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# **Taxable and Tax-advantaged Portfolio Management for UK Personal Investors**

By

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# Taxable and Tax-advantaged Portfolio Management for UK Personal Investors

R. GUY THOMAS\*

## Abstract

*This article makes some observations on the interaction of UK taxation and portfolio decisions by a personal investor managing his own investments in quoted company shares. Three holding vehicles are considered: two types of tax-advantaged account (ISAs and SIPPs), and taxable holdings registered directly in the investor's own name or a nominee (personal account). Some observations are made on ways in which portfolio management of a taxable account differs from management of a tax-advantaged account. Simple models are used to illustrate the difficulty of producing post-tax out-performance from active management of a taxable account. Guidelines are suggested for the type of investment to be allocated to each type of account, for turnover in each type of account, and for decisions on switching between investments held in a taxable account.*

## Introduction

THIS article makes some observations on the interaction of UK taxation and portfolio decisions by a personal investor managing his own investments in quoted company shares. Most extant literature on portfolio management, whether academic or practitioner-orientated, seems to ignore taxation. Similarly marketing materials from private client investment managers generally focus on pre-tax returns. In recent years a small literature on taxable portfolio management has developed, mainly with reference to US tax regimes,<sup>1</sup> but this literature generally gives no consideration to tax regimes outside the

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<sup>1</sup> R.H. Jeffrey and R.D. Arnott, "Is Your Alpha Big Enough to Cover its Taxes?" (1993) *Journal of Portfolio Management*, Spring 1993; R.D. Arnott, A.L. Berkin, and J. Ye, "The Management and Mismanagement of Taxable Assets" (2001a) *Journal of Investing* Spring, 15 and "Loss Harvesting: What's it Worth to the Taxable Investor?" (2001b) 3 *Journal of Wealth Management* 4 at 10; A.L. Berkin and J. Ye, "Tax Management, Loss Harvesting and FIFO Accounting" (2003) 59 *Financial Analysts' Journal* 4 at 91; and W. Reichenstein "After-tax Asset Allocation" (2006) 62 *Financial Analysts' Journal* 14 are all examples of papers on taxable investment management in a US context. In the economics literature, there are more theoretical papers: for example, G.M. Constantinides in "Capital Market Equilibrium with Personal Tax" (1983) 51 *Econometrica* 611 and "Optimal Stock Trading with Personal Taxes" (1984) 13 *Journal of Financial Economics* 65 considers the effect of personal taxation on capital market equilibrium; R.M. Dammon, C.S. Spatt and H.H. Zhang, "Optimal Asset Location and Allocation with Taxable and Tax-deferred Investing" (2004) 59 *Journal of Finance* 999; and L. Garlappi and J. Huang, "Are Stocks Desirable in Tax-deferred Accounts?" (2006) 90 *Journal of Public Economics* 2257 consider stylised lifetime consumption/investment models with taxable and tax-deferred accounts. In the actuarial literature, M. Sherris, "Reserving for Capital Gains Tax (an Application of Option Pricing Theory)" (1992) 119 *Journal of the Institute of Actuaries* 1 at 45 uses

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United States. Although the focus of this article is on the personal investor who manages his own investments, most of the concepts discussed also seem potentially relevant to firms which offer investment management services to such investors. Many of the concepts can also be applied, with suitable adjustments, to other entities which pay tax on their investment returns—for example, insurance companies, other companies, and many private trusts.

This article assumes that the investor is resident and domiciled in the United Kingdom, and a higher-rate taxpayer who can hold shares in three main ways, all of which are referred to as “accounts”:

- (1) in a tax-advantaged Investment Savings Account (ISA) to which contributions may have been made since 1999; and possibly in a fund accumulated in a Personal Equity Plan (PEP), the predecessor scheme for contributions between 1987 and 1999;
- (2) in a tax-advantaged Self-Invested Personal Pension (SIPP); and
- (3) direct holdings registered in the investor’s own name or a nominee (personal account).

This article is concerned with questions such as: which type of investments should be held in which accounts? In which accounts should turnover of investments be concentrated? How should the differing tax positions of the different accounts influence portfolio management?

This article is also concerned with decisions for an investor who holds an investment portfolio through the conventional accounts listed above. For investors with substantial funds, other less conventional accounts may offer some tax advantages. For example, an offshore life insurance bond can be written on an underlying portfolio of assets under the effective direction of the investor; or an authorised unit trust can be created for a single investor or family (a “private unit trust”). In the author’s view such schemes can be effective, but they tend to exploit tax legislation in a way not intended or envisaged by legislators, and as such are vulnerable to court challenges by the authorities or legislative changes; they also tend to involve relatively high charges. This article does not consider such schemes.

This article does not consider complex tax planning for single transactions, for example when an entrepreneur is considering the sale of a company and steps are taken to structure the transaction in a way which mitigates the chargeable gain. The accounting and legal professions appear to devote considerable effort to developing such schemes, and the taxation authorities to challenging them. But this level of effort does not seem to have been applied previously (at least in published literature) to the portfolio management questions which this article considers.

The issues considered in this article are topical because of the substantial capital gains tax reforms which were proposed in the Pre-Budget Report in October 2007: a reduction in the capital gains tax to a rate of 18 per cent (previously 40 per cent, for higher rate income tax payers), combined with abolition of both taper relief and indexation relief. This article generally assumes the 18 per cent tax rate which is expected to apply from April 2008, but also draws some comparisons with the old regime.

the Black-Scholes formula to calculate reserves for deferred capital gains tax, but this article is not concerned with portfolio management.

### The main tax rules for personal investors

This section summarises the main tax rules for the various types of account, which may be well known to many readers. As stated above, this will be on the basis that the investor pays income tax at the higher rate on earned income (which may include pension income).

#### *Personal account*

If shares are directly held by the investor with no tax wrapper, the tax position for the investor can be summarised as follows. Income tax is payable at 25 per cent of the amount of share dividends received, and at 40 per cent on interest from bank deposits or company or government bonds. As regards capital gains, there is an annual exempt amount (£9,200 in 2007/08). Net chargeable gains (that is, gains offset by current year losses and any unused losses brought forward from previous years) below the annual exempt amount are free of tax. The annual exempt amount for each year can be utilised only in that year; any unutilised portion of the exemption cannot be carried forward. In general, losses cannot be set against income. Net chargeable gains above the annual exempt amount are taxed at 18 per cent. All gains and losses are recognised for tax purposes only when they are realised.

