

# Parametric Portfolio Associates

## Research Brief

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### **Enhanced Tax Rate Management: Expanding Loss Harvesting to Offset Short-Term Capital Gains**

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In actively managing taxes, value accrues in numerous ways. First, there is value from deferring the realization of capital gains, which can be thought of as receiving a free loan from the IRS. Second, there is value from realizing capital losses, derived from exploiting a tax option. Third, value can be added by anticipating tax rate changes. There is an interplay among these, and there are times when we may want to give up on tax deferral in order to expand loss harvesting. At the present time (2005), for example, it may be argued that the value of tax deferral is low: tax rates on long-term capital gains are lower than they have been in over 60 years, and some investors have only modest expectations for appreciation in the stock markets. In addition, the difference between long-term and short-term tax rates is high. For investors who expect to incur large short-term capital gains (as are frequently distributed by hedge funds, for example), additional short-term losses are particularly valuable, and it may be worth realizing a long-term capital gain in order to re-set cost basis and expand short-term loss harvesting opportunities. We refer to this as *Enhanced Tax Rate Management (ETRM)*.

The main topics discussed here relate to estimating the size of the benefits and costs of ETRM, in which the tax-averse investor pays more taxes at an early stage in order to reduce anticipated taxes at a later stage. The main benefits are additional short-term capital losses generated over time. A secondary benefit comes from increasing the average basis of the portfolio and delaying portfolio lock-up or freeze. The costs are the earlier taxation of long-term capital gains and trading expenses. There are some additional tax risks: if the anticipated need for losses does not develop, if markets are such that short-term losses are difficult to harvest, or if tax rates decline in the future, performance benefits will be lower.

Here is a very rough way of thinking about this topic, without including tax-deferral. Suppose we invest an initial \$100 in a market that has a 6% price appreciation. As with a PPA Tax Managed Core Portfolio, we can expect to realize about \$13 of short-term capital losses in the first year, providing a benefit at a 35% tax rate of  $\$13 \times .35 = \$4.60$ . At the end of the year, the cost basis is then \$87 and market value is \$106. At this point, if we realize all gains at the long-term rate of

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15%, the tax cost is  $\$19 \times .15 = \$2.85$ . The net tax benefit is  $\$1.75$  or 1.75% of starting value, and we are ready to repeat the exercise.

We explore here the value that ETRM adds when the investor has a large appetite for short-term capital losses, and compare it to the value added by a Tax Managed Core (TMC) portfolio. Our analysis is based on Monte-Carlo simulations using our SQUAD portfolio simulator<sup>1</sup> and seeks to model the behavior of portfolios over time under different investment management strategies and in different market environments. In what follows, we model a starting \$100 investment with no subsequent cash flows, and we measure a variety of statistics on the evolving portfolio over time. We explore a relatively simple portfolio management strategy in which we select the aggressiveness of tax management: we realize all losses and those long-term capital gains that are not “too big” at each rebalancing period. Short-term capital gains are not realized.

In each case, the portfolio is subject to risk controls. To ensure that the portfolio closely tracks its target, we realize losses only if we can keep the security holding to within 50bp of its target index weight. When a tax lot of a security is held at a loss, we realize this loss up to the 50bp limit, and do not re-purchase the security for at least 31 days. When a long-term gain is realized, we are able to re-purchase the security immediately as this does not violate a wash-sale rule.

We assume an S&P500-like universe of stocks, and tax rates of 15% on long-term capital gains and dividends, and 35% on short-term capital gains. In these simulations, taxes incurred are not removed from the portfolio value – that is, the dollar value of tax costs and benefits accrue outside the portfolio – but we do measure their impact on after-tax performance.

The main parameters are:

- market price and dividend return
- investment horizon.
- aggressiveness of realization of capital gains
- frequency of trading
- cost of trading
- initial cost basis of the portfolio

Please note that our simulations are only rough approximations, and are intended to describe and explore the opportunity. In practice, additional issues occur that both add to and detract from performance.

The first set of simulations in **Table 1** depicts the “base case” of a Parametric Tax Managed Core portfolio rebalanced at a two-month frequency, where we actively realize capital losses while avoiding the realization of gains. (There is a slight cash drag in these simulations that would not exist in actual portfolios.) The columns show what can be expected in different market-return environments – total return environments of 0%, 4% and 8% respectively with a dividend yield of 2% in each case. In the 8% market environment, we observe:

- The tax alpha<sup>2</sup> averages 1.53% per year for 10 years; it starts more strongly and declines to 0.4% in year 10.

