P a r a m e t r i c P o r t f o l i o A s s o c i a t e s

Research Report

Reporting After-Tax Returns: A Pragmatic Approach

David M. Stein, Ph.D.

Brian Langstraat, CFA

Premkumar Narasimhan, Ph.D.

Parametric Portfolio Associates
1151 Fairview Avenue North
Seattle, WA 98109-4418
Ph: 206.694.5575
Fax: 206.694.5581
www.parametricportfolio.com

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Abstract

We address pragmatic issues associated with calculating and reporting after-tax performance. We identify and define essential components of a regular after-tax performance report. We present a rationale and methodology for comparing portfolio performance to a carefully considered and customized after-tax benchmark.

1. Introduction

Investors and their advisors are exhibiting a growing awareness of the role of taxation in portfolio management. However, there are no widely accepted standards for after-tax performance reporting, and we believe that this impedes tax-aware investing and improvements in tax-aware investment strategy.

The effect of taxes on portfolio performance is important (AIMR[1997], Stein[1998], Jacob[1995], Dickson and Shoven[1993], Jeffrey and Arnott[1993]). Taxable investors need to understand the performance of portfolios in the presence of taxes. In concept, performance evaluation is simple: adjust the returns of the portfolio for taxes, identify a suitable after-tax benchmark that is similarly adjusted for taxes, and compare the two. But, in practice, numerous complexities arise.

One such complexity is that portfolios don't pay taxes - taxpayers pay taxes, and often from a different account. Another complexity is that actual tax rates are dependent on a variety of issues unrelated to the portfolio, and the final tax rate is not known in detail until taxes are filed. For these reasons, some industry participants have avoided after-tax reporting and disparaged simplifications as overly rough estimates. But, all performance

measurement requires simplification. For most high net worth investors, an assumed tax rate at the highest marginal rate (sum of federal and state taxes) is a good one. The precise tax rate used is of second order importance compared to other topics we address here.

Other after-tax performance complexities are due to cost basis and cash flow issues. First, when an initial portfolio is transferred to a manager in existing securities rather than in cash, the holdings have a cost basis different from (and often lower than) market value. Second, any ongoing cash flow, either into or out of the portfolio, has tax ramifications. Third, the portfolio may or may not be liquidated at termination, or there may be a step-up in cost basis. This implies the need for a benchmark that is specific to the investor: one size does not fit all.

The Association of Investment Management and Research (AIMR[1997], Price [1997]) has published standards for the calculation of after-tax performance. These have both positive and negative aspects. On the positive side, a central recommendation is that performance be calculated on a *realized basis,* which requires that taxes be incurred on investment income or capital gains at the time of the taxable event. In the case of capital losses, the portfolio is credited with the value of the tax saving. On the other hand, AIMR standards do not consider *unrealized* tax liabilities, thereby over-simplifying portfolio valuation. For comparison with a benchmark, the AIMR approach gives rise to a problem in which a manager's performance may be penalized for incurring capital gains taxes because of client withdrawals.[1] To solve this problem of "non-discretionary capital gains", they recommend that capital gains arising from client withdrawals be deducted from the total capital gains realized over the period.[2]

The AIMR approach has been motivated to a large extent by the question of how an investment manager should report the *composite* returns of a set of client portfolios in a similar strategy. The subject of composite reporting is much harder for taxable portfolios than for tax-exempt because of the need to customize each client's benchmark. In general, the distribution of a manager's after-tax returns will be more diverse than that of

tax-exempt returns. We do not address the subject of composite reporting directly in this paper.

The goal of this paper is to encourage the investment management industry to do a better job at reporting after-tax performance by outlining the elements of what such a report should show and by discussing related issues. Performance numbers should be able to be easily duplicated, verified and explained. While our comments focus mainly on portfolios of equities in separately managed accounts, they apply to other asset classes and commingled vehicles as well.

The reporting approach recommended in this paper has the following salient features:

1. It focuses carefully on the economic value of the portfolio, including any unrealized tax liability. Taxes incurred by the portfolio – both on dividends and capital gains – are paid from the portfolio.
2. The benchmark is unique to the investor, subject to the same cash flows and cost basis as the portfolio. It represents what the investor could relatively easily have achieved passively.
3. Tax rates are simplified. The tax rates are assumed equal to the highest marginal tax rates for the period.

The paper is organized as follows. Section 2 lays out various measures of after-tax return of a portfolio, and explores differences by way of some examples. Section 3 discusses aspects of choosing an appropriate after-tax benchmark. Section 4 details a method for calculating after-tax benchmark returns. Section 5 discusses how to handle complications that normally arise in practice, and Section 6 proposes a set of reports for presenting after-tax performance.

2. After-Tax Return

Portfolio return is the rate of change of value. With no cash flows and with dividends re-invested, the pre-tax return, R_P, of a portfolio is:[3]

$$R_p=(V_1 – V_0)/V_0 \quad (1)$$

where:

- V_0 is the initial value of the portfolio,
- V_1 is the final value of the portfolio.