According to the capital gains tax regime that existed prior to April 2008, chargeable gains for assets held for longer periods were reduced by taper relief, with accelerated rates of taper relief available on “business assets” as distinct from “non-business assets”. The main capital gains tax rate (for a higher-rate taxpayer) was 40 per cent; but taper relief could reduce the effective rate to 24 per cent (for non-business assets held for at least ten years); or to as little as 10 per cent (for business assets held for at least two years). Shares listed on any stock exchange which appeared on the list of recognised exchanges published by the tax authorities were non-business assets; but crucially, the Alternative Investment Market (AIM), operated under the auspices of the London Stock Exchange, was *not* a recognised stock exchange, and so trading companies with AIM listings qualified as business assets. The large differential in capital gains tax rates for otherwise comparable shares on the full list and on AIM became a very substantial factor in taxable portfolio management. There were also a number of subtleties arising from the interaction of current year losses, losses brought forward, taper relief and the annual exemption, and a knowledge of these interactions was useful in day-to-day investment decision-making. From April 2008 most of these subtleties disappear, and so this article does not go into details, although we do make some comparisons with the old regime where appropriate.

Special rules apply to transfers of assets to spouses or civil partners, whether by way of gift or sale. In effect, no gain or loss arises on such a transfer; instead the transferee spouse assumes the transferor’s original cost. Where one spouse has an unutilised annual exemption or unrelieved losses, transfers between spouses before onward sale can reduce the sum of taxes for the two spouses. However these opportunities (and views on the non-fiscal aspects of such transfers) tend to be idiosyncratic to each household, and they are not considered further in this article. There are also special rules for transfers to other “connected persons,” a broad category which includes many relatives. Transfers to connected persons are generally deemed to be made at market value, whatever the actual consideration (if any) paid, and losses are deductible only from gains arising on other disposals to that same connected person. Thus there may be some opportunities (and

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some potential pitfalls) in transfers to other family members; but these opportunities (and views on their non-fiscal aspects) again tend to be idiosyncratic to each household. These rules are not considered further in this article.

### *ISAs (formerly PEPs)*

The investor can also hold investments in a tax-advantaged Individual Savings Account (ISA). Contributions of up to £7,000 (£7,200 from April 6, 2008) may be made each year. The ISA can be invested in a range of collective vehicles and in shares listed on any recognised stock exchange. AIM shares are not permitted (unless they have a dual listing on an overseas recognised stock exchange).<sup>2</sup> The predecessor scheme of Personal Equity Plans (PEPs) operated between 1987 and 1999 with broadly similar parameters. The contribution levels varied over the years. The maximum which an investor could contribute to PEPs between 1987 and 1999 was £88,200. There were originally some minor differences in the rules for PEP and ISA schemes, but all PEPs are statutorily re-designated as ISAs with effect from April 6, 2008.

No income tax or capital gains tax is payable on investments held in an ISA. In a stocks and shares ISA, a flat rate of 20 per cent tax is deducted by the plan manager on interest earned on any cash held; but given that cash is only permitted to be held temporarily, pending investment or reinvestment, this tax will generally be trivial. An ISA therefore provides (almost) tax-free roll-up, and the ability to vary a portfolio without tax consequences. Withdrawals can be made at any time with no tax penalty, apart from loss of the shelter from future taxation on the funds withdrawn.

### *Self-Invested Pension Plan (SIPP)*

The investor can also hold investments in a tax-advantaged registered pension plan. Broadly speaking, a registered pension plan offers income tax relief on contributions; no income or capital gains tax is payable on the investments held in the pension account; but income tax is payable on the pension drawn in retirement (except for tax-free retirement cash of one-quarter of the total fund utilised at vesting or partial vesting). From April 2006, former restrictions on membership of multiple pension plans were relaxed to allow "full concurrency". This means that an investor who wishes to manage his own investments in shares and other assets can establish a self-invested pension plan (commonly known as a SIPP), even if he is also a member of an employer's pension plan.

There is also a "lifetime limit" (expected to be £1.8 million in 2010/11, increasing thereafter in line with the retail prices index) on the amounts which can be accumulated at date of vesting (i.e. date of first drawing pension benefits) in all the investor's pension plans. If the investor is a member of a defined benefit plan, those benefits are valued at vesting date for the purposes of the lifetime limit in accordance with a prescribed basis. Any excess of accumulated funds above the lifetime limit attracts a 25 per cent tax charge at the vesting date; the residual excess can then be drawn as either a lump sum or as income, in both cases subject to 40 per cent tax. This article generally ignores the lifetime

<sup>2</sup> HMRC PEP and ISA Bulletin 30.

limit; it is assumed that accumulated pension benefits at vesting are worth less and so the limit does not bite.<sup>3</sup>

There are many further pensions rules concerning the level of tax-relieved contributions, and the timing and form of the benefits. While these further details are important in practice, they do not directly impinge on the portfolio management issues which this article considers, and so they are not detailed further here.

### Some observations on tax-aware portfolio management

Under the previous regime which applied before April 2008, taper relief created enormous complexities in taxable portfolio management. The last-in-first-out (LIFO) identification of share purchases when calculating taper relief meant that a record of average cost for a share was not a sufficient decision input: a full history of dates, prices and quantities purchased had to be considered. Furthermore, the periodic accrual of taper relief (and indexation relief, for older holdings) meant that the effective marginal capital gains tax rate on one's shareholding in any company (often acquired in several tranches on various dates) was continually changing. The abolition of taper and indexation reliefs represents a very substantial simplification: in future decisions can generally be based on the average cost of a holding, rather than taking into account the full record of dates, prices and quantities purchased.

However even after the abolition of the taper and indexation reliefs, optimal portfolio management for a taxable investor remains a quite complex and subtle problem. Capital gains tax is triggered by the decision to sell, and so depends on the share price at that time; but it also depends on the average price at which a share was originally purchased. If a share is sold today, a particular set of alternative investment opportunities is available; but if the sale is deferred, a different set of alternatives will be available, which may be better or worse than those available today. The tax position for a particular share cannot be considered in isolation, since losses realised on some shares can be used to offset gains realised on others. The renewal of the annual exemption each year means that the effective marginal tax rate on gains falls to zero on each April 6, but tends to increase later in the tax year.

It seems clear that for a taxable investor, results net of taxation are what matters; and hence that both risk and return need to be evaluated, and decisions made, on a post-tax basis. This can be difficult, and some popular investment aphorisms suggest that it is too difficult to be worth attempting: for example, it is often said that "the tax tail should not wag the investment dog". The author's view is that whilst it is conceivable that a portfolio managed without regard for tax may also produce a good post-tax return, this approach seems unlikely to be optimal. The intuition behind this is that tax-aware behaviour often implies an advantage which is relatively certain at the time the decision is made; on the other hand, portfolio reallocations which incur tax often crystallise a *certain* tax cost to

<sup>3</sup> This may be a less important limitation than it first appears, because the SIPP is substantially tax-advantaged even for funds which exceed the limit at the vesting date. You get tax relief on the contributions, tax-free roll-up, and an effective 55% tax ( $0.75 \times 0.6 = 0.45$ ) at vesting. Now  $0.6 \times (1.02)^{15} \times 0.45 \approx 1.0$ , so for a term of 15 years an excess return of around 2% pa during roll-up is required in the SIPP to match the proceeds of taxed personal account investment. In the author's view 2% pa may be a low estimate of the advantage a skilful active investor can reasonably expect to derive from total absence of taxes during roll-up.