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<sup>1</sup> Please see the following Parametric Portfolio Associates White Papers:

- *Simulating Loss Harvesting Opportunities Over Time*, 2003 (this provides detail on interpreting the simulations and tables).
- *SQUAD Portfolio Simulator*, 2002 (this provides detail on the simulator and its assumptions).

<sup>2</sup> We define Tax Alpha as the difference between non-liquidated after-tax excess return and pre-tax excess return. It is a measure of tax-management value, after adjusting for pre-tax differences. The non-liquidation return does not measure *unrealized* gain.

- The cost basis drops over time as an unrealized gain builds up; by year 10 the basis has declined to about 47% of market value.
- Turnover is high at the start and drops substantially.

The second set of simulations in **Table 2** shows an ETRM-managed portfolio in which all losses up to 50bp underweight and all gains are realized each period. On average over 10 years, in a flat market the value of loss harvesting increases from TMC's 2% to 3% per year; in an 8% environment, the value of loss harvesting increases from 1.5% to 2% per year.

For the 8% environment, we observe:

- Tax alpha (non-liquidation) starts strongly, as in Table 1, and drops in year 2 when we start to realize long-term gains. It then increases, stabilizing at about 1.5% in year 10.
- Even though this average is only .33% higher than Case 1 over the 10-year period, it can be sustained over time. Capital gain realization increases.
- The cost basis, after dropping in year 1 when only losses are realized, rises to about 90% and remains there. If we compare “liquidation return”<sup>3</sup>, we see a substantial improvement relative to Case 1.
- Turnover is high throughout the period.
- On the face of it, risk management in Case 2 is easier than in Case 1. Securities sold at a gain can be immediately re-purchased; cash received can be used to rebalance the portfolio and reduce portfolio risks. On the other hand, there is a benefit to deviate from target benchmark in order to take advantage of the increased loss harvesting opportunity.

In weaker market environments, the benefit of ETRM increases. A number of issues are at play here: as with all tax management, the amount of capital losses – and so the value of the tax option – increases; when we do realize a capital gain, the average tax paid is lower; and the value foregone by not deferring an unrealized gain is also lower.

**Table 3** shows a less aggressive implementation of ETRM in which we realize gains on those lots which have cost basis/market value (Cost/Val) more than 60%<sup>4</sup>. The benefits derived are lower but turnover is lower too.

### Variations on the simulations

#### *Transaction costs and portfolio turnover*

Because turnover increases, a key issue here is that of the cost of transactions. As we increase the realization of gains, turnover increases. The same happens as we increase the frequency of portfolio re-balancing. Certainly, we can also reduce the effect of transactions by trading only when losses are large enough and when gains are not too large. Our simulations provide a rough approximation, and with a little more thought we are able to do substantially better in reducing transactions costs in a real implementation. Please contact us for simulations in which we model a non-zero transactions cost and further explore strategies of loss harvesting and rebalancing.

#### *The investor horizon and long-term performance*

Investors with a long-term focus derive substantial benefit from the deferral of taxes. For them, the long-term portfolio becomes more-and-more “locked up” or frozen over time, not necessarily a bad thing. They are perhaps most interested in the pre-liquidation return of the portfolio. On the

<sup>3</sup> *Liquidation Return*, is a measure of after-tax performance if the portfolio is liquidated. It is the rate of change of the “liquidation value” of the portfolio.

<sup>4</sup> For example, if a security was purchased for \$100, we realize the gain if the security value is under \$167, but not if the value is above \$167.

other hand, investors with a shorter horizon do not derive as much benefit from the tax deferral; they may be more interested in the liquidation-return of the portfolio.

The annualized value that accrues to ETRM depends on the investment horizon and whether one focuses on the pre-liquidation or liquidation-return. Importantly, note that tax-management benefits can be sustained over time.

**Table 4** displays the long-term behavior of ETRM: simulations are run for 25 years, with 6 rebalances/year in an 8% return environment, no transactions costs. A summary comparison of long-and short-term behavior of ETRM is shown in **Table 5**.<sup>5</sup>

#### *Other issues*

Net capital gain realization increases with ETRM. Without ETRM, the investor can carry unused losses forward to the next year. Now there is a possibility, depending on the investor's tax situation, that the short-term losses will be used instead to offset a long-term gain. In this case, the value added by ETRM will be reduced.

In general, it may be necessary to selectively time the realization of capital gains and losses to take advantage of their true potential. If we expect to realize long-term gains in the coming period, it may be necessary to delay the realization of short-term losses and ensure that they will not be used to offset long-term gains.

So, ETRM requires both careful planning and careful portfolio implementation.

