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Tax-Efficient Pension Choices in the UK

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Abstract

The special tax treatment of UK pensions means that the decision on how to use pensions assets is more involved than in other tax jurisdictions. In particular, the ability to take up to 25% of pensions 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.

1. Introduction

The decision as to if and when to annuitise has been covered in detail by a number of authors. However, much of the work assumes a 401(k), or at least non-UK-pension, framework. Given the special tax treatment of pensions 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, 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 and 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 and Poterba (2002) who look at the adverse selection in the UK PLA and CPA markets. Cannon and 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 and 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 compuslory 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 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.

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 provides 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. 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 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%.

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 UK Actuarial Guidance Note GN9 (2006) which includes discussion on the calculation of pension scheme solvency and securing benefits with an insurance company.

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 x evaluated at interest rate i using the formula:

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

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 and Tonks (2006) find some non-linearity in annuity prices, particularly for smaller amounts, but Finkelstein and Poterba (2004) state that in relation to fees, annuity pricing is broadly linear. I therefore ignore fees.

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 and 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 compulsory market is around half of that in the voluntary market. Finkelstein and 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 it to calculate the annuity that can by 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 that 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 that 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.

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 total value at risk. 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.

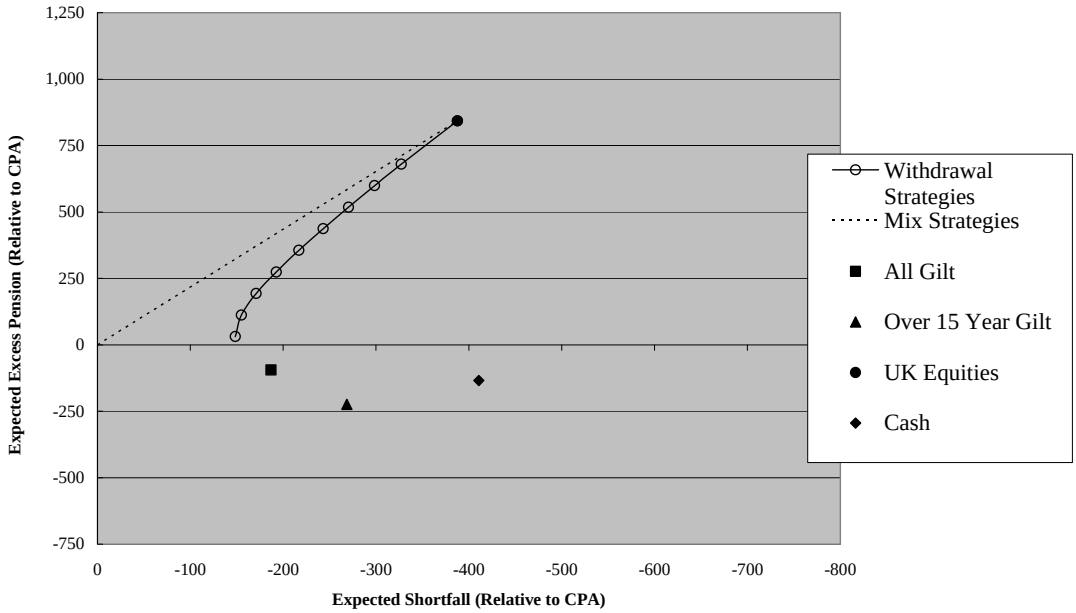
There are, in fact, an infinite number of outcomes that can be obtained from the various strategies, through carrying the asset allocation used in each strategy. I therefore determine a set of efficient strategies. These are asset allocations where the level of expected excess pension cannot be obtained with any lower 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.

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.

The first choice I consider is the most basic, and involves an investor with no tax-free cash available. This could reflect a typical non-UK situation, or a situation in the UK where the tax-free cash is needed for another purpose such as repayment of a mortgage. The choice is therefore simple: to buy a CPA at age 65 with the £500,000 retirement fund, or to invest the £500,000 until age 75 whilst withdrawing monthly income, then purchase a CPA at age 75. As stated above, I assume that the income withdrawn is equal to the income that the annuity would provide.

Figure 1 – Income Withdrawal vs CPA Purchase



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 purchase of a CPA. Any other strategy (excepting one that includes investment in other high-returning asset classes) is suboptimal as shown in Figure 1. Here, I start with a fund of £500,000 at retirement which generates a level monthly risk-free annuity of £1,785. All calculations are relative to this amount. I also show the results for other single-asset investment strategies.

In Table 1 I give the figures behind Figure 1 together with the asset allocations in the efficient frontier and some other relevant statistics. Unsurprisingly, a full allocation to UK equities gives the greatest expected excess pension. This asset class has the same expected shortfall as an allocation to cash; however, the probability of shortfall is considerably higher for cash, suggesting that the low probability of shortfall for UK equities is combined with a larger average shortfall in those scenarios that produce a lower eventual income than that available from the annuity. Note also that the minimum risk position does not consist only of bonds: if risk is measured by expected shortfall, then the minimum risk position consists of 73% All Gilts, 11% Over 15 Year Gilts, but also 17% UK equities. However, as noted above, all of the portfolios below can be beaten by a combination of a CPA and equity-based income withdrawal.