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capture a prospective advantage, which is highly *uncertain* at the time the decision is made. (For example, suppose we hold a share standing at a loss, and we are now neutral about the share's prospects: a tax-aware decision to realise the loss and set it against other gains will generate a certain benefit. On the other hand, suppose we hold a share standing at a gain, but we now consider that a different share has better prospects: a decision to switch will crystallise a certain tax cost, for highly uncertain benefits.)

There is one advanced mathematical approach which should be briefly mentioned. In principle, optimal post-tax portfolio management can be characterised as a problem of dynamic stochastic optimisation. In other words, given a model for share price changes and dividends, we could in principle evaluate all possible future paths along a decision tree, making optimal decisions at each branch of the tree. But this is very difficult, because the size of the decision tree grows exponentially with number of time periods, and quickly becomes unmanageable as soon as one considers any realistic number of shares and time periods. Three recent papers in the operational research literature have taken this approach<sup>4</sup> but due to the size of the decision tree, they can consider only greatly simplified problems involving small numbers of shares and time periods. The impression from these papers is that a great deal of effort and quite restrictive assumptions are required to produce rather limited results. We will not consider this approach further in this article, but it may be a worthwhile area for future research.

### *Tax-advantaged accounts potentially offer very large benefits*

Tax-advantaged accounts such as ISAs and SIPPS can offer very large benefits to the long-term investor, which are often under-appreciated. This is partly because an advantage which is small initially compounds over the years, and the large effect of compounding a small advantage is counter-intuitive to many investors. A more subtle point is that the portfolio in tax-advantaged accounts can be varied as much as one likes with no tax consequences, so that any skill the investor may have can be fully exploited. The *combination* of these two effects can lead to a much higher compound return in tax-advantaged accounts than by the same investor in taxable accounts. To the investor with a long time horizon who believes he has some ability to generate pre-tax excess returns, £1 within a tax-advantaged account is worth substantially more than £1 in a taxable account. The time, care and effort which the investor applies to managing each type of account should reflect this.

### *The tax authority as a risk-sharing partner*

The tax authority's role in relation to capital gains tax is sometimes characterised as providing an interest-free loan to the investor. This reflects the fact that an investor who defers realising a gain also defers payment of tax. However, the notion of an interest-free loan is an incomplete mental model, because the time value of money is not the only

<sup>4</sup> M.A. Osorio, N. Gulpinar, B. Rustem, and R. Settergren, "Post-tax Optimisation with Stochastic Programming" (2004a) 157 *European Journal of Operational Research* 152 and "Tax Impact on Multi-stage Mean-variance Portfolio Optimisation" (2004b) 11 *International Transactions in Operational Research* 535; V. DeMiguel and R. Uppal, "Portfolio Management with the Exact Tax Basis via Non-linear Programming" (2005) 51 *Management Science* 2 at 277.



relevant point. A complementary mental model is that the tax authority acts as a risk-sharing partner who puts up no initial capital, but agrees to share in any profits, and also in losses (provided the investor has other gains to offset the losses).

The role of the tax authority as a risk-sharing partner means that for marginal investments, a higher downside risk tolerance may be appropriate in taxable than in tax-advantaged accounts. Under the old regime, prior to April 2008, this point was reinforced by the asymmetry inherent in the taper relief rules for business assets. If a risky investment in a business asset was a success, any gain realised after a two-year holding period was taxed at an effective rate of 10 per cent; but if the investment was a failure, the loss could potentially be used to relieve other gains on non-business assets, which would otherwise have been taxed at rates up to 40 per cent. For a portfolio investor, the elimination of this asymmetry is an economically significant feature of the April 2008 reforms. Many commentators have suggested that investors may bring forward sales of AIM shares standing at a gain before April 2008, in order to pay tax on the gain at 10 per cent, rather than 18 per cent thereafter. For the portfolio investor it might be more important to bring forward sales of AIM shares standing at a *loss* before April 2008, in order to set the losses against other gains taxable at rates up to 40 per cent, rather than 18 per cent thereafter.

The “tax authority as risk-sharing partner” model is also relevant to the decision to reduce any holding which has appreciated so that it represents a large fraction of a total portfolio. Because part of an appreciated asset in a taxable account is effectively owned by the government, the level at which the asset becomes too large a proportion of the investor’s portfolio is higher than if the investment were held in a tax-advantaged account.

*Diversity of tax sale costs is valuable in taxable accounts*

The benefits of diversity across different assets bearing different idiosyncratic risks are widely recognised. In taxable accounts a more subtle form of diversity is beneficial: diversity of tax sale costs. The “tax sale cost” of an asset is the tax payable (or loss relief available) if the asset were sold today. A portfolio of shares with diverse tax sale costs provides more options for varying the portfolio at low cost—for example by taking losses early, and deferring the realisation of gains—than a portfolio containing a single risky asset, or a portfolio of shares all with similar tax sale costs. This is an example of the general point that a portfolio of options (in this case, options to realise a gain or loss) is worth more than an option on a portfolio.

According to the previous regime, which applied before April 2008, tax sale costs could vary across different assets because of different basis costs—that is, historical costs as a proportion of the current value—or because of different accrued amounts of taper relief or indexation relief. The latter sources of variation disappear with the April 2008 changes, and so for some purposes distinguishing between different assets by tax sale costs is now equivalent to distinguishing solely by basis costs. Nevertheless, the author’s view is that the concept of tax sale cost remains a useful one—partly because it focuses attention directly on the tax penalty (or benefit) of selling an asset, and partly because in some contexts tax sale costs may still vary for reasons other than variations in basis costs. For example, if the investor has an unutilised annual exemption or losses brought forward from prior years, this reduces the tax sale cost of assets currently held. Conversely, if the investor has already fully utilised losses brought forward and the annual exempt amount

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for the current year, the tax sale cost of assets currently held is higher in the current tax year than after the next April 5, when a fresh exemption will be available.

### *Optimal weightings depend on holding accounts and tax sale costs*

The optimal portfolio weighting for a particular asset depends partly on the account in which it is held, and (where the account is taxable) its tax sale cost. For example, if a share held solely in a tax-advantaged account doubles in price, a larger reduction in the holding may be warranted than if the same share were held entirely in a taxable account. As noted above, this is for two distinct reasons: (1) the tax cost of reducing the holding in a taxable account; (2) the taxation authority effectively owns part of the appreciated holding in a taxable account (and so the investor's effective portfolio allocation to the appreciated asset is lower).

There can also be cross-effects between size of holding and tax sale costs for different shares. Suppose one share in our portfolio has been a spectacular success, appreciating to a very large portfolio weighting. The portfolio now has a high exposure to the specific risk of this one share, and also a high exposure to shares as an asset class. In a tax-free account, we would probably reduce the holding in this share; this would both reduce the specific exposure, and could also be used to adjust the overall portfolio exposure away from shares towards other asset classes, such as cash or bonds. But in a taxable account, the tax sale cost of reducing the holding in this share will be very high. We might prefer to live with the high specific risk, and adjust the overall portfolio exposure by selling *other* shares with lower tax sale costs. Thus the presence of one greatly appreciated share (large weighting, low basis cost, high tax sale cost) can sometimes make it more attractive to sell *other* shares, compared with the position if the appreciated share was absent from the portfolio.