For the after-tax return, we charge the portfolio at the end of the period for taxes by reducing V_1 by T, the sum of the taxes due on dividends and realized gains:[4]

$$R^t_p = (V_1 – V_0 – T)/V_0 \quad (2)$$

In the pre-tax situation, the definition of portfolio value is unambiguous – V_0 and V_1 in equation (1) refer to market values. However, the after-tax value of a portfolio cannot be defined unambiguously. A number of after-tax measures of portfolio value are possible, and some of these are discussed in Stein[1998]: the *"adjusted market value"* (which does not consider unrealized taxes at all), the *"liquidation value"* (which assumes that all unrealized taxes are paid immediately), and the *"full cost equivalent (FCE) value"*.

The concept of FCE grapples with the issue of evaluating portfolios with unrealized capital gains. The FCE value is defined as that amount of cash[1] which, if invested in the same stocks as the actual portfolio, would have the same final future liquidation value as the portfolio. The FCE value depends, among other parameters, on the investment horizon, the expected capital gains realization rate during the holding period, the marginal tax rates of the investor, and the tax treatment at the end of the horizon (i.e., whether the investor receives a step-up in basis or not). Stein[1998] details the procedure to determine a portfolio's FCE value. He shows that the FCE value can be computed as a simple weighted average of the adjusted market value and liquidation value:

$$V_F= (1-w)V_M+ wV_L \quad (3)$$

[1] Or the value of a full-cost (cost basis equals market value) portfolio

where V_F, V_M and V_L are FCE, market and liquidation values and the weight *w* depends on investor expectations, horizon and portfolio turnover parameters. In the examples in this paper we set the numerical value of *w* to 0.43. This value is suitable for an investor with a 20 year horizon, an expected market return of 10%, and a low-turnover strategy.

At this time there is no industry standard for computing after-tax value, and many manager discussions are in terms of adjusted market value. We recommend that performance reports expose multiple tax aspects of the portfolio, and perhaps show all measures of value. The client can then use whatever is most relevant to his needs.

After-tax performance will vary, depending on the measure of value that is used. As a simple example, consider three managers starting with identical portfolios each with a market value of $100 and a cost basis of $50. Manager 1 liquidates the portfolio immediately and re-invests the proceeds. Manager 2 does not realize any capital gains, but leaves the portfolio passively for the year. Manager 3 realizes losses of $10 by selling some securities at a loss, and re-invests the proceeds. In this example, there are no dividends, and the investor pays taxes from another account. All three managers end the year with $110, i.e. a pre-tax return of 10%. We assume in this and the following examples a tax rate of 20% on capital gains and 40% on dividends, and that any tax losses generated have economic value to the investor. Exhibit 1 lays out the situation.

Assuming that the expected return of all three final portfolios are the same, most would agree that manager 3 has the best after-tax performance, followed by manager 2 and then by manager 1. Let us compare how the three after-tax return measures – based on adjusted market value, liquidation value and FCE – assess the managers.

From equation (2), the *adjusted market value* based after-tax returns are:

Manager 1: $(110 – 100 – 10)/100 = 0\%$

Manager 2: $(110 – 100 – 0)/100 = 10\%$

Manager 3: $(110 – 100 + 2)/100 = 12\%$

By realizing the capital gain, manager 1 has eliminated the pre-tax return of 10%. This is the high cost of turnover for this taxable portfolio. Manager 2 has preserved the pre-tax return, while manager 3 has added value through tax management. Returns based on market value penalize manager 1 too heavily – although he has realized gains of $10, he has increased the cost basis of the portfolio, and future liquidations will be less costly. Similarly, too much credit has been given to manager 3 who has reduced the cost basis of the final portfolio and has made future turnover more costly.

By substituting *liquidation* values in equation (2), we have:

Manager 1:	(108 – 90 – 10)/90	= 8.89%
Manager 2:	(98 – 90 – 0)/90	= 8.89%
Manager 3:	(96 – 90 + 2)/90	= 8.89%

The after-tax return based on liquidation value suggests that all three managers have performed equally well. It assumes that the tax penalty on realized gains is the same as that on unrealized gains, and it gives no credit to a manager who accelerates the realization of losses and defers capital gains.

The *FCE* after-tax return recognizes the realized tax liability (or, credit) as well as the future tax liability on unrealized gains. The FCE after-tax returns are:

Manager 1:	(109.14 – 95.70 – 10)/100	= 3.59%
Manager 2:	(104.84 – 95.70 – 0)/100	= 9.55%
Manager 3:	(103.98 – 95.70 + 2)/100	= 10.74%

It is illustrative to compare FCE after-tax returns to adjusted market value after-tax returns. Manager 1 has a higher FCE return (3.59%) than market value return (0%), reflecting the higher cost basis of the final portfolio. Similarly, manager 3 has a lower FCE return than market value return, because the unrealized capital gain is higher in the final portfolio.