Table 1 – Income Withdrawal vs CPA Purchase

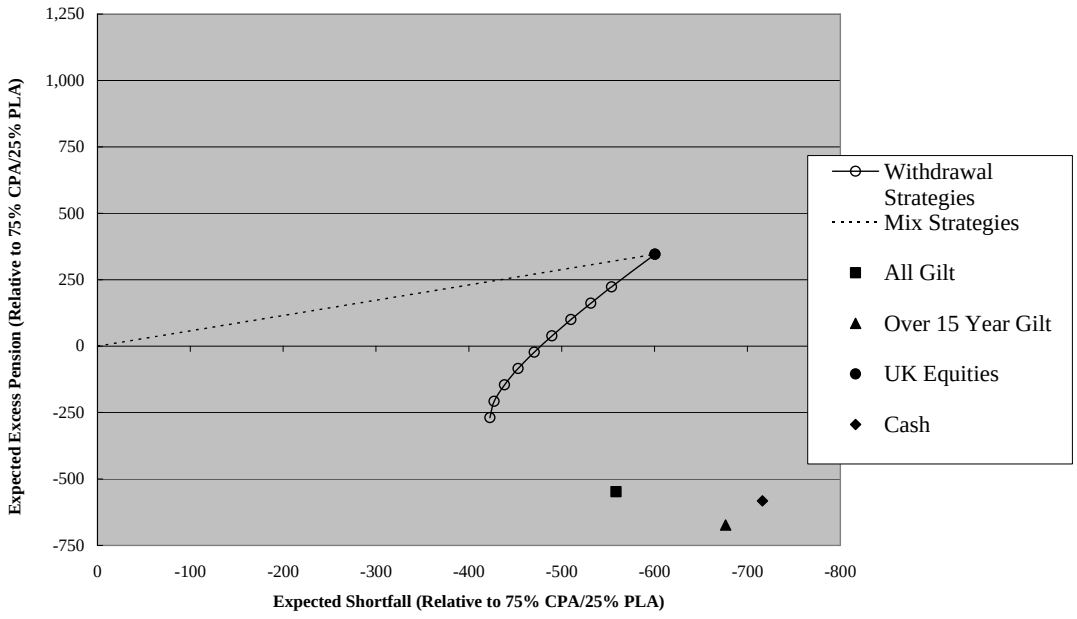
	Minimum Risk									**Maximum Pension**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Expected Excess Pension	31	112	193	274	356	437	518	599	680	843
Expected Shortfall	-149	-155	-171	-193	-217	-243	-270	-299	-327	-388
Asset Allocation (percentages may not sum to 100% due to rounding)										
All Gilt	73%	76%	67%	58%	49%	40%	32%	24%	16%	0%
Over 15y Gilt	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%
UK Equity	17%	24%	33%	42%	51%	60%	68%	76%	84%	100%
Cash	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Probability of Shortfall	57%	51%	48%	45%	44%	44%	44%	44%	44%	45%
Standard Deviation of Excess Pension	468	597	741	901	1,074	1,258	1,452	1,656	1,869	2,323

	All Gilt	Over 15 Year Gilt	UK Equity	Cash
Expected Excess Pension	-94	-224	843	-134
Expected Shortfall	-187	-269	-388	-411
Asset Allocation				
All Gilt	100%	0%	0%	0%
Over 15y Gilt	0%	100%	0%	0%
UK Equity	0%	0%	100%	0%
Cash	0%	0%	0%	100%
Probability of Shortfall	72%	80%	45%	70%
Standard Deviation of Excess Pension	384	314	2,323	1,000

If an investor does not need all of his tax free cash lump sum, then there is an alternative risk-free solution to just buying a CPA. As demonstrated earlier, it is more tax efficient to take the maximum tax free cash lump sum and to use this to purchase a PLA. If 25% of the £500,000 retirement pot is available as tax-free cash, then the new net-of-tax risk-free option against which expected excess pension and expected shortfall should be calculated is a CPA purchased with £375,000 and a PLA purchase with £125,000.

Clearly, the mortality credit issue still exists here, so income withdrawal is still only worthwhile if it is entirely equity based. How does an income withdrawal strategy now compare with the new risk-free position? Figure 2 shows that the level of expected excess pension has fallen and the level of expected shortfall risen for an all-equity strategy compared with the 75% CPA/25% PLA strategy. The dashed line suggests the intermediate risk solutions that might be taken.

Figure 2 – Income Withdrawal vs 25% PLA/75% CPA Purchase



As above, I also give the data underlying Figure 2 in Table 2.

Table 2 – Income Withdrawal vs 25% PLA/75% CPA Purchase

	Minimum Risk									Maximum Pension
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Expected Excess Pension	-269	-208	-146	-85	-23	38	100	161	223	346
Expected Shortfall	-423	-427	-438	-453	-470	-489	-510	-531	-554	-600
Asset Allocation (percentages may not sum to 100% due to rounding)										
All Gilt	66%	59%	52%	45%	38%	32%	25%	19%	12%	0%
Over 15y Gilt	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
UK Equity	34%	41%	48%	55%	62%	68%	75%	81%	88%	100%
Cash	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Probability of Shortfall	73%	68%	64%	62%	61%	59%	58%	57%	57%	56%
Standard Deviation of Excess Pension	649	780	918	1,061	1,210	1,364	1,524	1,688	1,859	2,216

	All Gilt	**Over 15 Year Gilt**	**UK Equity**	**Cash**
Expected Excess Pension	-548	-673	346	-583
Expected Shortfall	-558	-677	-600	-716
Asset Allocation				
All Gilt	100%	0%	0%	0%
Over 15y Gilt	0%	100%	0%	0%
UK Equity	0%	0%	100%	0%
Cash	0%	0%	0%	100%
Probability of Shortfall	97%	99%	56%	85%
Standard Deviation of Excess Pension	242	323	2,216	838

Note that the proportion of equity in the minimum risk portfolio has risen sharply, to 34%. Note also that the probabilities of shortfall have risen for all asset classes, although UK equity is the least affected.