### **Modelling the tax costs of turnover**

#### *Is your alpha big enough to cover its taxes?*

The question heading this section was the title of probably the first US paper to consider taxable portfolio management from a practitioner perspective.<sup>5</sup> These authors were concerned with whether the gains typically generated by active management of a taxable portfolio (relative to a passively-indexed portfolio) can reasonably be expected to cover the incremental tax costs of that turnover. Writing eight years later, Arnott suggested the answer: "at best, *probably not*, and if I had to give a one-word answer, it would be *no*".<sup>6</sup> In this section we consider some simple models which show that these remarks probably also have some force for UK investors.

We assume that the investor has a finite time horizon, say 10 years. The investor has a choice between (1) passive investment in the accumulation units of a unit trust index fund and (2) active management of directly held investments. The index fund charges 0.5 per cent per annum and has a low level of turnover costing say a further 0.2 per cent

<sup>5</sup> Jeffrey and Arnott (1993), fn.1.

<sup>6</sup> R.D. Arnott, "Tax Efficient Investing is Easier Said than Done" (2001) *Journal of Wealth Management* Summer 2001 at 10.

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per annum (commissions, stamp duty on reinvestments, and bid-offer spread). Under active management, we assume charges as follows: 0.5 per cent stamp duty on purchases, commissions at 0.25 per cent on both purchases and sales, 1 per cent for bid-offer spreads, and 1 per cent as a charge for active management. We approximate these active management costs by a total charge payable at the end of each year of 3 per cent per annum for a one-year holding period, 2 per cent per annum for a two-year holding period, and 0.67 per cent per annum for a three-year holding period. The total return on shares is 8 per cent per annum, comprised of dividends of 3 per cent per annum and share price gains of 5 per cent per annum.

The active investor can use his annual capital gains tax allowance for the first part of each year's gains. This can substantially reduce the effective tax rate, even for quite large funds. For example, if realised gains less losses (net chargeable gains) are 5 per cent of the fund in a particular year, the effective rate of capital gains tax paid on a fund of £250,000 will be only about 5 per cent of net chargeable gains; on a fund of £500,000, about 11 per cent; and on a fund of £1 million, about 15 per cent. Table 1 (below) shows the range of effective capital gains tax rates for four sizes of funds and three levels of net chargeable gains in any year.

**Table 1 Effective rates tax on net chargeable gains, at different wealth levels**

Net chargeable gains (as percentage of end of year pre-tax fund)	Total fund at year end (outside tax-advantaged wrappers)			
	£100,000	£250,000	£500,000	£1,000,000
5%	NIL	5%	11%	15%
10%	1%	11%	15%	16%
15%	7%	14%	16%	17%

Assumptions: annual exempt amount = £9,200 (as in 2007/08).

Table 1 suggests that a range of effective tax rates may be relevant to the personal investor, particularly at lower levels of wealth held outside tax-advantaged accounts. We also need to remember that the annual exemption cannot be carried forward from year to year, and that the current year's losses must be set against gains before applying the exemption; this means that it is likely that in some years, the exemption will be partly or wholly wasted. Taking all this into account, an effective capital gains tax rate of 15 per cent seems a reasonable illustrative figure to work with. For the previous tax regime which applied before April 2008, a comparable illustrative figure for the effective capital gains tax rate is  $15/18 \times 40 \approx 33$  per cent.

Table 2 (below) shows the excess capital return required from active management to produce the same proceeds as the index fund after 10 years, given holding periods of one, two or three years (that is, turnover of 100 per cent, 50 per cent or 33 1/3 per cent per annum). The required excess capital returns are shown on both pre-liquidation and

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**Table 2 Personal investor with 10-year time horizon: excess capital return (% per annum) required for post-tax proceeds of active management to equal post-tax proceeds of unit trust index fund**

**15% effective tax rate (illustrative figure for post-April 2008 regime):**

	Excess capital return required (%pa)	
	Pre-liquidation basis	Post-liquidation basis
<b>Average holding period</b>		
1 year (100% turnover):	3.8%	3.0%
2 years (50% turnover):	2.0%	1.4%
3 years (33% turnover):	1.0%	0.3%

**33% effective tax rate (illustrative figure for old regime):**

	Excess capital return required (%pa)	
	Pre-liquidation basis	Post-liquidation basis
<b>Average holding period</b>		
1 year (100% turnover):	6.2%	4.9%
2 years (50% turnover):	2.9%	2.3%
3 years (33% turnover):	2.0%	1.0%

post-liquidation bases, where the latter allows for the tax cost of realising the entire portfolio after 10 years. Figures are shown separately for the post-April 2008 tax regime, and for the old regime. Figures for longer horizons than 10 years are not shown, because it turns out that any further deferral of final liquidation of the portfolio after 10 years makes little difference to the required excess annual returns.

The striking feature of Table 2 is that (particularly under the old regime) the required excess capital returns are in many cases well in excess of reasonable expectations of active management. Few active managers would claim expected excess capital return over 3 per cent per annum; moreover, any such claim is uncertain, but the tax and transaction costs of attempting to generate excess capital return are certain. Even for lower turnover, say less than 50 per cent per annum (that is, an average holding period longer than two years), the investor needs to be confident he can generate excess returns of 1–2 per cent per annum after costs to keep up with a passive investment. Nevertheless, comparing the old and new regimes, the tax penalty on active management of a directly-held portfolio relative to long-term investment in unit or investment trusts is substantially reduced by the April 2008 changes.

The results in this section are broadly consistent with studies based on US tax rates which suggest that an excess return of 2–3 per cent is needed in a conventionally managed active portfolio to match the after-tax returns of an index fund.<sup>7</sup>

<sup>7</sup> Jeffrey and Arnott (1993), fn.1; Arnott, Berkin and Ye (2001a), fn.1.

### Asset location in tax-advantaged and taxable accounts

*Asset location* is the term used by US authors<sup>8</sup> for the question of which type of asset (for example, shares or bonds) should be held in each of the various accounts available to an investor. This section considers asset location decisions for a UK personal investor.

#### *Shares or bonds in tax-advantaged accounts?*

There is academic literature which suggests that a corporate sponsor of a defined benefit pension fund should prefer bonds rather than shares to be held by the pension fund, because of a tax arbitrage effect.<sup>9</sup> Holding bonds in the pension fund (on which untaxed interest is received) enhances the capacity of the company to issue its own bonds (on which the interest paid is tax-deductible). For the personal investor, a similar argument in favour of allocating bonds (or perhaps shares which pay high dividends) to tax-advantaged accounts can be made. Interest receipts from bonds and dividends from shares held in a higher-rate taxpayer's personal account are taxable, at 40 per cent and 25 per cent respectively. On the other hand, capital gains are taxed at only 18 per cent, and can also be wholly or partly offset by the annual exemption (£9,200 in 2007/08). This is an argument for holding corporate bonds or high-yielding shares in tax-advantaged accounts, and other shares in taxable accounts.

