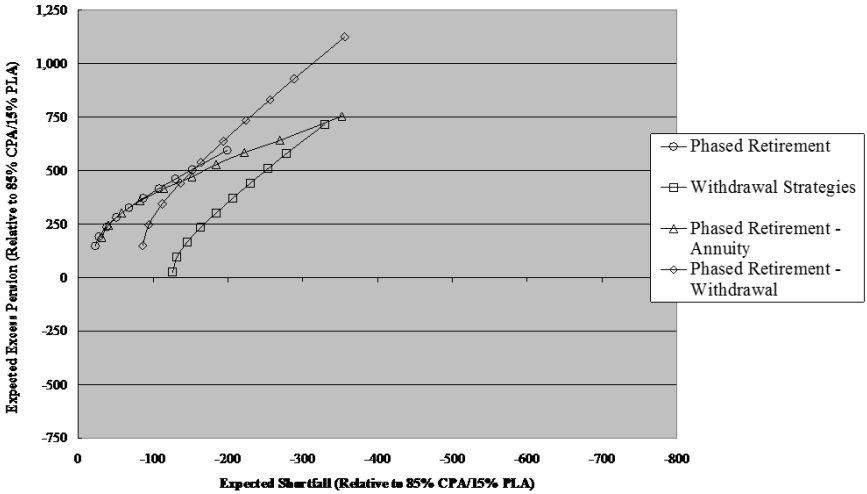

Figure 7. Phased retirement and income withdrawal plus PLA vs 15% PLA/85% CPA purchase

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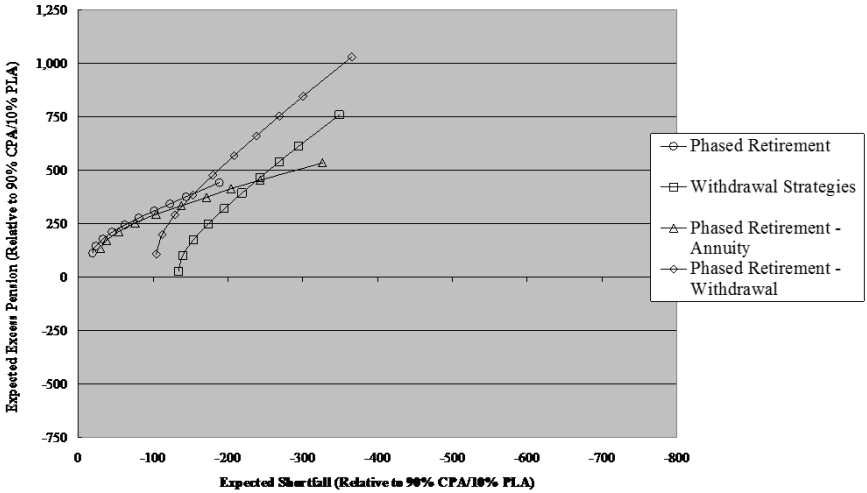

Figure 8. Phased retirement and income withdrawal plus PLA vs 10% PLA/90% CPA purchase

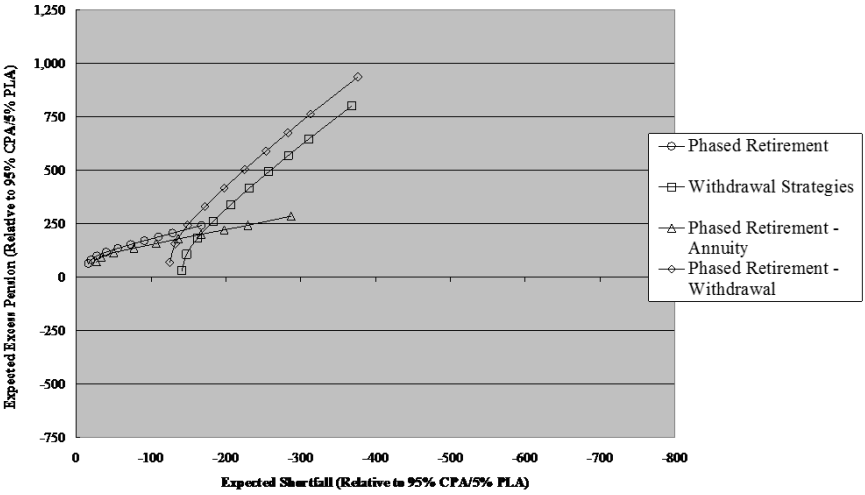

Figure 9. Phased retirement and income withdrawal plus PLA vs 5% PLA/95% CPA purchase