The dashed line in Figure 2 assumes that for a trade-off between income withdrawal and annuity purchase, the 75% of assets not committed to income withdrawal are used to purchase a CPA and the remainder to purchase a PLA. There is, however, a better approach. This approach is to take the £125,000 tax free cash and purchase a PLA, and then consider income withdrawal only on the remaining £375,000. The result of this approach is shown in Figure 3, with the supporting data given in Table 3.

Figure 3 – Income Withdrawal plus PLA vs 25% PLA/75% CPA Purchase

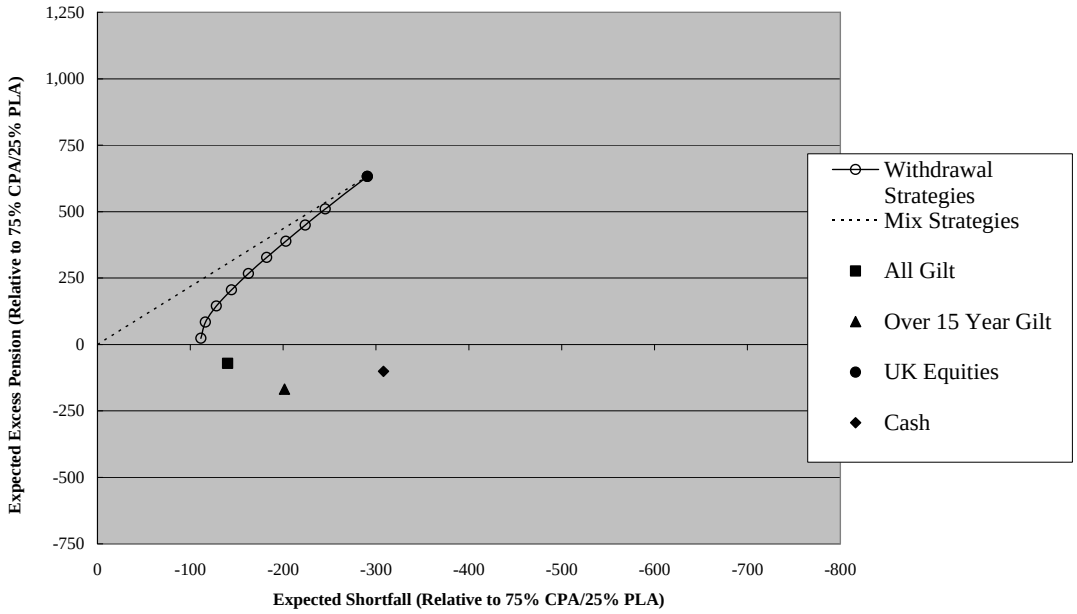


Table 3 – Income Withdrawal plus PLA vs 25% PLA/75% CPA Purchase

	Minimum Risk									Maximum Pension
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Expected Excess Pension	23	84	145	206	267	328	388	449	510	632
Expected Shortfall	-111	-116	-128	-144	-163	-182	-203	-224	-245	-291
Asset Allocation (percentages may not sum to 100% due to rounding)										
All Gilt	73%	76%	67%	58%	49%	40%	32%	24%	16%	0%
Over 15y Gilt	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%
UK Equity	17%	24%	33%	42%	51%	60%	68%	76%	84%	100%
Cash	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Probability of Shortfall	57%	51%	48%	45%	44%	44%	44%	44%	44%	45%
Standard Deviation of Excess Pension	204	260	323	393	468	549	633	722	815	1,013

	All Gilt	**Over 15 Year Gilt**	**UK Equity**	**Cash**
Expected Excess Pension	-71	-168	632	-101
Expected Shortfall	-140	-201	-291	-308
Asset Allocation				
All Gilt	100%	0%	0%	0%
Over 15y Gilt	0%	100%	0%	0%
UK Equity	0%	0%	100%	0%
Cash	0%	0%	0%	100%
Probability of Shortfall	72%	80%	45%	70%
Standard Deviation of Excess Pension	167	137	1,013	436

Here, it is clear that using 25% of the fund to purchase a PLA and 75% in equity-based income withdrawal gives a higher expected excess pension and a lower expected shortfall than committing 100% of your assets to equity-based income

withdrawal. The intermediate strategies here involve substituting some of the equity-based income withdrawal for a CPA. It should also be clear that this chart is simply a 75%-scaled version of Figure 1 – as the proportion of tax free cash available in the initial £500,000 fund reduces to zero, Figure 3 converges to Figure 1.

However, a better solution even than this exists: this solution is phased retirement. Implementing a phased retirement approach gives you a higher expected return for each level of risk than any of the other risky solutions if no tax-free cash lump sum is required. It is also unique in that it is worth holding a variety of asset allocations in a phased retirement strategy rather than mixing an all-equity strategy with the 75% CPA/25% PLA solution in all but the lowest risk scenarios, as shown by the line demonstrating the mix strategies. In fact, the asset allocation needs to be 80% All Gilts/20% UK equities before mixing with the 75% CPA/25% PLA is worthwhile.