A further argument can be made relating to the optional nature of capital gains tax. The tax is optional in the sense that it crystallises only on disposal of a particular asset, when either a gain or an allowable loss is created. As noted earlier in this article, a diversity of tax sale costs can be valuable in a taxable account. This suggests that the value of the option might be increased by holding investments with greater dispersion of returns—for example, risky shares—in the taxable account.

Based on arguments along the lines above, some papers by authors considering US tax regimes derive results suggesting that the investor should allocate assets with low volatility and high yields taxable at high rates—typically bonds—mainly to tax-advantaged accounts; and allocate assets with high volatility and low yields taxable at low rates—typically shares—mainly to taxable accounts.<sup>10</sup> However, as with the Black/Tepper “pension fund in bonds” strategy for corporates,<sup>11</sup> these prescriptions are widely ignored in practice, and disputed in theory. Under US tax regimes, tax-advantaged accounts are generally pension plans, and so the investor has only limited access to the funds before retirement age. Some authors have suggested that allocating both shares and bonds to taxable accounts may be justified in these circumstances by a precautionary motive, that is a desire to smooth returns in the taxable account which can be drawn

<sup>8</sup> E.g. Shoven and Sialm, 2003, fn.10; Dammon *et al.*, 2004, fn.1.

<sup>9</sup> See F. Black, “The Tax Consequences of Long-run Pension Policy” (1980) 36 *Financial Analyst's Journal* 21; I. Tepper, “Taxation and Corporate Pension Policy” (1981) 36 *Journal of Finance* 1; and J. Ralfe, C. Speed and J. Palin, “Pension Funds and Capital Structure: Why Hold Equities in the Pension Fund?” (2004) *North American Actuarial Journal* July 103.

<sup>10</sup> See, for example, J.B. Shoven and C. Sialm, “Asset Location in Tax-deferred and Conventional Savings Accounts” (2003) 88 *Journal of Public Economics* 23; Dammon *et al.* (2004), fn.1.

<sup>11</sup> Black (1980), fn.9; Tepper (1981), fn.9.

on without restrictions before retirement age.<sup>12</sup> In the United Kingdom, this is less convincing, because some types of tax-advantaged accounts (ISAs) can be drawn on at any time. To an active UK investor, a more compelling argument for allocating shares rather than bonds to tax-advantaged accounts is that tax benefits will be maximised if the largest gains from the investor's "best ideas" are located in tax-advantaged accounts. For most active investors, most of the time, "best ideas" will tend to be specific shares rather than bonds. Also, the active investor may have an active investment strategy from which he thinks he can generate pre-tax excess returns, but which requires a high turnover. Such a strategy may well produce negative excess returns on post-tax basis in a taxable account, and so can be exploited only in a tax-advantaged account.

For the UK personal investor, which effect is likely to be more important—the income tax saving by placing bonds in the tax-advantaged account, or the capital gains tax saving by placing one's "best ideas" (typically shares) in the tax-advantaged account? Intuitively, for a successful investor, the saving in capital gains tax seems likely to be more important. A study by Poterba *et al.*<sup>13</sup> showed that allocating equity mutual funds in priority to bonds to a tax-advantaged account would have accumulated greater wealth under US tax rules, based on actual returns in US financial markets over the period 1962–1998. The United States taxes the mutual fund investor on an annual basis on the fund's returns, which is similar to the position of a UK investor holding shares directly. On this basis, the author's experience accords with the result of Poterba *et al.*

In conclusion, the author's view is that for an active investor who believes he can generate pre-tax excess returns, the most important priority in asset location is to place "best ideas" in tax-advantaged accounts. This should take precedence over sheltering high yields in tax-advantaged accounts, or increasing the value of capital gains tax options by allocating volatile assets to taxable accounts.

### Turnover in tax-advantaged and taxable accounts

This section considers the level of activism in portfolio management which is appropriate for tax-advantaged and taxable accounts. In principle, any decision to vary a portfolio should be based on "opportunity cost" comparisons, including tax effects if the portfolio is taxable. This means that any decision to transact in a particular quantity of a particular share should be evaluated against the full set of possible transactions and tax consequences (including doing nothing, and waiting for a better opportunity) at that time. This is easier to state than to apply in practice. Taxes on income are relatively easy to analyse, because they can be netted off a future income stream in perpetuity. Taxes on capital gains cannot be analysed in this way; instead they need to be thought of as (sometimes very large) transaction costs.

In a tax-advantaged account, tax transaction costs are zero. This implies that a higher level of activism in portfolio decisions will generally be optimal than in taxable accounts. The investor should, as far as possible concentrate turnover in tax-advantaged accounts. Any share which the investor expects to hold only for a relatively short time should, if possible, be allocated at the time of purchase to a tax-advantaged account.

<sup>12</sup> G. Amromin, "Household Portfolio Choices in Taxable and Tax-deferred Accounts: Another Puzzle?" (2003) 7 *European Finance Review* 547; Garlappi and Huang (2006), fn. 1.

<sup>13</sup> J.M. Poterba, J.B. Shoven and C. Sialm, "Asset location for retirement savers" (2000) 7991 NBER Working Paper 28.

In taxable accounts, on the other hand, tax transaction costs are often substantial. Furthermore, the tax transaction costs are always certain, but the prospective benefit which the investor is attempting to obtain by switching from one share to another are always uncertain. The combination of *certain* costs with *uncertain* benefits suggests that even when the investor believes a switch from one share to another is worthwhile on a post-tax basis, he should be cautious about acting on this belief. For a taxable investor, judicious lethargy is often a valuable trait.

An exception to the merits of judicious lethargy in a taxable account is where tax sale costs are negative. This applies when a share in a taxable account is standing at a loss, so there will be a tax benefit of selling (assuming that other gains are available against which to set the loss). In these circumstances, the investor should be more “trigger-happy” about switching to another share in a taxable account than in a tax-advantaged account.

#### *Loss harvesting*

This idea of taking losses early, while deferring the realisation of gains is described by US authors as “loss harvesting”.<sup>14</sup> In the previous paragraph loss harvesting was framed as a discretionary decision by the investor, but it can also be developed as a mechanical strategy. Consider a taxable account where the investor makes no attempt at active share selection, choosing the initial portfolio either at random or by reference to a market index. In a mechanical loss-harvesting strategy, the investor reviews the portfolio say once a month and sells any shares which are standing at a capital loss, and reinvests in shares with similar risk and return characteristics.<sup>15</sup> If the losses generated can be set against gains in the passive portfolio arising from corporate events such as takeovers or rebalancing towards the index, loss harvesting can generate an advantage over entirely passive management. Alternatively, the losses generated can be used against the investor’s gains on assets held outside the passive portfolio. The tax benefit from loss harvesting is usually more certain than any excess return which a portfolio manager might hope to generate from share selection.

