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TAX ALPHA

Rewards and Risks of Loss-Harvesting Strategies

By Lisa Goldberg, PhD, Pete Hand, and Taotao Cai

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In an industry guilty of many crimes against investors, ignoring the tax consequences of portfolio transactions ranks among the most grievous.

—David Swensen (2005, p. 93)

We report historical after-tax return and risk for three hypothetical tax-managed U.S. equity strategies based on the Russell 1000 Index. The first strategy aims to deliver index-like returns; the second is a factor tilt; and the third tracks the index while excluding oil producers. By staggering start date, we generated multiple runs of each strategy at five-, 10-, and 20-year horizons beginning January 31, 1987, and ending October 31, 2018. Tax alpha was highest in the index-tracking strategy, and differences in tax alpha were more pronounced, both across strategies and at different time horizons, in the estate/donation disposition than in the liquidation disposition. As the strategies aged, tracking error to the Russell 1000 tended to drift upward and ranges of outcomes compressed. Key findings are the following:

- Tax alpha in an indexing strategy was uniformly positive at five-, 10-, and 20-year horizons for the estate/donation and liquidation dispositions.
  - At a 20-year horizon, median tax alpha for the index-tracking strategy was 0.98 percent in the estate/donation disposition and 0.63 percent in the liquidation disposition.
- Multi-factor and carbon-free strategies delivered tax alpha on par with the indexing strategy.
  - At a 10-year horizon, median annualized tax alpha in the estate/donation disposition was 1.65 percent for a carbon-free strategy and 1.21 percent for a multi-factor strategy, compared to 1.66 percent per year for the indexing strategy.
- Loss-harvesting strategies compared favorably to top-quintile actively managed strategies.
  - Median tax information ratios were 1.17, 1.28, and 0.99, respectively, for the index-tracking, multi-factor, and carbon-free strategies at a 10-year horizon.

The laser focus of the financial services industry on pre-tax return can lead to unwelcome surprises for a taxable investor. Consider that in 2018, the average U.S. equity mutual fund lost 5.66 percent, and taxable investors lost an additional 2.05 percent in taxes on capital gains realized by their fund managers.[1] Tax management can mitigate these unwelcome surprises and, in the best case, transform an equity portfolio into an engine of tax savings.

Loss harvesting is a tax management technique that aims to realize losses on individual stocks in conjunction with an investment objective such as index tracking. In a loss-harvesting strategy, the realized losses in the portfolio are used to offset capital gains, enabling an investor to delay tax payment or avoid it entirely. This makes loss harvesting valuable to taxable investors, but how valuable? Historically, the appraisal of the potential benefits, risks, and limitations of loss harvesting has been based largely on anecdotes and Monte Carlo simulation. Both deliver useful, but incomplete, information: Anecdotes are necessarily limited in scope, and Monte Carlo simulations rely on idealized assumptions about return and risk.[2] Here, we complement those perspectives with a detailed historical analysis, emphasizing the spectrum of potential investor experiences rather than simple averages.

The performance of a taxable strategy may be particularly sensitive to its age as well as market attributes such as turbulence. We address this complexity by aggregating characteristics of loss-harvesting strategies over many historical periods and at different investment horizons. Our study provides insight into the life cycle of a loss-harvesting strategy, which, we believe, has its youth, midlife, and golden years.

In this article, we focus on the historical performance of three hypothetical loss-harvesting U.S. equity strategies. The first aims to deliver index-like returns; the second is a factor tilt; and the third tracks the index while excluding oil producers. Our analysis only touches on the broad question of how to effectively integrate loss harvesting into active strategies. The examples we provide are intended to illustrate the possibilities.

REWARDS AND RISKS OF LOSS-HARVESTING STRATEGIES

The most basic tax-managed portfolio strategy, generally speaking, attempts to harvest portfolio losses while controlling tracking error against a diversified benchmark; return is tax dollars saved, compounded over time.[3] The relative importance of loss harvesting and risk control varies across investors because more-aggressive harvesting tends to widen tracking error, thereby increasing the chance of substantial pre-tax underperformance. The trade-off between loss harvesting and risk control can be tailored to individual preferences. More-complex loss-harvesting strategies incorporate tilts or exclusions, which may be based on either financial or ethical considerations.[4]

The bottom-line performance measure of a taxable strategy is the spendable benefit to the investor: after-tax active return (ATAR), which is the difference between after-tax returns of a portfolio and its benchmark.