Figure 4 – Phased Retirement vs 25% PLA/75% CPA Purchase

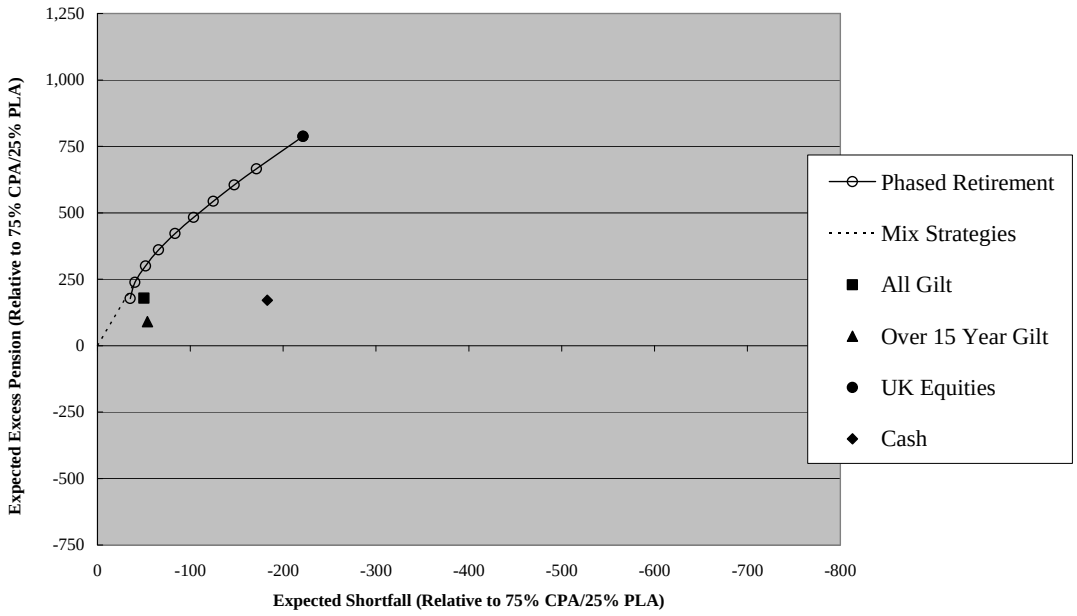


Table 4 – Phased Retirement vs 25% PLA/75% CPA Purchase

	Minimum Risk									Maximum Pension
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Expected Excess Pension	177	238	299	361	422	483	544	605	666	788
Expected Shortfall	-35	-40	-52	-66	-84	-104	-125	-147	-171	-221
Asset Allocation (percentages may not sum to 100% due to rounding)										
All Gilt	39%	48%	61%	67%	57%	46%	37%	27%	18%	0%
Over 15y Gilt	52%	35%	14%	0%	0%	0%	0%	0%	0%	0%
UK Equity	9%	17%	25%	33%	43%	54%	63%	73%	82%	100%
Cash	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Probability of Shortfall	30%	28%	28%	30%	31%	32%	33%	33%	35%	37%
Standard Deviation of Excess Pension	331	412	515	628	750	889	1,040	1,203	1,378	1,759

	All Gilt	Over 15 Year Gilt	UK Equity	Cash	Efficient Portfolio
Expected Excess Pension	179	90	788	171	235
Expected Shortfall	-50	-54	-221	-183	-40
All Gilt	100%	0%	0%	0%	80%
Over 15y Gilt	0%	100%	0%	0%	0%
UK Equity	0%	0%	100%	0%	20%
Cash	0%	0%	0%	100%	0%
Probability of Shortfall	34%	40%	37%	52%	28%
Standard Deviation of Excess Pension	419	266	1,759	899	404

This is shown in Figure 4, together with the single-asset strategies, and the supporting data are given in Table 4. I term the phased retirement portfolio tangential to the 25% PLA/75% CPA line the efficient portfolio.

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 5 – Phased Retirement, All Cash then CPA Purchase vs 25% PLA/75% CPA Purchase