Monte Carlo simulation studies of loss harvesting of a portfolio based on the Standard and Poor’s 500 index have been described.<sup>16</sup> Some US firms offer “indexed funds with loss harvesting” as an investment strategy for taxable investors. Whether or not the investor favours such a mechanical strategy, the simulation studies are of broader interest as a quantitative indication of the potential benefits from tax-aware portfolio management. The author has carried out simulations using parameters appropriate to UK investors, which are reported in more detail in Appendix A. In summary, the results suggest that under the post-April 2008 regime there are modest benefits from a loss-harvesting strategy, even after transaction costs; for example after 15 years a fund with loss harvesting would typically be about 9 per cent ahead of a fund without loss harvesting. (Under the old tax regime, the potential benefits were more substantial: after 15 years a fund with loss harvesting would typically be about 25 per cent ahead of a fund without loss harvesting.)

<sup>14</sup> E.g. Arnott *et al.* (2001b), fn.1 and Berkin and Ye (2003), fn.1.

<sup>15</sup> In practice a loss is harvested only if the loss is sufficient to cover round-trip transaction costs on the sale and reinvestment into new shares.

<sup>16</sup> See Arnott *et al.* (2001b), fn.1 and Berkin and Ye (2003), fn.1.

### Switching guidelines for taxable accounts

The previous section noted that the *certain* and often high tax transaction costs of switching from one share to another, and the *uncertain* prospective benefits of the switch, mean that a policy of judicious lethargy is often appropriate in taxable accounts. However, in some cases the uncertain benefits will be sufficiently large that the switch should be made despite the certain tax costs. This section develops guidelines for this switching decision.

We start by noting that if the anticipated period of out-performance of the new share which is bought over the old share which is sold were long enough, it would always be right to switch to the share with a higher expected return, no matter how high the tax sale cost associated with the original share. This is because differences in expected return have an exponential effect on terminal wealth, but the tax payment has only a multiplicative effect on terminal wealth. To refine this observation for shorter time horizons, the investor needs to have some idea of the time horizon over which he expects the new share which is bought to out-perform the old share which is sold; and also of the time horizon for any ultimate liquidation of the portfolio. Note that the new “share” could be another share, or it could be a bond or cash.

Table 3 (below) shows the excess capital return required from the new share relative to the old share to justify a sale subject to capital gains tax, for various basis costs expressed as a decimal of the original purchase price. Figures for the post-April 2008 regime and the old regime are shown separately. For simplicity dividends have been ignored (which can be justified either by the dividends actually being nil, or by assuming that the *difference* in the dividend streams for the new and old shares is small enough to ignore.) The figure at the top left of the 18 per cent table shows that where a share already held has a low basis cost, and the out-performance of the alternative asset is expected to persist for only one year, a difference of 17 per cent per annum in the expected return is required to justify a switch to the alternative asset. The figure at the bottom right of the 18 per cent table shows that where an existing share is held with a high basis cost and the time horizon for the future difference in expected return is five years, just 1 per cent per annum difference in expected return is sufficient to justify a switch. The table for 40 per cent tax shows much higher differences in required expected returns to justify a switch. The general inference is that the investor should have a much stronger bias towards activity in switching decisions under the post-April 2008 regime than under the old regime.

Table 3 ignores tax after the end of the expected period of out-performance. To consider this, it is necessary for the investor to specify a terminal time horizon over which he wishes to target wealth after realization of investments, say 20 years. We can then assume that after the period of expected out-performance, the two shares compound at the same rate until the time horizon, when all shares are sold and tax on liquidation is paid. Table 4 (below) shows the excess capital return required over various horizons from 1 to 5 years from the new share relative to the old to justify a sale subject to capital gains tax, for various base costs, using a terminal time horizon of 20 years. Figures for 18 per cent and 40 per cent tax are shown separately.<sup>17</sup> The capital return on the original share is assumed to be 5 per cent per annum, and the same assumption is made for the identical capital return on the two shares after the period of out-performance.

<sup>17</sup> The figures in the 40% table assume tax at 40% on the sale of the first share to make the switch, and an effective tapered rate of 24% at final liquidation.



**Table 3 Excess capital return (per cent per annum) from new share relative to old share required to give equivalent fund *before* liquidation tax at end of out-performance time horizon**

**Capital gains tax rate: 18% (post-April 2008):**

Basis cost of old share	Out-performance time horizon (years)				
	1	2	3	4	5
0.2	17%	8%	5%	4%	3%
0.3	14%	7%	5%	3%	3%
0.4	12%	6%	4%	3%	2%
0.5	10%	5%	3%	2%	2%
0.6	8%	4%	3%	2%	2%
0.7	6%	3%	2%	1%	1%
0.8	4%	2%	1%	1%	1%

**Capital gains tax rate: 40% (old regime):**

Basis cost of old share	Out-performance time horizon (years)				
	1	2	3	4	5
0.2	47%	21%	14%	10%	8%
0.3	39%	18%	12%	9%	7%
0.4	32%	15%	10%	7%	6%
0.5	25%	12%	8%	6%	5%
0.6	19%	9%	6%	4%	4%
0.7	14%	7%	4%	3%	3%
0.8	9%	4%	3%	2%	2%

**Assumptions:**

- prospective tax on liquidation of the fund is ignored
- excess capital returns is defined as  $((1+n)/(1+o) - 1)\%$ , where  $n$  is the capital return on the new share and  $o$  is the capital return on the old share.

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**Table 4 Excess capital return (per cent per annum) from new share relative to old share required to give equivalent fund *after* liquidation, with terminal time horizon of 20 years**

**Capital gains tax rate: 18% (post-April 2008 regime):**

Basis cost of old share	Out-performance time horizon (years)				
	1	2	3	4	5
0.2	10%	5%	3%	3%	2%
0.3	9%	4%	3%	2%	2%
0.4	8%	4%	2%	2%	1%
0.5	6%	3%	2%	2%	1%
0.6	5%	2%	2%	1%	1%
0.7	4%	2%	1%	1%	1%
0.8	2%	1%	1%	1%	0%

**Capital gains tax rate: 40% (old regime):**

Basis cost of old share	Out-performance time horizon (years)				
	1	2	3	4	5
0.2	39%	18%	12%	9%	7%
0.3	32%	15%	10%	7%	6%
0.4	26%	12%	8%	6%	5%
0.5	21%	10%	6%	5%	4%
0.6	16%	8%	5%	4%	3%
0.7	11%	5%	4%	3%	2%
0.8	7%	4%	2%	2%	1%

Assumptions:

- fund liquidated and tax paid at time horizon of 20 years
- excess capital returns are measured as  $((1+n)/(1+o) - 1)\%$ , where  $n$  is the return on the new share and  $o$  is the return on the old share.
- old share compounds at 5 per cent p.a. during the out-performance period; after this, both shares compound at 5 per cent p.a.