#### **Starting from an existing portfolio: the value of a single rebalance – An Example**

The simulations shown assume that the investor starts with a \$100 cash investment at the start of the investment period. Investors with a starting portfolio with a lower basis have a higher hurdle – their initial tax costs are higher and it will take longer to recoup this cost through the management of capital losses. It is necessary to customize this analysis and address also the value of a single rebalance, given a particular set of tax lots and cost basis. Here is a specific example, based on a real portfolio.

The initial portfolio has the following characteristics:

Market Value	\$1,901,379		
Cost Basis	\$1,412,716		
<i>Unrealized:</i>		<i>Gains LT</i>	\$ 489,675
		<i>Gains ST</i>	\$ 16,153
		<i>Losses LT</i>	\$ 16,641
		<i>Losses ST</i>	\$ 524

Suppose we rebalance the portfolio, realizing all gains for which the initial cost basis/market value (Cost/Val) exceeds 70%. Turnover will be about 48% and we will realize \$181,000 in capital gains.

To determine the benefits and costs we estimate the present value of future loss harvesting. In fact, we estimate the present value of future opportunities for loss realization on the identified lots

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<sup>5</sup> In Table 5 we have adjusted the benchmark return to remove simulation noise and cash drag, and have adjusted portfolio performance similarly using the tax alpha of the simulations.

minus the present value of taxes due at liquidation. That is, our estimate includes the value of the future liquidation tax and tax deferral. Appendix 1 describes our approach in more detail.

In this example, we assume the following parameters

<i>Horizon:</i>	<i>20 years</i>
<i>Transactions cost:</i>	<i>0.5%</i>
<i>Discount rate:</i>	<i>4.0%</i>
<i>Tax rates (LT,ST)</i>	<i>17.55%, 36.95%</i>

<b>Realize Gains on tax lots for which Cost/Val Exceeds:</b>	<b>70%</b>
Market Value of Tax Lots Sold	\$907,225
Gains Realized	\$181,523
Turnover	48%
<b>Benefits</b>	
Expected PV of Loss Harvesting on lots sold *	\$95,534
<b>Costs</b>	
Expected PV of Loss Harvesting if trade is not done *	\$46,370
Current Taxes	\$31,857
Transactions Cost	\$4,536
<b>Expected Net Benefit</b>	<b>\$12,770</b>
	(.67%)

And, we can generalize by being more (or less) aggressive with respect to gain realization:

<b>Realize Gains on tax lots for which Cost/Val Exceeds:</b>	<b>90%</b>	<b>80%</b>	<b>70%</b>	<b>50%</b>	<b>0%</b>
Market Value of Tax Lots Sold	\$104,844	\$383,972	\$907,225	\$1,530,253	\$1,646,723
Gains Realized	\$4,777	\$48,562	\$181,523	\$419,023	\$489,675
Turnover	6%	20%	48%	81%	87%
<b>Benefits</b>					
Expected PV of Loss Harvesting on lots sold *	\$12,218	\$42,475	\$95,534	\$153,406	\$162,815
<b>Costs</b>					
Expected PV of Loss Harvesting if trade is not done *	\$9,733	\$27,135	\$46,370	\$50,358	\$45,975
Current Taxes	\$838	\$8,523	\$31,857	\$73,539	\$85,938
Transactions Cost	\$524	\$1,920	\$4,536	\$7,651	\$8,234
<b>Expected Net Benefit</b>	<b>\$1,123</b>	<b>\$4,898</b>	<b>\$12,770</b>	<b>\$21,857</b>	<b>\$22,668</b>
	0.06%	0.26%	0.67%	1.15%	1.19%

Of course, the costs and benefits of an ETRM re-balance will differ for each investor, and depend on his starting holdings.

## **Conclusion**

ETRM is suitable for investors who expect to realize large short-term capital gains each year. They can add after-tax value by realizing long-term capital gains early. This tax expenditure boosts the cost basis and buys the option value of a short-term loss. Transaction costs reduce the value added.

When the investor expects to need short-term capital losses, he should be willing to incur an up-front tax in order to derive a future benefit. The amount of the capital loss in the future is uncertain, and depends on market movements, the nature of the portfolio, the size of the capital gains in the portfolio and its risks. Their value will depend on transactions costs, and the investor's investment horizon. It will also depend on the tax rate that the investor expects to pay in the future. It is necessary to plan and budget for this tax-management. Done badly, ETRM will increase turnover and realize gains at a higher rate than Tax Managed Core. With appropriate tax-budgeting over time, the high penalty of short-term capital gains can be reduced.

With Enhanced Tax Rate Management, portfolio implementation is key, and is more complex than that of Tax Managed Core portfolio management.