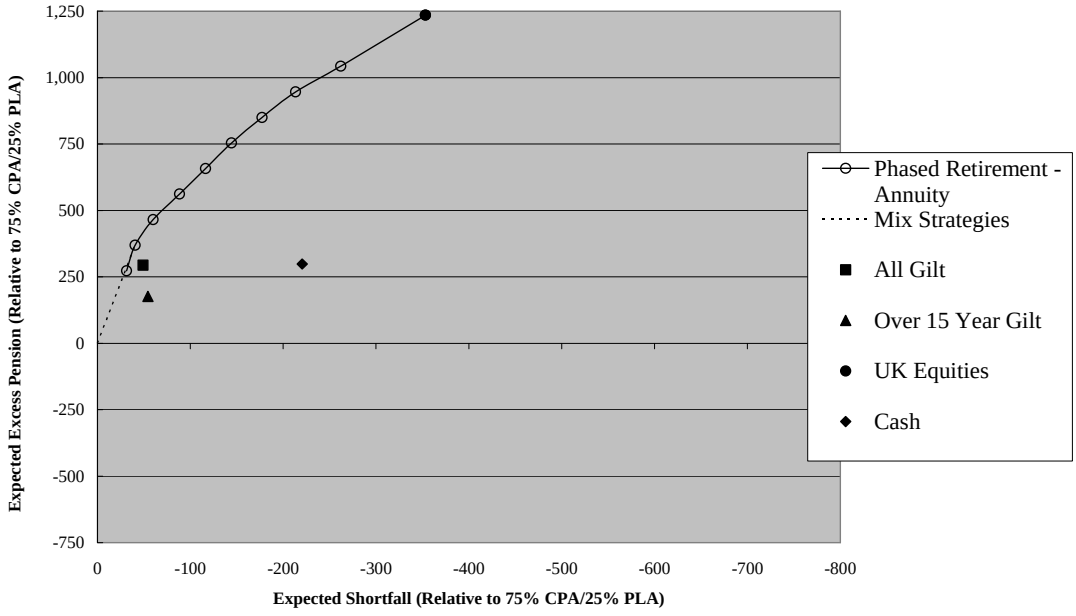


Figure 5 shows the results for the first case, assuming a two-stage CPA purchase (at tax-free cash exhaustion and at age 75) with Table 5 displaying the underlying data.

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.

Table 5 – Phased Retirement, All Cash then CPA Purchase vs 25% PLA/75% CPA Purchase

	Minimum Risk									Maximum Pension
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Expected Excess Pension	273	369	465	562	658	754	850	946	1,043	1,235
Expected Shortfall	-31	-41	-60	-88	-117	-144	-177	-213	-262	-353
Asset Allocation (percentages may not sum to 100% due to rounding)										
All Gilt	39%	59%	70%	66%	55%	46%	37%	28%	18%	0%
Over 15y Gilt	55%	26%	6%	0%	0%	0%	0%	0%	0%	0%
UK Equity	7%	15%	23%	34%	45%	54%	63%	72%	82%	100%
Cash	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Probability of Shortfall	24%	23%	25%	26%	28%	29%	32%	34%	35%	38%
Standard Deviation of Excess Pension	418	556	729	922	1,121	1,347	1,591	1,846	2,159	2,766

	All Gilt	**Over 15 Year Gilt**	**UK Equity**	**Cash**	**Efficient Portfolio**
Expected Excess Pension	294	176	1,235	298	369
Expected Shortfall	-49	-54	-353	-220	-41
All Gilt	100%	0%	0%	0%	59%
Over 15y Gilt	0%	100%	0%	0%	26%
UK Equity	0%	0%	100%	0%	15%
Cash	0%	0%	0%	100%	0%
Probability of Shortfall	28%	32%	38%	50%	23%
Standard Deviation of Excess Pension	555	362	2,766	1,246	556

Figure 6 shows the results for the second case, with Table 6 displaying the underlying data. 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 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.

Figure 6 – Phased Retirement, All Cash then Withdrawal vs 25% PLA/75% CPA Purchase

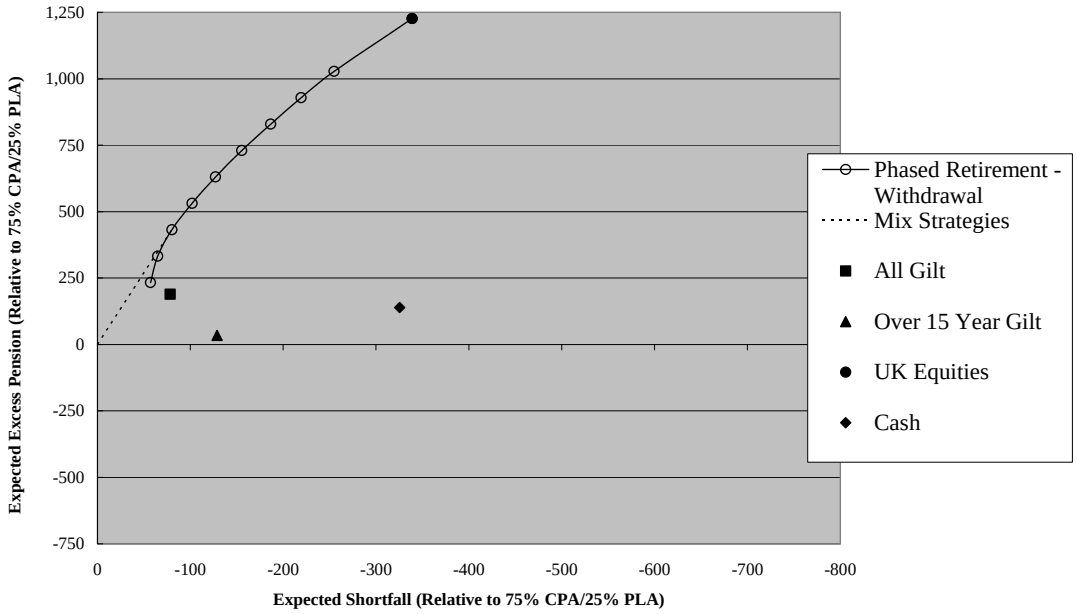


Table 6 – Phased Retirement, All Cash then Withdrawal vs 25% PLA/75% CPA Purchase