After-Tax Active Return =
After-Tax Portfolio Return –
After-Tax Benchmark Return

In a tax-managed strategy, a substantial component of after-tax active return is tax alpha, which is the difference between after-tax and pre-tax active return.

Tax Alpha =
After-Tax Active Return –
Pre-Tax Active Return

Tax alpha (and hence, after-tax active return) comes in two varieties, depending on disposition. In the estate/donation disposition, wealth is either bequeathed or donated to a charitable organization, and taxes are never paid. In the liquidation disposition, payment of taxes is delayed but not indefinitely. We show results for both dispositions in our study. Tax alpha tends to accrue in younger strategies and also during periods of turbulence, and it cannot be arbitraged away. This characterization distinguishes tax alpha from other sources of alpha, which are mercurial, or more often, negative.[5]

Our portfolio construction process controlled tracking error, which indicates how effectively pre-tax portfolio returns are expected to align with benchmark returns. In a loss-harvesting strategy, tracking error tends to drift upward over time, and we quantified this drift as part of our study.

Return on a risk-adjusted basis is reported as the tax information ratio (IR) of the estate/donation after-tax active return divided by its standard deviation.[6]

The relative importance of loss harvesting and risk control varies across investors because more-aggressive harvesting tends to widen tracking error, thereby increasing the chance of substantial pre-tax underperformance.

STUDY OUTLINE

This study advances the work presented in Goldberg et al. (2017). Here, we broaden the perspective by considering several different investment strategies. We launched long-horizon, tax-loss harvesting strategies composed of Russell 1000 stocks on a quarterly basis beginning January 31, 1987, and ending October 31, 2018. To avoid risk associated with leverage, we disallowed short positions, and we set tax rates to the highest U.S. federal level at the end of 2018.[7] Our portfolio construction process relied on the Barra US Total Equity Model (Barra USSLOW) and mean-variance optimization, and we rebalanced monthly.

In the analysis below, we show the historical after-tax return and risk for three tax-managed strategies. The first aims to deliver index-like returns; the second tilts toward multiple factors such as value, momentum, quality, and size; and the third excludes stocks in the energy reserves and oil refining industries. We constructed portfolios for all three strategies quantitatively by minimizing tracking error to the Russell 1000. Further details are in appendix A.

EMPIRICAL RESULTS

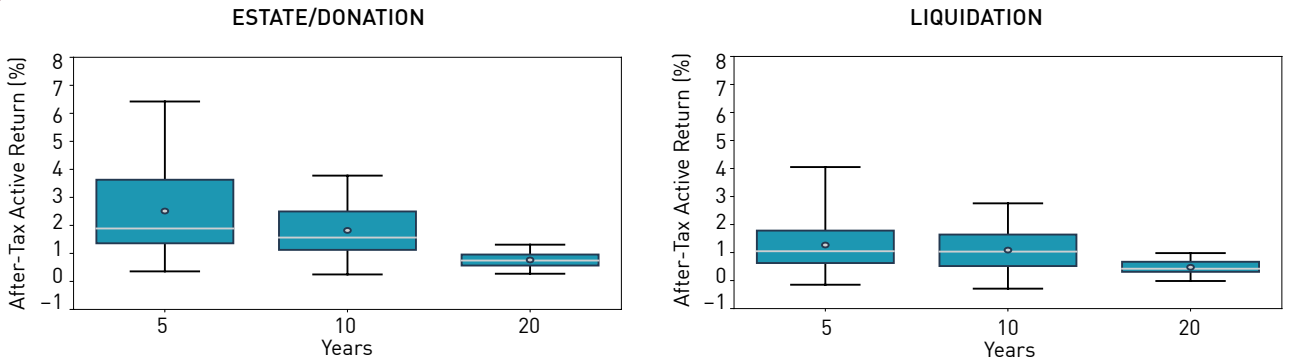
Here we present ranges of after-tax active return, tax alpha, tracking error, and tax IR observed in our historical study, varying the time horizons and investment strategies. To highlight the aging process of loss-harvesting strategies, we show outcomes at horizons of five, 10, and 20 years for the index-tracking strategy.[8] To isolate the loss-harvesting capabilities of different investments, we compare the three tax-managed strategies at a 10-year horizon. In each case, we generate a box plot, which identifies the median and average outcomes, the 25th and 75th percentiles delimiting the interquartile range, and the worst and best cases at the extremes. This gives a concise presentation of the ranges of strategy outcomes at fixed horizons over different periods.