The figures in Table 4 show a similar but lower pattern to Table 3, with the proportional differences between the two tables greater under the post-April 2008 regime than under the old regime. This is as expected. In Table 3, the portfolio incurred capital gains tax if switched, but over the time horizons considered there were no realisations in the original portfolio; consequently a very large excess return on the new share was required to overcome this disadvantage. In Table 4, only the switched portfolio incurs capital gains tax now; but capital gains tax for both original and switched portfolios is deducted at the terminal time horizon, and that for the original portfolio is calculated using a lower base cost (because the base cost was not raised by an earlier realisation). This method of evaluation leads to a lower excess return required from the new share to justify the switch. The proportional differences between the two tables are greater under the post-April 2008 regime because the tax at the time horizon is at the *same* 18 per cent rate as tax on the switch now, whereas in the old regime the tax at the time horizon was at a *lower* (tapered) effective rate than tax on the switch now.

### Conclusions

This article has reviewed the interaction of UK taxation and portfolio decisions by a personal investor managing his own investments in quoted company shares. The most important top-level principles and concepts can be summarised as follows:

- *tax-advantaged accounts potentially offer very large benefits.* The combination of a small advantage which compounds over the years, and freedom to vary the portfolio as much as one likes with no tax consequences, can potentially lead to very large benefits;
- *post-tax thinking on risk and return.* Risk and return should always be considered on a post-tax basis. The tax authority acts as a profit-sharing partner who shares in the investor's profits and losses, but contributes no capital. The presence of this partner probably means that the investor should be more tolerant of downside risk, and more tolerant of large portfolio weightings in appreciated assets, in a taxable account than in a tax-advantaged account;
- *capital gains taxes as transaction costs.* Decisions to vary a portfolio should be considered by opportunity cost comparisons, including tax effects. Income taxes can be regarded as reductions in yield in perpetuity. Capital gains taxes can be regarded as (sometimes very large) transaction costs;
- *judicious lethargy.* The tax transaction costs of switching from one share to another in a taxable account are often high and always certain. The prospective benefits derived from a switch are usually uncertain. The combination of certain cost and uncertain benefit means that a lower level of turnover and activism in decisions is generally optimal than in a tax-advantaged account. For the taxable investor, judicious lethargy can be a valuable trait;
- *loss harvesting.* An exception to the previous point is where tax transaction costs are negative, that is a share in a taxable account is standing at a loss and realising the loss will enable it to be offset against gains. In these circumstances, the investor should be more "trigger-happy" about switching in a taxable account than in a tax-advantaged account.

This article has taken the perspective of an active personal investor managing his own investments. Some investors delegate portfolio management to professional investment

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managers, for whom many of the concepts in this article seem applicable. It would be interesting to see articles on tax-aware portfolio management written from the perspective of professional managers in the United Kingdom, rather than the United States. Many of the concepts which this article has discussed can also be applied, with suitable adjustments, to management of the portfolios of other entities which pay tax on their investments—for example, insurance companies, other companies, and many private trusts. It would be interesting to see articles about this.

### APPENDIX A—Simulations of loss harvesting

#### *A model of loss harvesting*

To give an indication of the potential benefits of loss harvesting (and also of tax aware management in general), it is convenient to consider a mechanical strategy where the investor makes no subjective decisions, and trades only to harvest losses. The strategy is as follows:

- the investor starts at time zero with a portfolio of 50 shares all priced at 100;
- the time horizon when the investor will liquidate the portfolio is 15 years;
- the benchmark portfolio is managed entirely passively;
- the loss harvesting portfolio is managed passively, except that once a month the investor reviews the portfolio and sells and repurchases any shares standing at a loss;
- we assume that the loss thereby generated can be set against other gains, arising either within the portfolio, from corporate events and rebalancing towards a benchmark index, or on the investor's other assets outside of the passively-managed, loss-harvested portfolio. The loss therefore generates a tax benefit;
- our convention to account for the tax benefit of the loss (calculated as loss \* tax rate) is to reinvest this amount immediately into the same share (the time delay in payment of tax is ignored);
- every six months, dividends received in the past six months are invested into a new share;
- in both portfolios, corporate events and index rebalancing lead to one of the original 50 shares share being realised for cash and replaced every eight months (with 50 shares, this represents a passive turnover of 3 per cent per annum);
- after 15 years, the two portfolios are liquidated, and tax paid on the gains on liquidation;
- the benchmark and loss-harvested portfolios operate in identical economic environments, in particular in each simulation the *same* random numbers are used to generate the evolution of both portfolios. All results presented are based on 1,000 simulations;
- initially, we ignore transaction costs.

In practice it is not possible to harvest a loss by selling and immediately repurchasing the same share, because of the 30-day rule whereby a sale is matched first against any repurchase within 30 days. For example, suppose a share was originally purchased for 100p and now stands at 95p. If we sell the share for 95p and then immediately (or within

the next 30 days) repurchase it at  $95\frac{1}{4}$ p (say), the sale at 95p is matched against the purchase at  $95\frac{1}{4}$ p to give a tax loss of  $\frac{1}{4}$ p; the base cost for the share now held is the original 100p, and the loss from 100p to 95p has *not* been harvested. However, in principle we can get round this by investing the sale proceeds in a different share with similar risk and return characteristics. In practice it might be difficult to reliably identify such a share; but the purpose of our model is to give some indication of the potential benefit from loss harvesting, rather than to represent a real world strategy.

### *Models for share returns*

We now need a model for the capital and dividend returns from shares generally, and a model for the cross-sectional variation in returns from different shares. Previous work by US authors used the Capital Asset Pricing Model with a truncated normal distribution for individual share betas.<sup>18</sup> But this is probably not a good model for long-term returns, because it cannot allow for auto-regressive or mean-reverting behaviour. A more suitable approach for these purposes is the Wilkie model, an actuarial time series model which is widely used for long-term investment modelling.<sup>19</sup>

The Wilkie model projects investment variables at annual intervals, but we need share prices at monthly intervals. These can be created by calculating the log share price at the end of each year (from dividends/yields) and then constructing “Brownian bridges” for monthly log share prices. The Brownian bridge from one year-end value to the next is constructed by generating a random walk 12 monthly steps forward from the starting annual figure, calculating the adjustment required to get from the end-point of this random walk to the required next annual figure, and then distributing this adjustment equally over the 12 monthly steps.<sup>20</sup>

The parameters for the Wilkie model are as in the 1995 paper,<sup>21</sup> except that the long-term central value for the share dividend yield, YMU, is multiplied by 0.9 to reflect “actual” rather than “gross” dividends receivable since the removal of tax credits in 1999 (i.e.  $YMU = 0.0375 \times 0.9 = 0.03375$ ). The Brownian bridge for monthly log share prices is based on a monthly standard deviation of 0.0433 (i.e. 15 per cent per annum). We also need to model the cross-sectional variation of monthly log price changes in individual shares around the log price change in the overall shares index. We assume that the cross-section is a normal distribution with a standard deviation of 0.09 (i.e. 31 per cent per annum). This is in on top of the variability in the market index.<sup>22</sup>

Table B.1 (below) shows figures for portfolio relatives for a personal investor under the post-April 2008 regime, before and after allowance for tax on capital gains on liquidation.