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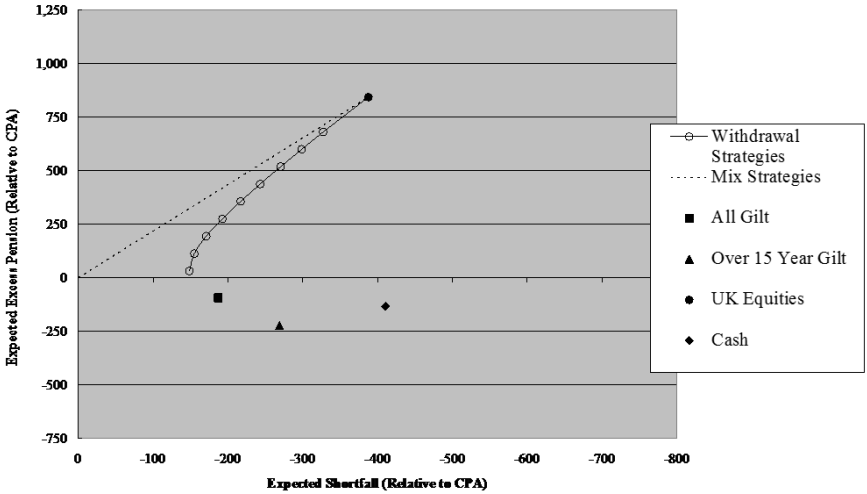

Figure 10. Income withdrawal vs CPA purchase

The fact that some approaches are unambiguously more attractive than others for all levels of risk tolerance, or where there are clear divisions between approaches for low and high risk groups, means that there is little to be gained from extending this analysis to include preference analysis — most sensible utility functions would give the same results for a wide range of parameters.

6. A Comment on Basic Rate Tax Payers

Unsurprisingly, the pattern of outcomes for basic rate tax payers is similar to that for higher rate tax payers. The initial levels of net-of-tax pension are higher than for higher rate tax payers, but the relative attractiveness of the various strategies is similar for both types of tax payer.

7. Conclusion

If a retiree needs the tax-free cash as a lump sum, then the choice is straightforward and between annuitisation through a CPA, income withdrawal with an equity-based investment strategy, and linear combinations of these two approaches. No other asset allocation makes sense in the income withdrawal strategy, since risk-free bonds give a lower return than the CPA due to the mortality bonus. Clearly, if other risky assets are

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available that offer a return greater than the risk-free rate plus the mortality bonus, then these can be used in income withdrawal.

If the full 25% level of tax-free cash is available to be used to provide income, then the lowest risk approach is to purchase a PLA with these assets. However, for even a relatively low level of risk tolerance, either of the post-A Day phased retirement strategies offers an attractive alternative.

As tax-free cash available for income falls, the greater the difference becomes between these strategies. In particular, the income withdrawal version becomes more attractive for those with a high risk tolerance, whilst the annuity purchase version becomes more attractive for those with a lower risk tolerance. For levels of tax free cash below 15% of the fund, traditional phased retirement gives a better risk/reward trade-off than the annuity purchase post-A Day approach. Efficient solutions can generally be found through combinations of the equity-invested withdrawal version of post-A Day phased retirement and the more bond-based versions of annuity purchase post-A Day phased retirement or traditional phased retirement.

The situation for an investor with a marginal tax rate of 22% is similar to that of a higher rate tax payer with a lower level of tax-free cash available.

It would be interesting to see the extent to which these conclusions change, or at least where additional efficiency can be achieved, through the use of dynamic asset allocation, where the asset mix changes either strategically or tactically over time. However, the static analysis above still provides some useful insights into the appropriate decisions for individuals at retirement.

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