AFTER-TAX ACTIVE RETURN

The performance of the index-tracking strategy at five-, 10-, and 20-year horizons is shown in figure 1. After-tax active returns were uniformly positive in the estate/donation disposition and mostly positive after liquidation. Ranges of outcomes declined as horizon increased in both the estate/donation and liquidation dispositions, but the decline was steeper in the estate/donation disposition. This can be explained, at least in part, by tax effects, as we discuss below. The compression of outcomes is consistent with the fact that longer horizons offer greater potential for outperformance and underperformance to offset each other. After-tax active return term structures for the multi-factor and carbon-free strategies exhibited similar silhouettes, and

Figure 1

PERFORMANCE OF THE INDEX-TRACKING STRATEGY



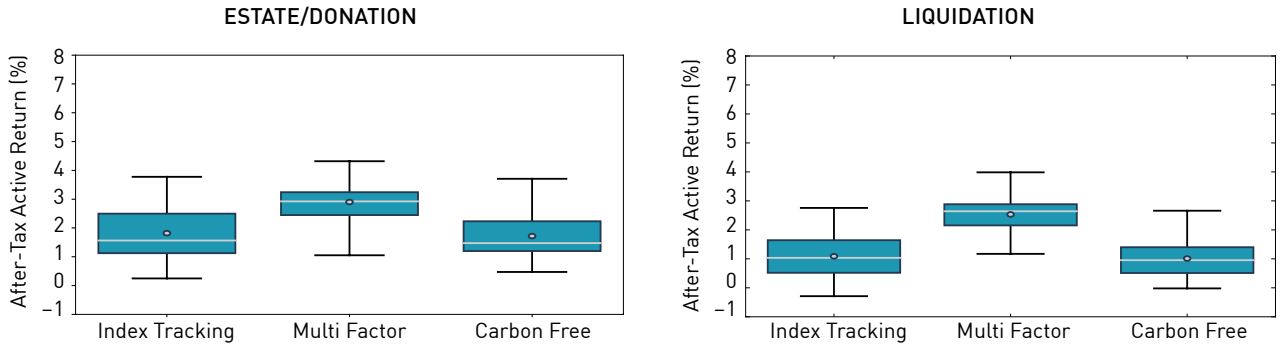
	5 Years	10 Years	20 Years
Median	1.89	1.57	0.75

	5 Years	10 Years	20 Years
Median	1.05	1.03	0.42

Ranges of annualized after-tax active return of an index-tracking Russell 1000 strategy beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

Figure 2

PERFORMANCE VARIED WITH STRATEGY AT A 10-YEAR HORIZON



	Index Tracking	Multi Factor	Carbon Free
Median	1.57	2.92	1.47

	Index Tracking	Multi Factor	Carbon Free
Median	1.03	2.64	0.95

Ranges of annualized after-tax active return of Russell 1000 strategies at a 10-year horizon beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

median values for all strategies at all horizons are shown in appendix B, table B1.

In figure 2, we look at how performance varied with investment strategy at a 10-year horizon. After-tax active returns were uniformly positive in the estate/donation disposition for all three strategies, and they were mostly positive in the liquidation disposition. Performances of the carbon-free and index-tracking strategies were roughly on par. This aligns with results in Geddes et al. (2016) showing that a strategy can effectively track a diversified U.S. equity index without carbon over long periods. The multi-factor strategy had markedly higher after-tax active return, and the ranges of outcomes were more compressed. As shown below, the compression can be explained by factor constraints but not tax effects.