We leave the following questions as an exercise for the reader. Which portfolio manager has done the best job over the period? If we assume that the investment horizon is very long term, what can we say about performance? If the portfolios of managers 2 and 3 are

in addition undiversified and very risky, which is now preferable? Finally, if the portfolios are well diversified and managers 2 and 3 will be able to realize capital gains at a very low rate, which portfolio would you now prefer?

3. Choice of Benchmark

In evaluating portfolio performance, the benchmark is key. We want to think of a benchmark in the same manner in which we think of a portfolio. It is another investment possibility, one to which the manager's performance will be compared. Just as the portfolio's after-tax performance depends on the investor's cash flows and tax rates, so too does that of the benchmark. Benchmark reports should show the same information as that for the portfolio.

Consider as an *ideal* benchmark a simulated passive portfolio with initial cost basis the same as that of the actual portfolio, subject to the same cash flow experience as the actual portfolio, and which invests in the broad capitalization-weighted average of all securities within the investment mandate. For example, if the mandate is a US large capitalization portfolio, the ideal benchmark would be the S&P500 with initial cost basis the same as the actual portfolio, and with the same cash flows as the portfolio.

In the presence of taxes, it is critical to choose an *appropriate* benchmark, but this is more complex than in the absence of taxes. Possibilities other than our ideal might be considered. For a portfolio that starts not from cash but from a pre-existing set of appreciated holdings, one useful benchmark is the "drift portfolio", the unchanged initial portfolio, held into the future. A good manager should provide after-tax value above this starting case. A disadvantage to using the drift portfolio as a benchmark, however, is that it may bear inefficient or undiversified risk. Another benchmark possibility is to compare performance with a live indexed mutual fund with a suitable mandate. While returns and tax information are easily available for indexed mutual funds, after-tax adjustments are not obvious. For example, an investment in a mutual fund generally requires an initial

liquidation with a tax consequence; mutual funds are subject to negative externalities; and as benchmarks, mutual funds cannot be easily customized.[5]

A rationale for the ideal benchmark is illuminated by the following example that frequently arises in private portfolios – a portfolio that begins with unrealized gains. Consider an initial portfolio with a market value of $100 and a cost basis of $50. The investor wants to transfer this portfolio to a manager who will take responsibility moving forward. At a 20% tax rate, the liquidation cost is $10. If the portfolio is comprised of a single risky security, it may be appropriate to realize taxes in order to diversify. On the other hand, if the portfolio is broadly diversified, it may be a mistake to liquidate the holdings. Consider these two cases separately.

Case 1: initial portfolio is well diversified

The manager may liquidate the portfolio and build another, or may maintain the diversified portfolio. If the manager liquidates the entire portfolio, the tax cost of $10 must be charged to performance. At the other extreme, the initial portfolio is held into the future, it may incur performance problems. In this case, measuring and following the "drift portfolio" provides interesting information. Our ideal benchmark, the simulated passive portfolio, works very well. As the manager realizes ongoing capital gains, these taxes will reduce portfolio value as well as after-tax performance.

Case 2: initial portfolio is concentrated

In this case, we must ask whether the decision to liquidate is that of the investor or that of the manager. If it is the investor's decision, the manager has essentially been given a cash flow of $90; after-tax performance evaluation is then reasonably straightforward, and can be measured relative to an after-tax passive alternative. While the drift portfolio may be an interesting comparison for the investor, it is largely irrelevant for evaluating the manager. In this case, the investor should measure manager performance *after initiation*. That is, the investor should separate performance measurement into the two distinct phases: before and after initiation.

On the other hand, if the manager makes the decision to liquidate the portfolio and to invest in another concentrated portfolio, then the drift portfolio is a reasonable comparison, as is a passive portfolio starting from an initial value of $90.

In this example, the portfolio actions taken at initiation are critical. Decisions made at this point can swamp any active performance that the manager might achieve over many years.

4. Calculating after-tax benchmark returns

As an ideal benchmark, we have suggested an indexed portfolio with a mandate similar to and with cash flows identical to those of the portfolio. A computer program can simulate such a benchmark stock-by-stock, and can derive the after-tax returns of a hypothetical manager who re-balances faithfully to the benchmark every period. As an example, Stein[1998] determines the historical after-tax return of an S&P 500 indexed portfolio and explores the effect of the start date on after-tax return. The example shown there applies only to portfolios that start from cash, but it can be generalized. The drawback is that this is a purist's approach, requiring complex computations and a large amount of data that is difficult to maintain.[6] It cannot be easily duplicated or verified. Merely adapting to an individual investor's cash flows or tax rates is not easy.

Here, we propose an approach with data requirements that are much less intense. Let us treat an investment in the benchmark as a single security. Using the actual benchmark turnover level and the particular cash flows of the investor, we apply the method described below to estimate how the cost basis and value of the benchmark investment evolve over time.[7] The computation is relatively simple, and can be done in a spreadsheet. This approach is similar to considering an investment in an index fund, but it is not subject to the problems with mutual fund data discussed above.