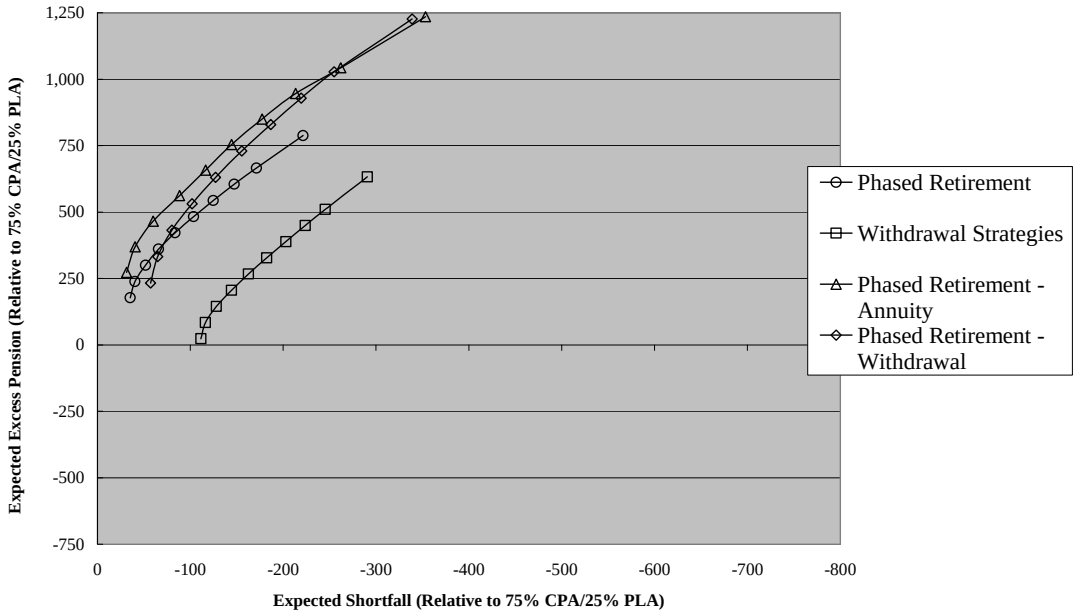
	Minimum Risk									Maximum Pension
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Expected Excess Pension	233	332	432	531	630	730	829	929	1,028	1,227
Expected Shortfall	-57	-65	-80	-102	-127	-155	-187	-219	-255	-339
Asset Allocation (percentages may not sum to 100% due to rounding)										
All Gilt	57%	66%	75%	67%	58%	49%	40%	30%	21%	0%
Over 15y Gilt	33%	17%	1%	0%	0%	0%	0%	0%	0%	0%
UK Equity	10%	17%	24%	33%	42%	51%	60%	70%	79%	100%
Cash	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Probability of Shortfall	33%	30%	29%	31%	32%	32%	33%	34%	36%	38%
Standard Deviation of Excess Pension	488	617	773	938	1,125	1,330	1,551	1,791	2,048	2,623

	All Gilt	**Over 15 Year Gilt**	**UK Equity**	**Cash**	**Efficient Portfolio**
Expected Excess Pension	189	35	1,227	139	432
Expected Shortfall	-78	-129	-339	-325	-80
All Gilt	100%	0%	0%	0%	75%
Over 15y Gilt	0%	100%	0%	0%	1%
UK Equity	0%	0%	100%	0%	24%
Cash	0%	0%	0%	100%	0%
Probability of Shortfall	41%	51%	38%	58%	29%
Standard Deviation of Excess Pension	545	395	2,623	1,274	773

The relative positions of the various phased retirement and income withdrawal strategies are shown in Figure 7. 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.

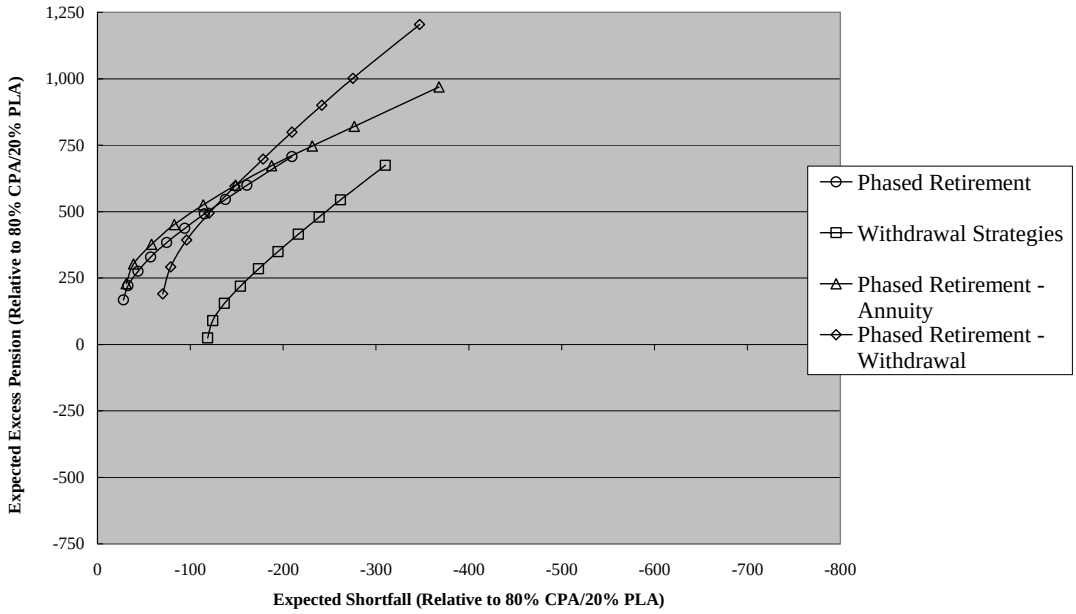
Figure 7 – Phased Retirement & Income Withdrawal plus PLA vs 25% PLA/75% CPA Purchase



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 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 8.