## Appendix 1: Estimating the costs and benefits of a single ETRM rebalance.

We want to estimate the value of a single ETRM rebalance. A given set of tax lots with long-term capital gain is to be sold, the capital gain is to be realized, and we have expectations of future loss realization. What are the costs and benefits of this transaction?

Let's look at a simple example. Consider a single tax lot with value \$100 and cost basis \$90. We assume a liquidation horizon of 20 years, and assume that the market return is 8%. We will sum the present value of the costs and benefits, assuming a discount rate of 4% and tax rates of 15% on long-term capital gains, 35% on short term.

For this tax lot, its cost/market determines its future harvesting value in each of the two cases, if sold and if not sold. Our Monte Carlo simulation analysis as outlined in Table 1 (with a market return of 8%), provides the amount of short-term and long-term losses that we can expect to realize over time for each \$100 invested in cash. A similar analysis, provides short and long-term losses that we can expect to realize starting with a security that has an initial cost/market ratio of .9 (at long-term holding). Data from these tables is used in generating the cost/benefit analysis for this example security, shown in the following table.

### If we hold the security

Liquidation in 20 years:	
PV of future taxes (15% of \$10 gain, to be paid in 20 years)	(\$0.68)
Future Harvesting Value:	
PV of tax benefit of losses <sup>6</sup>	\$8.33
PV of additional LT gain generated by these losses	(\$1.17)
	<u>\$6.48</u>

### If we sell the security

Future Harvesting Value:	
PV of tax benefit of losses	\$11.59
PV of additional LT gain generated by these losses	(\$1.78)
Transactions cost at .5%	(\$0.50)
Immediate taxes, a5% of \$10 gain	(\$1.50)
	<u>\$7.81</u>

### Net benefit

\$1.33

For a portfolio, we sum the costs and benefits for each tax lot sold.

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<sup>6</sup> Expected future losses, both long-term and short-term, are determined by Monte Carlo simulation. These also generate additional gains that need to be liquidated in year 20.

**Table 1: Base case: Realize no gains actively**

S&P500-like environment, Turnover 4% per year

Rebalance frequency: 6/year

Trading cost: 0

Tax Rates: 15%, 35%

Dividends: 2% per year

<b>Total Return</b>		<b>0%</b>	<b>4%</b>	<b>8%</b>						
AFTER-TX ALPHA		2.06	1.73	1.42						