Our procedure requires the following information:

- monthly benchmark price and dividend returns
- monthly benchmark turnover or capital gains realization rate (due to index reconstitution and taxable corporate actions)
- cash flow data
- tax rates.

At inception, we set the market value and the cost basis of the benchmark security equal to those of the initial portfolio. For an initial cash inflow, we set the cost basis equal to the market value.

For each period I, define:

r_I - price return
d_I - dividend return
t_d - dividend tax rate
t_g - capital gains tax rate
g_I - rate at which gains are realized
I_I - inflow for the period
O_I - outflow for the period
V_I - market value at the start of the period
C_I - cost basis at the start of the period

Each period, the dividend taxes equal $t_d d_I V_I$; the capital gains taxes from forced turnover equal $g_I[(1+r_I)V_I - C_I]$; and the capital gains taxes resulting from cash withdrawals equal $f_I[(1+r_I)V_I - C_I]$, where $f_I = O_I/[(1+r_I)V_I]$ is the cash outflow as a fraction of the end of period market value before taxes and dividends ($[1+r_I]V_I$). We allow capital losses, and credit the portfolio with the value of the tax saving. Then, at the start of period I+1,

$$V_{I+1} = (1+r_I+d_I)V_I - t_d d_I V_I - t_g g_I [(1+r_I)V_I - C_I] + I_I - O_I \qquad (4)$$

$$C_{I+1} = C_I + (1-t_d)d_I V_I + I_I + (g_I + f_I)(1-t_g)[(1+r_I)V_I - C_I] \qquad (5),$$

The difference equations (4) and (5) provide the cost basis and market value of the portfolio at each stage in time. They can easily be generalized to include different tax rates on short and long-term gains.[8] Exhibit 2 follows a sample benchmark calculation

through time. This calculation is made at the security level rather than at the tax lot level, since we assume that the hypothetical benchmark manager is tax-unaware.

How good is the single stock approximation? We explore this question in the Appendix, and show that it is reasonably close: the average annual difference in after-tax performance is less than -0.01%, with a standard deviation of about 0.37%. We also discuss in the appendix theoretical differences between the two approaches and how to improve the approximation if necessary.

5. Pragmatic Issues in Measuring After-Tax Portfolio Returns

Cash flows

Methods for measuring pre-tax returns in the presence of cash contributions and withdrawals are described in standard finance texts, e.g. Bodie, Kane and Marcus [1996].[9] When there are significant intra-period cash flows, performance can be obtained either by: (1) adjusting the beginning market value to match the previously-calculated pre-tax return; (2) utilizing the modified Dietz method; or (3) revaluing the portfolio mid period and linking the returns geometrically.

After-tax returns can, in theory, be calculated similarly to pre-tax returns. However, these calculations may be difficult in practice because they require the market value, cost basis and other information at each date that a cash flow occurs.

To simplify the after-tax return calculation, we propose that the after-tax return be calculated from the pre-tax return as follows:

a) Calculate the "effective initial portfolio value" by discounting the final portfolio value at a rate equal to the pre-tax return R_P. The effective initial value represents the investment that would have grown to the final portfolio in the absence of interim cash flows.
b) Subtract realized taxes from the final portfolio value.
c) Calculate after-tax returns using the final value from (b) and the initial value from (a).

It is easy to show that the after-tax return calculated using this procedure is equivalent to

$$R^t_p = (1 + R_p)(1-T/ V_1) - 1 = R_p - [(1+ R_p)T]/ V_1 \quad (6)$$

Note that the after-tax return as calculated here does not fully control for interim cash flows. The tax liability will be higher if a large withdrawal of low basis holdings occurs, and this will lead to a lower value for the after-tax return. Note, however, that the benchmark suffers from the same issue, and the *relative* return is still meaningful.

In-Kind Transfers at Account Initiation

If the portfolio is transferred in kind, the unrealized capital gains and losses embedded in the initial portfolio will affect the after-tax portfolio returns of an active manager. As in the case of cash withdrawals, it is easier to adjust for the unrealized gains and losses in the *benchmark* than to adjust the realized taxes in the after-tax *portfolio* return calculation. To do this, merely set the cost basis and the market value of the benchmark equal to that of the portfolio. Once the initial benchmark is put in place, the benchmark can evolve according to its own return.

Step-up in cost basis

A special case exists when assets are bequeathed to heirs, who receive a cost basis that is stepped up to market value (i.e. there is a decrease in the unrealized gain at no tax cost). A manager who is not sensitive to this gift from the IRS has destroyed value. If the investor is aging or ill, a manager's decision to realize substantial taxes is poor. In this case, a useful benchmark is the drift portfolio, and a useful after-tax return measure is that based on adjusted market value.