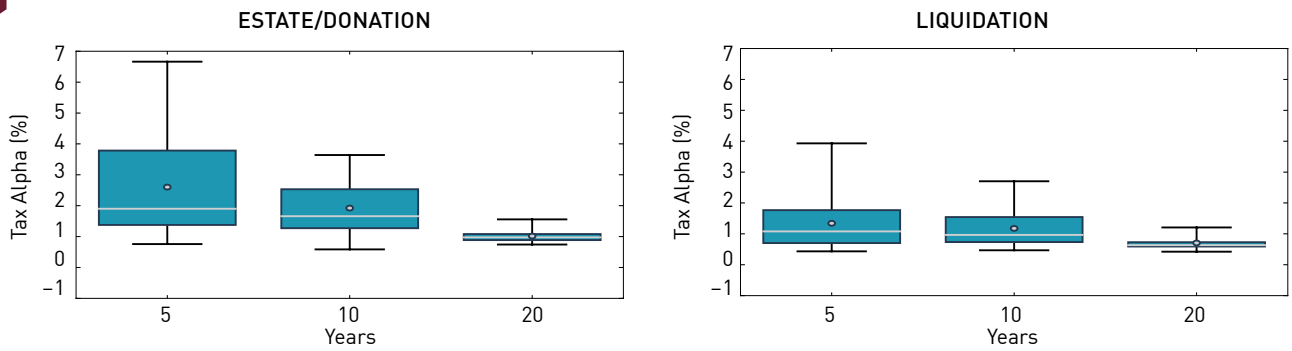
TAX ALPHA

Below, we isolate tax alpha, the component of after-tax active return due to loss harvesting, and present performance over a range of time horizons and across investment strategies for both the estate/donation and liquidation scenarios.

Figure 3 focuses on the life cycle of the index-tracking strategy, showing the improvement in active returns owing to effective tax management at five, 10, and 20 years.[9] The difference between the estate/donation (left panel) and liquidation (right panel) dispositions was more sharply delineated here than for after-tax active return (see figure 1), with tax alpha for the estate/donation

Figure 3

LIFE CYCLE OF THE INDEX-TRACKING STRATEGY



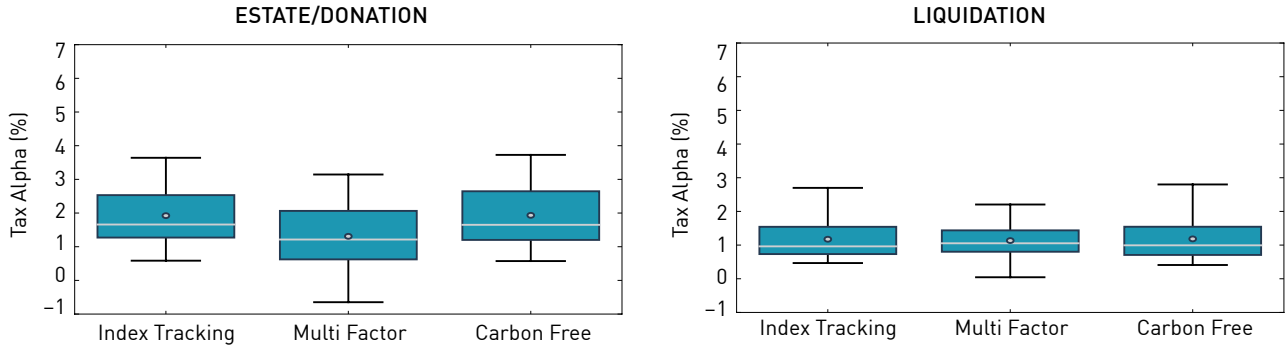
	5 Years	10 Years	20 Years
Median	1.90	1.66	0.98

	5 Years	10 Years	20 Years
Median	1.08	0.97	0.63

Ranges of annualized tax alpha of an index-tracking Russell 1000 strategy beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