PRE-TAX ALPHA		-0.04	-0.06	-0.12						
TAX ALPHA		2.09	1.79	1.53						
TRACKING ERROR		1.42	1.38	1.38						
AFTER-TAX RETURN		1.83	5.39	8.98						
AFTER-TAX BENCH		-0.22	3.66	7.57						
PRE-TAX RETURN		-0.05	3.99	8.00						
PRE-TAX BENCH		-0.02	4.05	8.12						
LIQ RETURN		1.23	4.62	8.08						
LIQ BENCH		-0.01	3.47	7.06						
LIQ EXCESS		1.25	1.15	1.01						
		<b>Year</b>			<b>Total Return</b>	<b>0%</b>	<b>4%</b>	<b>8%</b>		
AFTER-TAX RETURN:	1	5.67	9.38	12.95	TURNOVER:	1	126.06	115.80	107.95	
	2	2.89	6.30	10.01		2	78.00	67.38	58.06	
	3	2.08	5.64	8.97		3	61.71	50.82	42.93	
	4	1.59	5.28	8.70		4	55.65	44.21	36.56	
	5	1.58	4.67	8.69		5	50.38	40.35	32.57	
	6	1.27	4.50	8.44		6	47.90	37.11	29.04	
	7	0.86	4.60	8.24		7	44.60	35.03	27.05	
	8	1.07	4.82	8.21		8	43.19	33.11	25.76	
	9	0.70	4.51	7.90		9	42.94	32.38	24.47	
	10	0.82	4.34	7.91		10	41.59	31.05	24.29	
BENCHMARK AFTER-TAX RE	1	-0.30	3.73	7.76	REALIZED LT GAIN:	1	0	0	0	
	2	-0.28	3.71	7.70		2	1.17	1.32	1.37	
	3	-0.26	3.69	7.65		3	1.39	1.36	2.05	
	4	-0.24	3.67	7.60		4	1.74	2.29	3.21	
	5	-0.23	3.66	7.56		5	2.10	2.96	3.12	
	6	-0.21	3.65	7.53		6	2.42	2.94	3.53	
	7	-0.20	3.64	7.50		7	2.13	3.52	4.59	
	8	-0.18	3.62	7.48		8	2.51	3.01	5.37	
	9	-0.17	3.62	7.45		9	2.88	3.72	5.95	
	10	-0.16	3.61	7.44		10	2.66	3.93	8.24	
AFTER-TAX EXCESS RETUR	1	5.84	5.37	4.78	REALIZED LT LOSS:	1	0	0	0	
	2	3.13	2.49	2.15		2	-2.65	-2.30	-2.12	
	3	2.32	1.88	1.24		3	-2.46	-2.12	-1.82	
	4	1.83	1.55	1.03		4	-1.95	-1.75	-1.49	
	5	1.80	0.97	1.05		5	-1.81	-1.60	-1.32	
	6	1.48	0.82	0.85		6	-1.62	-1.63	-1.24	
	7	1.05	0.93	0.70		7	-1.55	-1.44	-1.25	
	8	1.25	1.16	0.69		8	-1.58	-1.28	-1.20	
	9	0.87	0.87	0.42		9	-1.40	-1.47	-1.21	
	10	0.97	0.71	0.44		10	-1.44	-1.41	-1.58	
PORTFOLIO VALUE:	1	99.79	103.91	107.90	REALIZED ST GAIN:	1	0	0	0	
	2	99.73	108.01	116.61		2	0	0	0	
	3	99.74	112.41	125.78		3	0	0	0	
	4	99.68	117.12	135.90		4	0	0	0	
	5	99.89	121.60	146.97		5	0	0	0	
	6	99.99	126.20	158.81		6	0	0	0	
	7	99.72	131.29	171.56		7	0	0	0	
	8	99.80	136.89	185.46		8	0	0	0	
	9	99.63	142.41	200.07		9	0	0	0	
	10	99.54	147.98	216.06		10	0	0	0	
COST BASIS/VALUE:	1	0.85	0.83	0.81	REALIZED ST LOSS:	1	-17.24	-15.89	-14.51	
	2	0.77	0.74	0.71		2	-8.52	-7.27	-6.31	
	3	0.72	0.68	0.64		3	-6.22	-5.33	-4.66	
	4	0.68	0.63	0.59		4	-5.44	-4.62	-4.13	
	5	0.65	0.61	0.55		5	-4.84	-4.35	-4.00	
	6	0.63	0.58	0.52		6	-4.54	-4.05	-3.84	
	7	0.62	0.56	0.50		7	-4.25	-4.00	-3.75	
	8	0.61	0.54	0.48		8	-4.03	-3.94	-3.78	
	9	0.60	0.53	0.47		9	-3.96	-4.02	-3.84	
	10	0.60	0.52	0.47		10	-3.95	-4.00	-4.07	