Consider an example. At Jan 1st 1998, we have a portfolio with market value of $100 and a cost basis of $50. Suppose that the market increases by 10% (pre-tax) during the year, and that the investor expects to receive a step-up in cost basis on Dec 31st 1998. Exhibit 3

shows the valuation and return calculations for two possible strategies at the start of 1998: (1) retaining the drift portfolio and (2) liquidating the initial portfolio and reinvesting the proceeds in a passive indexed portfolio. Clearly, retaining the drift portfolio dominates the strategy of rebalancing the portfolio, regardless of the after-tax return measure used. Thus, the appropriate benchmark to be used in this case is the drift portfolio. If the client liquidates the drift portfolio immediately after the step-up in basis, the portfolio will return 10% on an after-tax basis, which exactly equals the adjusted market value return, or the FCE return with w close to zero.[10] The return based on liquidation value does not accurately measure the after-tax return. Neither does the FCE return with w=.43, which that the drift portfolio is liquidated after 20 years.

6. After-Tax Reporting

Exhibit 4 shows a comprehensive set of monthly after-tax reports that we have in mind. In this example, the portfolio and the benchmark have the same initial value of $100, initial cost basis of $50, and initial distribution of capital gains and losses. For both the portfolio and the benchmark, the pre-tax price return for the month is 1% and the pre-tax dividend return is 0.25%. The *Portfolio Monthly Accounting Report* shows the initial and final valuation figures for the portfolio and the benchmark.

The *Monthly Income and Return Statement* shows that the portfolio realized $2.50 in losses during the period. The benchmark sold (turned over) 1% of it value due to reconstitution of the index. A tax-unaware manager with the mandate to replicate the index would have realized a capital gain of $0.51 (1% of the portfolio's unrealized gains after the price appreciation). The estimated taxes are the sum of taxes paid on dividends and capital gains. In this example, the portfolio generated a tax credit of $0.40 while the benchmark incurred a tax cost of $0.20. Accordingly, the adjusted market value return and FCE return are higher for the portfolio than for the benchmark. The liquidation value returns are identical for the portfolio and the benchmark: this measure does not give credit for accelerating the realization of losses or for deferring the realization of gains.

Finally, the *Performance Report* summarizes the cumulative returns – both pre-tax and after-tax – for longer-term holding periods. Although we show the FCE returns here, we encourage the reporting of the adjusted market value returns and the liquidation value returns as well. In this particular example, tax management resulted in a higher monthly after-tax return for the portfolio than for the benchmark.

7. Conclusion

We have outlined pragmatic issues associated with reporting performance after taxes. We have addressed the issue of accounting for tax consequences that are beyond a manager's control by arguing for a customized benchmark that is tailored to the investor's initial market value and cost basis, and that incurs the same cash flows and tax rates as the portfolio. Issues at portfolio initiation and termination are critical and are integral to ongoing portfolio management. We have made recommendations on how to report after-tax performance for a portfolio and its benchmark. The performance report should show portfolio value, absolute and relative performance, as well as data on capital gains, losses and any tax issues. In computing after-tax values and return, all assumptions should be explicit. We have shown how to compute after-tax benchmark returns by using portfolio cash flow data, simplified turnover assumptions and pre-tax price and dividend return information.

Appendix. A Simple Approximation for After-Tax Benchmark Returns

Stein[1998] computes after-tax returns by adopting a detailed stock by stock simulation. In this paper we have proposed that benchmark after-tax returns be more simply obtained using a single security approximation, with turnover and price and dividend returns obtained from the pre-tax benchmark.

In this appendix, we study this approximation and show that it is a good one. On average, the approximate return estimates differ from those of the detailed simulation by only small amounts. This allows us to greatly reduce the complexity of the data and of the after-tax benchmark computation.

Exhibit A1 shows after-tax returns for portfolios starting in each year from 1985 to 1986. For this, a computer model has simulated the actions of a manager who ignores taxes and faithfully re-balances to the benchmark every month. It uses historical data (prices, dividends and weights of the S&P 500) over the period. Since the inception date of a portfolio affects its cost basis, the after-tax return in a given period differs for two portfolios that have different inception dates. To explore this, a new portfolio is started every year, and purchased precisely to the index.

Exhibit A2 treats the benchmark as a single security. Its monthly pre-tax price and dividend returns are calculated as the weighted average pre-tax price and dividend returns of the benchmark respectively. The monthly turnover is set equal to the turnover experienced by the indexed portfolio. The cost basis and value are calculated using difference equations (4) and (5).

Exhibit A3 shows the difference between the after-tax returns obtained from the single-security and stock-by-stock simulations. Each column represents a portfolio invested at a particular date. For example, the last entry in the first column shows the return differences for a “vintage 1985” portfolio, one that started in 1985. The difference is below 1% in each year, and the tracking error (standard deviation of differences) is about .37% per year.

The tax on dividends is, by construction, equal in the two methods. Differences in after-tax returns come from realized capital gains. The detailed stock-by-stock method keeps track of the actual capital gains realized when securities are sold, while the single stock approximation assumes that capital gains are realized in proportion to the gains in the portfolio.