Figure 4

TAX ALPHA FOR INDEX-TRACKING, MULTI-FACTOR, AND CARBON-FREE STRATEGIES AT A 10-YEAR HORIZON



	Index Tracking	Multi Factor	Carbon Free
Median	1.66	1.21	1.65

	Index Tracking	Multi Factor	Carbon Free
Median	0.97	1.06	0.99

Ranges of annualized tax alpha of Russell 1000 strategies at a 10-year horizon beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

disposition more clearly dependent on investment horizon than for liquidation. The multi-factor and carbon-free strategies exhibited similar effects, and median values are presented in appendix B, table B2.

In figure 4, we present tax alpha for index-tracking, multi-factor, and carbon-free strategies at a 10-year horizon. On the basis of tax alpha, the index-tracking and carbon-free strategies remained roughly in line in both the estate/donation and liquidation dispositions; however, the dominance of the multi-factor strategy on the basis of after-tax active return (see figure 2) was reversed here. The lower level of tax alpha displayed by the multi-factor strategy relative to its peers can be explained by its constraints, which can lead to the realization of gains. This result is consistent with the findings in Goldberg et al. (2019).

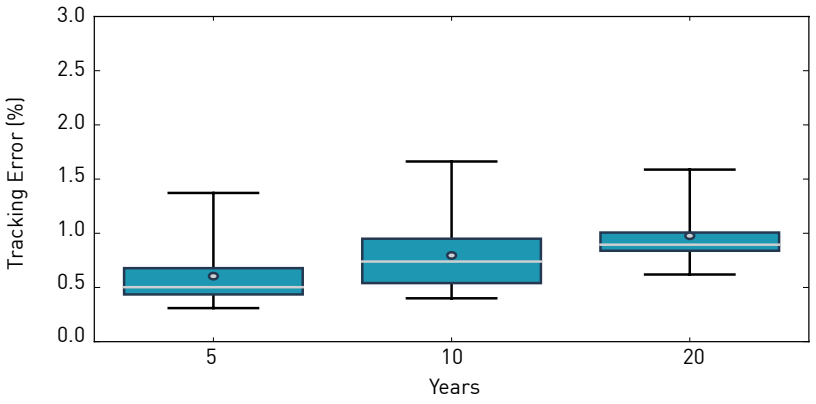
FORECAST TRACKING ERROR

Moving from returns to quantifying risk, we look at forecast tracking error, which reflects the divergence between a loss-harvesting portfolio's active return and its benchmark's return before tax (and is therefore irrespective of an investor's decision to donate or bequeath wealth versus liquidating an estate). Tracking error is an inevitable consequence of any form of active management, including loss harvesting, tilting toward factors, or excluding securities.[10] Controlling tracking error to a diversified benchmark amounts to controlling the likelihood of pre-tax underperformance.

Figure 5 shows how the index-tracking strategy deviated from the Russell 1000, pre-tax, over five-, 10-, and 20-year

Figure 5

HOW THE INDEX-TRACKING STRATEGY DEVIATED FROM THE RUSSELL 1000, PRE-TAX, OVER FIVE-, 10-, AND 20-YEAR HORIZONS

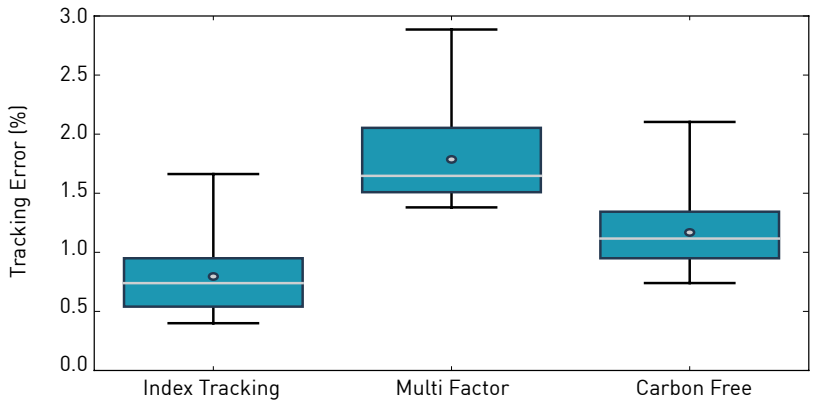


	5 Years	10 Years	20 Years
Median	0.50	0.74	0.89

Ranges of annualized forecast tracking error of a Russell 1000 index-tracking strategy beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed. Sources: Aperio Group, LLC and Barra USSLOW model.