Figure 8 – Phased Retirement & Income Withdrawal plus PLA vs 20% PLA/80% CPA Purchase



Figures 9, 10 and 11 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 as 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.

Figure 9 – Phased Retirement & Income Withdrawal plus PLA vs 15% PLA/85% CPA Purchase

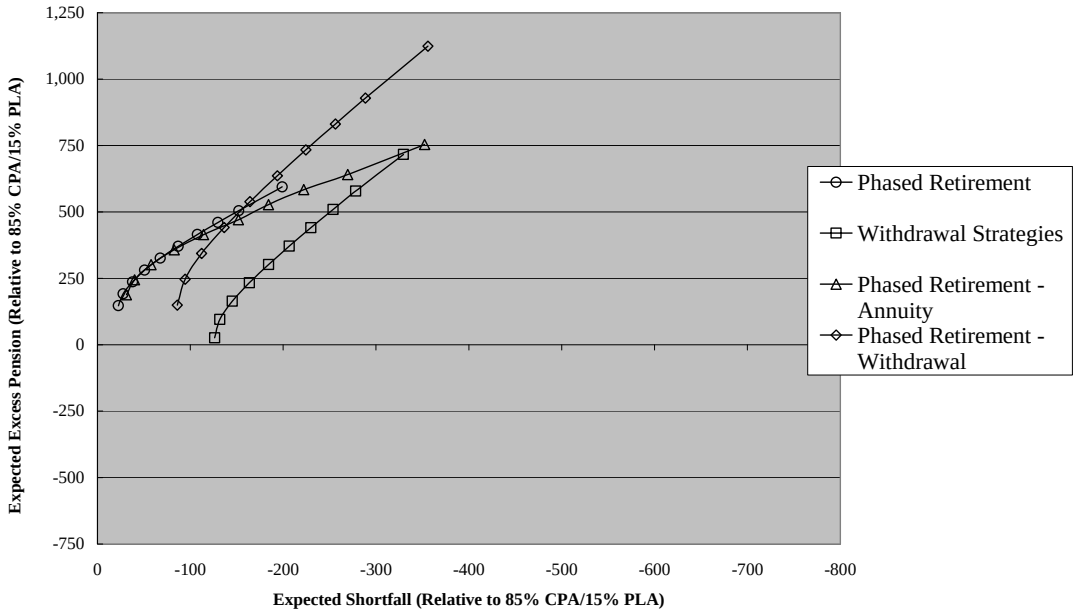


Figure 10 – Phased Retirement & Income Withdrawal plus PLA vs 10% PLA/90% CPA Purchase

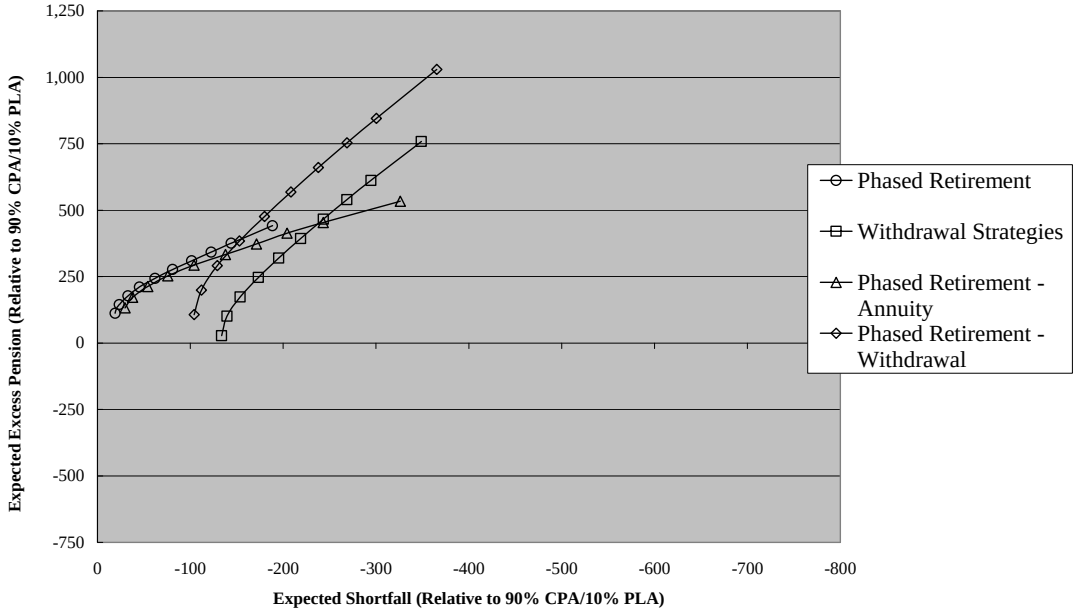
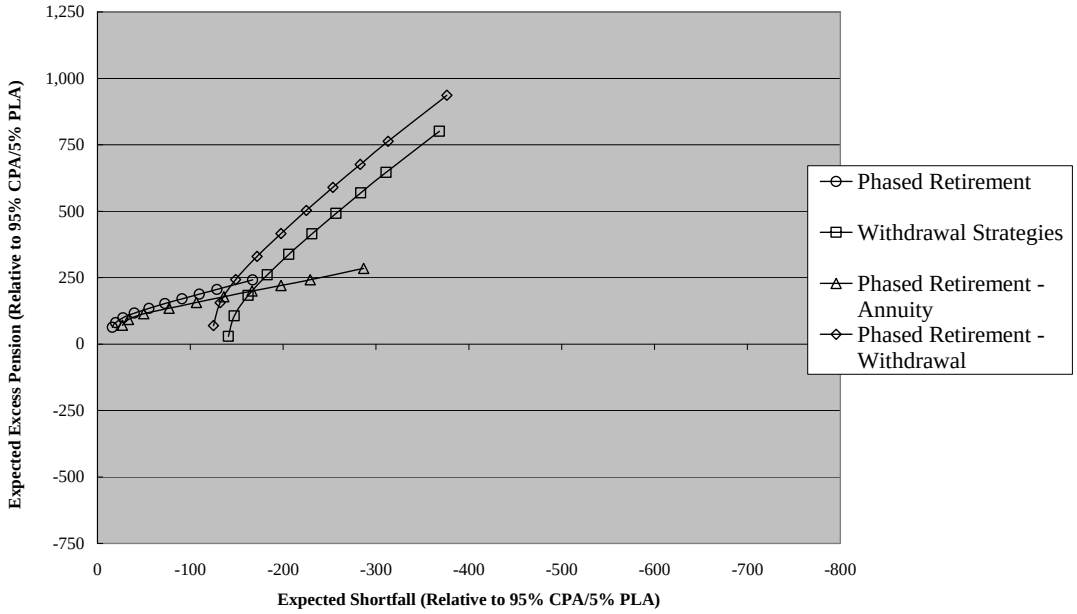