When a stock leaves the index because of a corporate takeover, its stock price is likely to have appreciated. The detailed simulation will recognize higher capital gains, and consequently, a lower after-tax return than will the single stock approximation. When a stock leaves the index after a period of bad performance, this effect is reversed. The empirical results are consistent with these predictions. Over the first half of the sample period (1985 to 1990), when the incidence of takeover activity was high, the average yearly differential was about 38 basis points. Over the period 1991-1996, when takeover activity was not very intense and more stocks left the index because of weak price performance, the average difference was –14 basis points. per year.

To improve the estimate of after-tax returns in prospective calculations, one might use information on takeover activity by either adjusting the returns directly or adjusting the turnover rate. For example, when the incidence of takeover activity is low, increase the annual after-tax return estimate or decrease the turnover rate. When takeover activity is high, decrease the return estimate or increase the turnover rate.

Endnotes

[1]

[2] This is not always easy to do. It requires that the portfolio manager segregate the tax consequences generated by his active strategy from those generated by client withdrawals and benchmark turnover. A security may, for example, be sold partly because its index weight becomes smaller and partly because the manager loses confidence in its future performance. The portfolio manager may not be able to isolate discretionary from non-discretionary tax consequences. We propose instead a more careful and customized benchmark approach in which both the *portfolio* and the *benchmark* are adjusted for taxes resulting from client-driven withdrawals. Any tax-efficient skill the manager can exhibit while accommodating the withdrawal will then be reflected as superior after-tax performance of the portfolio relative to the benchmark.

[3] The pretax return R_p may alternatively be defined as $(G + D)/V_0$, where G is the gain during the period -- the net realized gain plus the increase in unrealized gain. AIMR uses this definition. Although the two definitions are equivalent, our framework extends itself more easily to defining after-tax returns.

[4] Even though taxes may be paid at a later date, the liability is accrued during the period.

[5] The actions of one investor affect the returns of other investors.

[6] Minck[1998] explores this topic in a similar fashion, with particular focus on the tax treatment of corporate actions.

[7] While we use the term "turnover" here, this is more correctly the capital gains realization rate (realized gains / average unrealized gains). A further simplification can be made, if necessary, by applying an *approximate* constant annual turnover rate to the benchmark rather than the actual realized turnover rate.

[8] If the distinction between long term and short term lots is to be maintained, there can be as many as 13 lots (12 short term and 1 long term). In this case, it is necessary to track the purchase month of each short term lot separately. Once it becomes long term, it can be merged into the existing long term lot.

[9] A common pre-tax measure is the time-weighted return (TWR). Portfolio value may be measured by the market value, liquidation value or full cost equivalent, as appropriate. The TWR is obtained by calculating periodic (e.g. daily) returns and linking them geometrically. It gives equal weighting to the return each period, without regard to the portfolio value. This measure is useful for comparing the pre-tax performance of portfolio managers because it does not weight

returns by the amount of money invested. While TWR is a good gauge to compare manager performance, the dollar-weighted return (also called internal rate of return) may be more relevant to the investor because it measures the actual growth rate of the investor's portfolio. In our discussion, either measure of pre-tax return may be used.

[10] In this example, values are prior to the payment of estate taxes. Estate taxes can be very high, and are properly considered as part of portfolio management as well. A detailed discussion of estate taxes is beyond the scope of this paper.

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Exhibit 1

Comparison of after-tax returns for three managers

This table compares the after-tax performance of three managers using three different after-tax return measures – the adjusted market value return, the liquidation value return and the full-cost equivalent return. Manager 1 liquidates the initial portfolio and re-invests the proceeds for one year, manager 2 holds the initial portfolio for one year, and manager 3 harvests $10 of losses. Each portfolio returns 10% over one year (with no dividends), and the capital gains tax rate is 20%.

Numbers in italics are inputs to the calculation, while other numbers are calculated fields.

	Manager 1	Manager 2	Manager 3
Initial market value	***100.00***	***100.00***	***100.00***
Initial cost basis	***50.00***	***50.00***	***50.00***
Initial liquidation value	90.00	90.00	90.00
Full Cost Equivalent (FCE)[a]	95.70	95.70	95.70
Investor taxes	***-10.00***	***0.00***	***2.00***
Effective flows	10.00	0.00	-2.00
Final market value	110.00	110.00	110.00
Final cost basis	100.00	50.00	40.00
Final liquidation value	108.00	98.00	96.00
Final FCE[a]	109.14	104.84	103.98
Adjusted market value return	0.00%	10.00%	12.00%
Liquidation value return	8.89%	8.89%	8.89%
FCE return	3.59%	9.55%	10.74%

[a] The FCE is calculated as a weighted average of the liquidation and market values, with the weight on liquidation value being 0.43 (for more details, please see equation 3 and the discussion surrounding it), and the weight on the market value being 0.57.