Figure 6

FORECAST TRACKING ERROR AT A 10-YEAR HORIZON



	Index Tracking	Multi Factor	Carbon Free
Median	0.74	1.65	1.12

Ranges of annualized forecast tracking error of Russell 1000 strategies at a 10-year horizon beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed. Sources: Aperio Group, LLC and Barra USSLOW model.

horizons. Unlike annualized active return, which trended downward with longer horizons, risk tended to increase over time. We estimated the average drift in each strategy using a fixed-effects regression, which is described in appendix C. The upward drift of forecast tracking error in the index-tracking strategy over the full study period, beginning January 1987 and ending October 2018, was 0.64 percent over 20 years. Average 20-year drifts for the multi-factor and carbon-free strategies were 0.21 percent and 0.46 percent, respectively. Median values of tracking error for all strategies at all horizons are detailed in appendix B, table B3.

Figure 6 provides forecast tracking error for the three strategies at a 10-year horizon. The multi-factor strategy, constructed to deviate from the index-tracking strategy pre-tax, exhibited the highest risk. For the carbon-free strategy, which had a mandate to track the Russell 1000, divergence from the benchmark was intermediate and derived from both loss harvesting and the exclusion of oil, gas, and consumable fuels stocks. By contrast, loss harvesting was the only source of risk for the index-tracking strategy, which had the lowest forecast tracking error.

TAX INFORMATION RATIO

Finally, we evaluate the life cycle of the tax IR, calculated as the estate/donation after-tax active return divided by its standard deviation. We restrict attention to the estate/donation disposition because the lump-sum payment at liquidation distorts standard deviation. Information ratios at the levels shown in figures 7 and 8 typically would count as top-quartile among actively managed strategies, with the lowest median value exceeding 0.57, as shown in figure 7. Tax IRs for the index-tracking strategy declined and compressed over the course of five, 10, and 20 years. This result reflects both the way annualized after-tax active return diminished with horizon (see the left panel of figure 1) and the increase in risk seen over time (see figure 5). Tax IR tended to decline with horizon for the three strategies, as shown in appendix B, table B4.

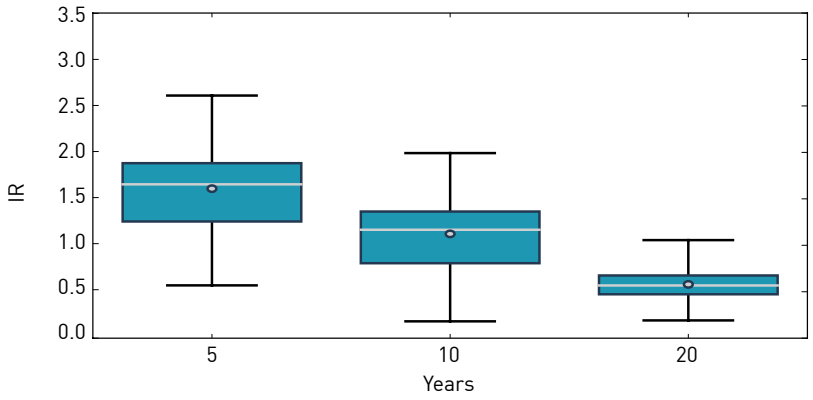
In Figure 8, we compare risk-adjusted performance for the index-tracking strategy, multi-factor tilt, and optimized carbon exclusion at a 10-year horizon. Of these strategies, the multi-factor tilt had the highest median tax IR, an outcome largely attributable to the outperformance of the factors over the study period. This phenomenon may or may not repeat in the future.