**Table 2: Realize all LT gains at each rebalance**

S&P500-like environment, Turnover 4% per year

Rebalance frequency: 6/year

Trading cost: 0

Tax Rates: 15%, 35%

Dividends: 2% per year

<b>Total Return</b>				<b>0%</b>	<b>4%</b>	<b>8%</b>
AFTER-TX ALPHA		3.06	2.48	1.91		
PRE-TAX ALPHA		-0.05	-0.07	-0.12		
TAX ALPHA		3.11	2.56	2.03		
TRACKING ERROR		1.37	1.37	1.39		
AFTER-TAX RETURN		2.83	6.14	9.47		
AFTER-TAX BENCH		-0.22	3.66	7.57		
PRE-TAX RETURN		-0.07	3.98	8.00		
PRE-TAX BENCH		-0.02	4.05	8.12		
LIQ RETURN		2.64	5.87	9.11		
LIQ BENCH		-0.01	3.47	7.06		
LIQ EXCESS		2.65	2.40	2.04		

  

	Year	<b>0%</b>	<b>4%</b>	<b>8%</b>	<b>Total Return</b>	<b>0%</b>	<b>4%</b>	<b>8%</b>
AFTER-TAX RETURN:	1	5.67	9.38	12.95	126.06	115.80	107.95	
	2	2.06	5.38	8.56	172.45	169.15	165.26	
	3	2.59	5.87	8.88	156.14	152.32	147.58	
	4	2.81	5.94	9.25	153.21	146.99	143.72	
	5	2.69	5.85	9.33	150.26	145.04	141.19	
	6	2.58	5.94	9.18	149.05	143.58	140.20	
	7	2.51	5.74	9.15	144.69	141.94	139.40	
	8	2.75	5.78	9.22	143.59	139.93	137.79	
	9	2.34	5.96	9.03	143.94	140.80	134.99	
	10	2.44	5.72	9.36	142.00	137.38	132.64	
BENCHMARK AFTER-TAX RE	1	-0.30	3.73	7.76	0	0	0	
	2	-0.28	3.71	7.70	18.62	21.92	25.47	
	3	-0.26	3.69	7.65	14.81	18.97	22.69	
	4	-0.24	3.67	7.60	13.94	17.59	23.10	
	5	-0.23	3.66	7.56	13.95	18.33	23.80	
	6	-0.21	3.65	7.53	13.62	19.90	26.24	
	7	-0.20	3.64	7.50	13.64	19.69	28.66	
	8	-0.18	3.62	7.48	13.47	20.05	30.19	
	9	-0.17	3.62	7.45	13.90	21.36	33.05	
	10	-0.16	3.61	7.44	13.09	21.92	34.00	
AFTER-TAX EXCESS RETUR	1	5.84	5.37	4.78	0	0	0	
	2	2.33	1.62	0.82	-1.89	-1.58	-1.43	
	3	2.82	2.10	1.16	-1.91	-1.63	-1.35	
	4	3.02	2.18	1.54	-1.81	-1.74	-1.49	
	5	2.89	2.11	1.65	-1.96	-1.85	-1.64	
	6	2.76	2.21	1.54	-2.03	-2.20	-2.06	
	7	2.68	2.03	1.54	-2.13	-2.45	-2.20	
	8	2.90	2.08	1.63	-2.27	-2.26	-2.37	
	9	2.49	2.25	1.47	-2.56	-2.71	-2.80	
	10	2.58	2.03	1.80	-2.47	-3.02	-3.53	
PORTFOLIO VALUE:	1	99.79	103.91	107.90	0	0	0	
	2	99.64	108.10	116.55	0	0	0	
	3	99.54	112.54	125.69	0	0	0	
	4	99.57	116.92	135.76	0	0	0	
	5	99.57	121.45	146.67	0	0	0	
	6	99.47	126.47	158.36	0	0	0	
	7	99.45	131.30	171.01	0	0	0	
	8	99.66	136.46	184.75	0	0	0	
	9	99.56	142.18	199.61	0	0	0	
	10	99.41	147.78	216.05	0	0	0	
COST BASIS/VALUE:	1	0.85	0.83	0.81	-17.24	-15.89	-14.51	
	2	0.89	0.88	0.86	-14.30	-13.60	-13.05	
	3	0.91	0.90	0.88	-13.92	-13.69	-13.55	
	4	0.91	0.90	0.89	-13.84	-14.17	-14.67	
	5	0.91	0.90	0.89	-13.55	-14.50	-15.53	
	6	0.91	0.91	0.89	-13.37	-14.78	-16.51	
	7	0.92	0.91	0.89	-12.85	-15.25	-17.72	
	8	0.92	0.91	0.89	-12.80	-15.55	-19.00	
	9	0.93	0.91	0.90	-12.60	-15.88	-19.57	
	10	0.93	0.91	0.89	-12.67	-16.35	-21.01	

**Table 3: Realize LT gains on lots for which Basis/MV greater than 60% at each rebalance**

S&P500-like environment, Turnover 4% per year

Rebalance frequency: 6/year

Trading cost: 0

Tax Rates: 15%, 35%

Dividends: 2% per year

<b>Total Return</b>				<b>0%</b>	<b>4%</b>	<b>8%</b>
AFTER-TX ALPHA		2.88	2.43	1.87		
PRE-TAX ALPHA		-0.05	-0.02	-0.17		
TAX ALPHA		2.93	2.45	2.04		
TRACKING ERROR		1.39	1.37	1.36		
AFTER-TAX RETURN		2.65	6.08	9.43		
AFTER-TAX BENCH		-0.22	3.66	7.57		
PRE-TAX RETURN		-0.07	4.03	7.95		
PRE-TAX BENCH		-0.02	4.05	8.12		
LIQ RETURN		2.25	5.53	8.74		
LIQ BENCH		-0.01	3.47	7.06		
LIQ EXCESS		2.27	2.06	1.67		

  

	Year	0%	4%	8%	<b>Total Return</b>	0%	4%	8%	
AFTER-TAX RETURN:	1	5.67	9.38	12.95	TURNOVER:	1	126.06	115.80	107.95
	2	2.57	5.95	9.47		2	151.01	144.23	136.37
	3	2.65	6.15	9.18		3	132.32	121.65	113.08
	4	2.71	5.89	9.44		4	126.58	114.43	104.42
	5	2.55	5.88	9.41		5	120.41	109.12	97.07
	6	2.23	5.69	8.89		6	118.33	103.82	92.76
	7	2.06	5.45	8.87		7	112.58	100.13	88.38
	8	2.25	5.53	8.91		8	112.06	96.60	84.15
	9	1.85	5.65	8.68		9	110.41	95.21	81.07
	10	2.14	5.41	8.72		10	107.61	92.00	77.65