Exhibit 2

Computation of benchmark values

This table presents multi-period benchmark computations that can readily be performed in a spreadsheet. It makes the following assumptions:

Price return	7.00%
Dividend return	3.00%
Turnover	5.00%
Dividend tax rate	40.00%
Capital gain tax rate	20.00%

The inflows and outflows are positive numbers for the first two months and zero subsequently.
Numbers in italics are inputs to the calculation, while other numbers are calculated fields.

	Period 0	Period 1	Period 2	Period 3	…	Period 20
Starting market value		100.00	113.66	113.29		450.23
Starting cost basis		100.00	107.34	115.90		251.12
Ending market value, before taxes, divs		107.00	121.62	121.22		481.75
Dividends		3.00	3.41	3.40		13.51
Unrealized gains		7.00	14.28	5.32		230.63
Cash inflows (end of period)	***100.00***	***10.00***	***15.00***	***0.00***		***0.00***
Cash outflows (end of period)		***5.00***	***10.00***	***0.00***		***0.00***
Turnover ($)		5.35	6.08	6.06		24.09
Gains realized from turnover[a]		0.35	0.71	0.27		11.53
Gains realized from outflows[b]		0.33	1.17	0.00		0.00
Total gains realized		0.68	1.89	0.27		11.53
Capital gains taxes paid		0.14	0.38	0.05		2.31
Dividends taxes paid		1.20	1.36	1.36		5.40
Total Taxes paid		1.34	1.74	1.41		7.71
Ending market value[c]		107.34	115.90	118.15		268.45
Ending cost basis[d]	100.00	113.66	113.29	123.21		487.55

[a] Computed as (Turnover rate * Unrealized gains) = 0.05 * 7.00

[b] Computed as (Cash outflows) / (Ending market value before taxes, divs) * (unrealized gains) = 10.00 / 107.00 * 7.00

[c] Ending market value may be calculated from equation (4), or as follows using period 1 values:

	Ending market value before divs, taxes	107.00
Add	Dividends	3.00
Add	Cash inflows	10.00
Less	Cash outflows	5.00
Less	Taxes	1.34
	Ending market value	113.66

[d] Ending cost basis may be calculated from equation (5), or as follows using period 1 values:

	Starting cost basis	100.00
Less	Reduction in cost basis due to turnover related sales	5.00
Add	Amount bought back in new securities (turnover)	5.35
Less	Reduction in cost basis due to cash outflows	4.67
Add	Cash inflows	10.00
Add	Dividends	3.00
Less	Taxes	1.34
	Ending cost basis	107.34

Exhibit 3

After-tax returns: step-up in cost basis at liquidation

This table compares the after-tax performance of two trading strategies for an investor whose heirs will receive a step-up in basis one year from now. The first strategy assumes that the portfolio is passively held for a year, while the second strategy assumes that the initial portfolio is liquidated immediately (January 1, 1998) and the proceeds reinvested for one year. In the computations, we assume that the portfolio returns 10% over one year (while paying no dividends), and that the capital gains tax rate is 20%.

Numbers in italics are inputs to the calculation, while other numbers are calculated fields.

	Drift portfolio	Manager realizes all taxes Jan 1st 1998
Initial market value	***100.00***	***100.00***
Initial cost basis	***50.00***	***50.00***
Initial liquidation value	90.00	90.00
Full Cost Equivalent (FCE)[a]	95.70	95.70
Investor taxes	***0.00***	***-10.00***
Effective flows	0.00	10.00
Final market value	110.00	110.00
Final cost basis	50.00	100.00
Final liquidation value	98.00	108.00
Final FCE [a]	104.84	109.14
Adjusted market value return	10.00%	0.00%
Liquidation value return	8.89%	8.89%
FCE return	9.55%	3.59%

[a] The FCE is calculated here as a weighted average of the liquidation and market values, with weights of 0.43 and 0.57 on liquidation and market values respectively.

Exhibit 4

After-tax reports

This exhibit shows performance figures of a hypothetical portfolio and its benchmark, each having a pre-tax price return of 1% and a dividend return of 0.25% for the month. In this example, the portfolio realizes $2.50 of losses during the period, and the benchmark turnover is 1%. The capital gains tax rate is assumed to be 20% regardless of the holding period, and the dividend tax rate is assumed to be 40%.