Figure 11 – Phased Retirement & Income Withdrawal plus PLA vs 5% PLA/95% CPA Purchase



As mentioned earlier, in the absence of tax-free cash, income withdrawal is the only alternative to annuity (100% CPA) purchase: this is the scenario outlined in Figure 1.

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 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 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.

References

Bernheim, B.D. (1991), "How Strong are Bequest Motives? Evidence Based on Estimates for Life Insurance and Annuities," *Journal of Political Economy*, 99, 899-927.

Blake, D., Cairns, A.J.G. and Dowd, K. (2003), "Pensionmetrics 2: Stochastic Pension Plan Design during the Distribution Phase", *Insurance Mathematics and Economics*, 33, 29-47.

Booth, P. and Wood, G.E. (2000), "Interest Rates are Low but are Annuities Expensive?" *Economic Affairs*, 20, 43-44

Brown, J.R. (2001), "Private Pensions, Mortality Risk and the Decision to Annuitize", *Journal of Public Economics*, 82, 29-62

Brugiavini, A. (1993), "Uncertainty Resolution and the timing of Annuity Purchases", *Journal of Public Economics*, 50, 31-62.

Cannon, E. and Tonks I. (2006), *Survey of Annuity Pricing – Department for Work and Pensions Research Report No 318.*

Cox, J.C., Ingersoll J.E. and Ross, S.A. (1985), "A Theory of the Term Structure of Interest Rates", *Econometrica*, 53, 385-407.
Dimson, E., Marsh, P. and Staunton, M. (2002), *Triumph of the Optimists: 101 Years of Global Investment Returns*, Princeton University Press, Princeton NJ
Dimson, E., Marsh, P. and Staunton, M. (2006), *Global Investment Returns Yearbook 2006*, ABN Amro
Finkelstein, A. and Poterba, J.M. (2002), "Selection Effects in the United Kingdom Individual Annuities Market", *Economic Journal*, 112, 28-50.
Finkelstein, A. and Poterba, J.M. (2004), "Adverse Selection in Insurance Markets: Policyholder Evidence from the U.K. Annuity Market", *Journal of Political Economy*, 112, 183-208.
Friedman, B.M. and Warshawsky, M.J. (1990), "The Cost of Annuities: Implications for Savings Behavior and Bequests", *Quarterly Journal of Economics*, 105, 135-154.
HMRC (1991), *The Income Tax (Purchased Life Annuities) (Amendment) Regulations 1991*.
HMRC (2006), *Insurance Policyholder Taxation Manual*.
HMSO (2004), *Finance Act*
HMSO (2004), *Pensions Act*
HMSO (2005), *Finance Act*
Milevsky, M.A. (1998), "Optimal Asset Allocation towards the End of the Life Cycle: To Annuitize or Not to Annuitize?" *Journal of Risk and Insurance*, 65, 401-426.
Milevsky, M.A. (2001), "Optimal Annuitization Policies: Analysis of the Options", *North American Actuarial Journal*, 5, 57-69
Pensions Board (2006), *GN9: Funding Defined Benefits – Presentation of Actuarial Advice*, Board for Actuarial Standards.
Tobin, J. (1958), "Liquidity Preference as Behavior Towards Risk", *Review of Economic Studies*, 67, 65-86.
Yaari, M.E. (1965), "Uncertain Lifetime, Life Insurance and the Theory of the Consumer", *Review of Economic Studies*, 32, 137-150.