  

	Year	0%	4%	8%	<b>REALIZED LT GAIN:</b>	0%	4%	8%
BENCHMARK AFTER-TAX RE	1	-0.30	3.73	7.76	1	0	0	0
	2	-0.28	3.71	7.70	2	12.37	13.98	15.50
	3	-0.26	3.69	7.65	3	10.20	11.32	13.21
	4	-0.24	3.67	7.60	4	9.40	11.18	13.39
	5	-0.23	3.66	7.56	5	9.24	11.77	13.30
	6	-0.21	3.65	7.53	6	9.42	11.83	13.95
	7	-0.20	3.64	7.50	7	8.70	12.05	15.72
	8	-0.18	3.62	7.48	8	9.63	11.80	15.85
	9	-0.17	3.62	7.45	9	9.24	12.43	17.15
	10	-0.16	3.61	7.44	10	8.76	12.88	19.21

  

	Year	0%	4%	8%	<b>REALIZED LT LOSS:</b>	0%	4%	8%
AFTER-TAX EXCESS RETURN:	1	5.84	5.37	4.78	1	0	0	0
	2	2.82	2.16	1.65	2	-1.89	-1.58	-1.43
	3	2.88	2.36	1.44	3	-1.73	-1.42	-1.15
	4	2.93	2.14	1.72	4	-1.49	-1.39	-1.16
	5	2.75	2.14	1.72	5	-1.60	-1.40	-1.18
	6	2.43	1.97	1.28	6	-1.57	-1.56	-1.27
	7	2.24	1.75	1.28	7	-1.54	-1.66	-1.40
	8	2.41	1.83	1.34	8	-1.60	-1.46	-1.23
	9	2.00	1.96	1.15	9	-1.65	-1.70	-1.54
	10	2.28	1.74	1.21	10	-1.70	-1.78	-1.91

  

	Year	0%	4%	8%	<b>REALIZED ST GAIN:</b>	0%	4%	8%
PORTFOLIO VALUE:	1	99.79	103.91	107.90	1	0	0	0
	2	99.69	108.05	116.62	2	0	0	0
	3	99.62	112.44	125.60	3	0	0	0
	4	99.67	116.87	135.72	4	0	0	0
	5	99.72	121.66	146.77	5	0	0	0
	6	99.63	126.59	158.13	6	0	0	0
	7	99.42	131.55	170.66	7	0	0	0
	8	99.64	136.94	184.30	8	0	0	0
	9	99.40	142.75	198.88	9	0	0	0
	10	99.41	148.52	215.02	10	0	0	0

  

	Year	0%	4%	8%	<b>REALIZED ST LOSS:</b>	0%	4%	8%
COST BASIS/VALUE:	1	0.85	0.83	0.81	1	-17.24	-15.89	-14.51
	2	0.85	0.82	0.79	2	-12.87	-11.93	-11.16
	3	0.83	0.79	0.77	3	-12.12	-11.46	-10.95
	4	0.81	0.77	0.74	4	-11.73	-11.32	-11.10
	5	0.80	0.75	0.71	5	-11.19	-11.24	-11.12
	6	0.79	0.74	0.68	6	-10.78	-11.08	-11.38
	7	0.78	0.72	0.67	7	-10.31	-10.95	-11.62
	8	0.77	0.71	0.65	8	-9.99	-10.86	-12.02
	9	0.77	0.70	0.64	9	-10.00	-11.14	-12.20
	10	0.76	0.69	0.63	10	-9.87	-11.39	-12.46