<sup>18</sup> Arnott *et al.* (2001b), fn.1 at 13.

<sup>19</sup> A.D. Wilkie, “More on a Stochastic Asset Model for Actuarial Use” (1995) 5 *British Actuarial Journal* 777.

<sup>20</sup> For a full description of this technique, see A.D. Wilkie, H.R. Waters and S.Y. Wang, “Reserving, Pricing and Hedging for Guaranteed Annuity Options” (2003) 41 *British Actuarial Journal* 263 at App. D

<sup>21</sup> Wilkie, fn.19.

<sup>22</sup> These figures may seem on the high side, but my impression is that the portfolios of active investors tend to be concentrated in mid-cap and smaller company shares, where volatility does tend to be higher.

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The “portfolio relative” is the ratio of the fund after 15 years of practising loss harvesting to the fund following 15 years with no loss harvesting.

### B.1 Personal investor: portfolio relatives after 15 years of loss harvesting, Wilkie returns; $t = 0.18$

	Quartiles for portfolio relatives		
	Lower	Median	Upper
Before liquidation:	1.13	1.15	1.17
After liquidation:	1.10	1.12	1.14

Table B.2 shows the same portfolio relatives, but under the old tax regime, with 40 per cent tax and taper relief on gains on liquidation. Taper relief has also been allowed on any capital losses on liquidation (but not on earlier losses generated from loss harvesting).<sup>23</sup> As expected, the relative advantage from loss harvesting was larger when the tax rate was higher. (Note that each table shows the *ratios* of final portfolio values with and without loss harvesting *under the given tax regime*; these ratios are lower under the new lower-tax regime. The tables do *not* represent the *absolute amounts* of the final portfolio values under each regime.)

### B.2 Personal investor: portfolio relatives after 15 years of loss harvesting, Wilkie returns, with allowance for taper relief of capital gains on liquidation; $t = 0.4$

	Quartiles for portfolio relatives		
	Lower	Median	Upper
Before liquidation:	1.31	1.36	1.42
After liquidation:	1.23	1.27	1.32

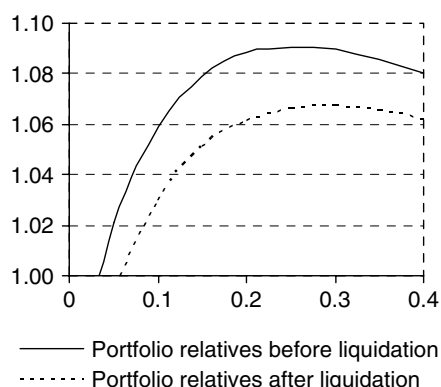
Further experiments showed that the results are not very sensitive to the assumed central rate of inflation in the Wilkie model (which drives all the other variables in that model). The most critical parameter seems to be the cross-sectional standard deviation of individual log share price returns, that is, the idiosyncratic risk.

<sup>23</sup> This is an approximation: the correct treatment is that losses on one share are set against gains on another share (or any other asset) chosen by the investor, and taper relief is applied to the net gain after offset of losses. Our assumption that taper relief applies to losses effectively assumes that the losses are set against gains on assets which had a similar holding period. In practice one would set losses against gains with the shortest holding period (equivalent to smallest amount of taper relief), and so our assumption may slightly under-estimate the benefits of loss harvesting.

*What about transaction costs?*

Previous simulations by US authors on loss harvesting have ignored transaction costs.<sup>24</sup> This over-states the benefit of loss harvesting, and is particularly suspect for the United Kingdom because of stamp duty on purchases at 0.5 per cent. In addition, in the UK commission on both purchases and sales might be 0.25 per cent each, and bid-offer spreads perhaps 1 per cent. If we allow for these costs, it is no longer optimal to realise *any* loss; there is a trade-off between transaction costs and tax benefit obtained, and we should realise only losses above a certain size. Suppose we follow a rule to realise only losses greater than some threshold fraction  $f$  of base cost. We can then compare median terminal wealth relatives for different values of  $f$ .

It is convenient to present results as a graph of median terminal wealth relatives plotted against  $f$ . Figure B.1 is the plot for a personal investor under the post-April 2008 regime ( $t = 0.18$ ). Comparing with Table B.1, the benefits of loss harvesting are (as expected) lower with transaction costs; but with suitable choice of  $f$ , they are still worth having. The optimal value of  $f$  appears to be between 0.25 and 0.30. Figure B.2 is the same plot, but under the old tax regime ( $t = 0.4$ , and taper relief at liquidation). As expected, the benefits of loss harvesting are higher under a higher tax rate, and the optimal value of  $f$  is lower, somewhere between 0.15 and 0.20.

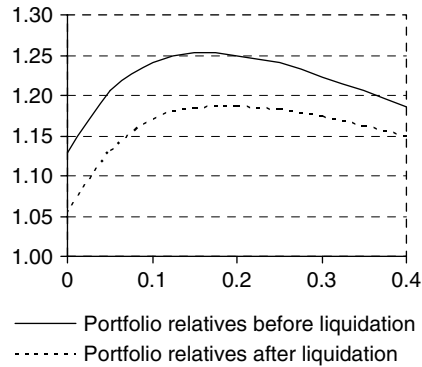


### B.1 Personal investor: portfolio relatives as a function of threshold fraction $f$ after 15 years of loss harvesting; $t = 0.18$

It is interesting to note that without the benefit of simulation, one's first conjecture for a reasonable strategy might be to realise any loss where the expected tax benefit exceeds the round-trip transaction costs. This corresponds to  $f \approx 0.095$  for a tax rate of 18 per cent (or  $f \approx 0.04$  for a tax rate of 40 per cent). Viewing each month in isolation, this strategy harvests the maximum tax benefit immediately available from that month; but it is not an optimal multi-period strategy. This is because by selling a share at a small loss as soon as the loss emerges in month  $n$ , you forego the chance to sell the *same* share (for

<sup>24</sup> Arnott *et al.* (2001b), fn.1 and Berkin and Ye (2003), fn.1.

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### B.2 Personal investor: portfolio relatives as a function of threshold fraction $f$ after 15 years of loss harvesting; $t = 0.40$

roughly the same transaction cost) when the loss may have grown larger, in month  $n+1$ ,  $n+2$ ,  $n+3$ , . . . etc. It is better to wait until the loss is of more reasonable size. This is another example of the benefits of judicious lethargy. <sup>(LT)</sup>

<sup>(LT)</sup> Capital gains tax; Individual savings accounts; Investment management; Losses; Self-invested personal pensions; Shares