Portfolio monthly accounting report

	Portfolio			Benchmark	
	1/1/99	2/1/99		1/1/99	2/1/99
Market value	100.00	101.00		100.00	101.00
Cost basis	50.00	47.50		50.00	50.51
Liquidation value	90.00	90.30		90.00	90.90
Full-Cost-Equivalent value	95.70	96.40		95.70	96.66
Unrealized gains					
Short	27.50	28.02		27.50	27.62
Long	25.00	25.48		25.00	25.12
Unrealized losses					
Short	1.50	0.00		1.50	1.38
Long	1.00	0.00		1.00	0.88

Monthly income and return statement

	Portfolio		Benchmark
Dividend income, pre-tax	0.25		0.25
Net realized gain	-2.50		0.51
Increase in unrealized gain	3.50		9.40
Taxes (est.)	-0.40		0.20
Cash inflows	0.00		0.00
Cash outflows	0.00		0.00
Pre-tax return (est.)	1.25%		1.25%
Adjusted market value after-tax return (est.)	1.65%		1.05%
Liquidation value after-tax return (est.)	1.06%		1.05%
FCE after-tax return (est.)	1.41%		1.05%

Performance report[a]

	Portfolio returns			Benchmark returns	
	Pre-tax	After-tax (FCE)[b]		Pre-tax	After-tax (FCE)[b]
Month	1.25%	1.41%		1.25%	1.05%
Quarter	3.10%	3.34%		3.50%	3.40%
Year-to-date	4.04%	4.50%		5.08%	4.76%
Since inception	5.75%	6.80%		5.50%	5.25%

[a] Returns shown here are for the holding period, and are not annualized

[b] We have elected to show the FCE returns here purely for illustrative purposes. The manager may elect to show the FCE return or the adjusted market value return as well.

Exhibit A1

After tax adjusted market value returns (%) estimated by the stock-by-stock simulation

	Pre-tax Return	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1985	32.16	28.79											
1986	18.47	16.01	16.31										
1987	5.23	3.19	3.30	3.71									
1988	16.81	14.06	14.20	14.69	15.07								
1989	31.49	28.58	28.68	29.04	29.46	29.83							
1990	-3.17	-5.01	-4.97	-4.59	-4.25	-4.23	-4.10						
1991	30.55	28.20	28.25	28.73	29.19	29.21	29.31	29.12					
1992	7.67	5.87	5.90	6.24	6.57	6.59	6.67	6.52	6.66				
1993	9.99	8.12	8.19	8.44	8.78	8.84	8.96	8.79	8.94	8.71			
1994	1.32	-0.56	-0.50	-0.26	0.05	0.12	0.29	0.15	0.39	0.11	0.15		
1995	37.59	35.01	35.10	35.27	35.69	35.70	35.89	35.64	35.89	35.64	35.74	35.72	
1996	22.96	20.48	20.56	20.51	20.82	20.89	21.08	20.84	21.09	20.93	21.06	21.05	21.61

Each column shows the annual after-tax adjusted market value returns, as estimated by the stock-by-stock simulation, of an S&P 500 indexed portfolio invested on January 1 of that year.

Exhibit A2

After tax adjusted market value returns (%) estimated by the single stock approximation

	Pre-tax Return	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1985	32.16	28.90											
1986	18.47	16.06	16.35										
1987	5.23	3.39	3.59	3.74									
1988	16.81	14.93	15.19	15.39	15.40								
1989	31.49	29.42	29.63	29.80	29.81	29.99							
1990	-3.17	-4.41	-4.35	-4.30	-4.30	-4.24	-4.09						
1991	30.55	28.69	28.78	28.84	28.85	28.92	29.13	29.06					
1992	7.67	6.23	6.29	6.33	6.34	6.39	6.53	6.49	6.67				
1993	9.99	8.19	8.26	8.32	8.32	8.38	8.55	8.49	8.71	8.76			
1994	1.32	-0.53	-0.45	-0.39	-0.39	-0.31	-0.12	-0.19	0.06	0.12	0.22		
1995	37.59	34.86	34.97	35.04	35.05	35.14	35.37	35.30	35.60	35.67	35.79	35.76	
1996	22.96	20.18	20.27	20.34	20.34	20.42	20.63	20.56	20.83	20.89	20.99	20.97	21.56

Each column shows the annual after-tax adjusted market value returns, as estimated by the single stock approximation, of an S&P 500 indexed portfolio invested on January 1 of that year.

Exhibit A3

Difference in returns (%)

Single stock approximation minus stock-by-stock simulation

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
1985	0.11											
1986	0.05	0.04										
1987	0.20	0.29	0.03									
1988	0.87	0.99	0.70	0.33								
1989	0.84	0.95	0.76	0.35	0.16							
1990	0.60	0.62	0.29	-0.05	-0.01	0.01						
1991	0.49	0.53	0.11	-0.34	-0.29	-0.18	-0.06					
1992	0.36	0.39	0.09	-0.23	-0.20	-0.14	-0.03	0.01				
1993	0.07	0.07	-0.12	-0.46	-0.46	-0.41	-0.30	-0.23	0.05			
1994	0.03	0.05	-0.13	-0.44	-0.43	-0.41	-0.34	-0.33	0.01	0.07		
1995	-0.15	-0.13	-0.23	-0.64	-0.56	-0.52	-0.34	-0.29	0.03	0.05	0.04	
1996	-0.30	-0.29	-0.17	-0.48	-0.47	-0.45	-0.28	-0.26	-0.04	-0.07	-0.08	-0.05

Mean: -.01% per year

Tracking Error: .37% per year