**Table 4: Long Term performance, 8% environment**

S&P500-like environment, Turnover 4% per year

Rebalance frequency: 6/year

Trading cost: 0

Tax Rates: 15%, 35%

Dividends: 2% per year

	Realize no gains actively	Realize all LT gains at each rebalance		Realize no gains actively	Realize all LT gains at each rebalance		Realize no gains actively	Realize all LT gains at each rebalanc e	
AFTER-TX ALPHA	0.94	1.76							
PRE-TAX ALPHA	-0.04	0.03							
TAX ALPHA	0.98	1.73							
TRACKING ERROR	1.46	1.45							
AFTER-TAX RETURN	8.34	9.16							
AFTER-TAX BENCH	7.40	7.40							
PRE-TAX RETURN	8.07	8.14							
PRE-TAX BENCH	8.12	8.12							
LIQ RETURN	7.98	9.08							
LIQ BENCH	7.16	7.16							
LIQ EXCESS	0.81	1.92							
	Year								
AFTER-TAX EXCESS RETURN:	1	4.78	4.78	TURNOVER:	107.95	107.95	REALIZED LT LOSS:	0.00	0.00
	2	2.15	0.82		58.06	165.26		-2.12	-1.43
	3	1.24	1.16		42.93	147.58		-1.82	-1.35
	4	1.03	1.54		36.56	143.72		-1.49	-1.49
	5	1.05	1.65		32.57	141.19		-1.32	-1.64
	6	0.85	1.54		29.04	140.20		-1.24	-2.06
	7	0.70	1.54		27.05	139.40		-1.25	-2.20
	8	0.69	1.63		25.76	137.79		-1.20	-2.37
	9	0.42	1.47		24.47	134.99		-1.21	-2.80
	10	0.44	1.80		24.29	132.64		-1.58	-3.53
	11	0.67	1.68		23.59	132.16		-1.40	-3.63
	12	0.68	1.68		23.24	130.84		-1.73	-4.37
	13	0.61	1.65		22.66	127.70		-1.91	-4.82
	14	0.38	1.64		22.52	128.67		-1.91	-5.10
	15	0.32	1.57		23.24	126.13		-2.09	-5.73
	16	0.27	1.59		23.64	127.35		-2.34	-6.70
	17	0.68	1.56		22.46	126.07		-2.89	-7.12
	18	0.60	1.39		22.05	123.77		-3.07	-7.99
	19	0.31	1.32		21.53	123.10		-3.19	-7.84
	20	0.62	1.42		21.77	120.94		-3.37	-8.46
	21	0.59	1.61		22.04	119.25		-4.46	-12.19
	22	0.30	1.31		22.15	119.75		-4.45	-11.27
	23	0.77	1.62		21.84	118.83		-4.43	-11.19
	24	0.67	1.59		20.96	115.74		-5.90	-13.36
	25	0.33	1.14		22.91	117.50		-5.73	-14.56
COST BASIS/VALUE:	1	0.81	0.81	REALIZED LT GA	0.00	0.00	REALIZED ST LOSS:	-14.51	-14.51
	2	0.71	0.86		1.37	25.47		-6.31	-13.05
	3	0.64	0.88		2.05	22.69		-4.66	-13.55
	4	0.59	0.89		3.21	23.10		-4.13	-14.67
	5	0.55	0.89		3.12	23.80		-4.00	-15.53
	6	0.52	0.89		3.53	26.24		-3.84	-16.51
	7	0.50	0.89		4.59	28.66		-3.75	-17.72
	8	0.48	0.89		5.37	30.19		-3.78	-19.00
	9	0.47	0.90		5.95	33.05		-3.84	-19.57
	10	0.47	0.89		8.24	34.00		-4.07	-21.01
	11	0.46	0.90		7.77	37.82		-4.38	-22.92
	12	0.45	0.90		8.63	41.53		-4.54	-23.66
	13	0.44	0.91		9.09	44.52		-4.77	-24.59
	14	0.44	0.91		10.98	47.24		-5.24	-27.32
	15	0.44	0.91		12.27	51.60		-5.70	-28.71
	16	0.45	0.91		14.38	55.40		-6.24	-31.43
	17	0.45	0.91		14.16	61.52		-6.26	-33.97
	18	0.44	0.92		14.89	65.41		-6.90	-35.63
	19	0.44	0.92		15.40	69.33		-7.14	-38.13
	20	0.45	0.92		20.42	72.90		-7.61	-41.12
	21	0.46	0.92		24.22	78.23		-7.69	-42.63
	22	0.47	0.92		28.03	86.13		-8.02	-44.61
	23	0.47	0.93		24.45	96.76		-9.52	-49.09
	24	0.46	0.92		23.29	97.90		-10.62	-51.41
	25	0.47	0.94		33.02	114.07		-10.74	-55.34

Table 5: Comparison of Long-term and Short-term Performance

	S&P 500	Loss Harvesting only	<i>Diff</i>	Enhanced Tax Rate Management	<i>Diff</i>
Pre-tax Return	8.00%	8.00%		8.00%	
<b>10-Year Horizon</b>					
Pre-liquidation Return	7.45%	8.98%	1.53%		1.98%
Post-liquidation Return	6.94%	8.07%	1.13%		1.80%
Final Basis/Market		0.47		0.9	
Tracking Error		1.4%		1.4%	
Turnover		30%		Up to 100%	
<b>25-year Horizon Return</b>					
Pre-liquidation Return	7.28%	8.26%	0.98%	1.73%	1.73%
Post-liquidation Return	7.04%	7.89%	0.85%	1.89%	1.89%
Final Basis/Market		0.47		0.94	
Tracking Error		1.5%		1.5%	
Turnover		20%		Up to 100%	