SUMMARY

Loss harvesting can generate value for taxable investors by facilitating delay, or even avoidance, of tax payments. The study described in this article quantified the value that was created

Figure 7

LIFE CYCLE OF THE TAX INFORMATION RATIO FOR THE INDEX-TRACKING STRATEGY

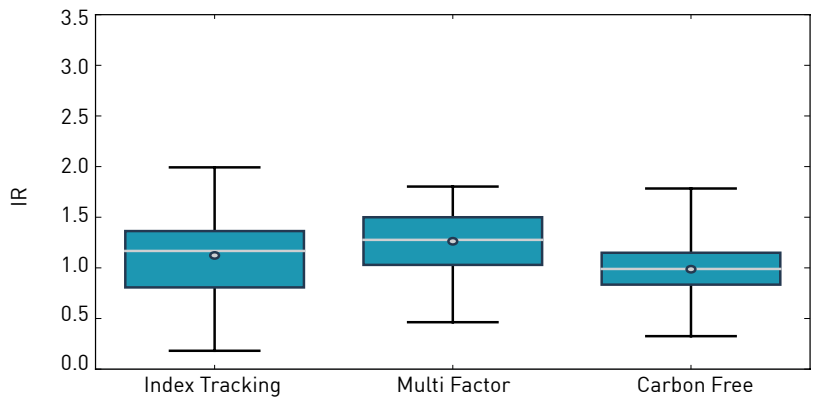


	5 Years	10 Years	20 Years
Median	1.66	1.17	0.57

Ranges of tax information ratio of a Russell 1000 index-tracking strategy in the estate/donation disposition beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

Figure 8

RISK-ADJUSTED PERFORMANCE FOR THE INDEX-TRACKING STRATEGY, MULTI-FACTOR TILT, AND OPTIMIZED CARBON EXCLUSION AT A 10-YEAR HORIZON



	Index Tracking	Multi Factor	Carbon Free
Median	1.17	1.28	0.99

Ranges of tax information ratio of Russell 1000 strategies in the estate/donation disposition at a 10-year horizon beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

historically through the simulation of an index-tracking strategy, a multi-factor tilt, and a carbon exclusion, all based on the Russell 1000 beginning January 31, 1987, and ending October 31, 2018. Our study highlights the life cycle of a loss-harvesting strategy as well as path dependence and sensitivity to market conditions by presenting ranges of historical after-tax active return, tax alpha, tracking error, and tax IRs at horizons of five, 10, and 20 years.

The three strategies we looked at delivered after-tax active returns that were uniformly positive at all horizons in the estate/donation disposition, and the results were also strong in the liquidation disposition. In this metric, the multi-factor strategy had the best performance. When we stripped out pre-tax performance and focused on tax alpha, however, the index-tracking and carbon-free strategies outperformed the multi-factor strategy. This is not surprising, given that the multi-factor strategy was more constrained than the other two. Tracking error tended to drift upward as our strategies aged. However, the extreme sensitivity of tracking error to market volatility could lead to a wide range of different experiences for different investors in different periods. On the basis of tax IR, which measures risk-adjusted return after tax, the performance of all three strategies was consistent with top-quartile active management.

The three tax-managed strategies considered in this article illustrate some of the benefits and risks that arise by integrating loss harvesting into the investment process. Our examples were drawn from the broad and largely unexplored range of tax-managed strategies that can be tailored to an investor's financial goals and personal values. The possibilities are virtually endless.

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Appendixes follow on pp. 42–43.

APPENDIX A: STRATEGY CONSTRUCTION PROCESS

All portfolios were constructed from the universe of securities in the Russell 1000 Index using the Barra US Total Equity Model (Barra USSLOW) and the Barra After-Tax Mean-Variance Optimizer. We rebalanced portfolios monthly, and the optimization settings we used are included below.

Table A1 GENERIC SETTINGS

Benchmark	Russell 1000
Universe of Securities	**Russell 1000**
Short-Term Capital Gains Rate	43.4%
Long-Term Capital Gains Rate	23.8%
Transaction Costs per Side	6 bps
Risk Aversion	0.5
Tax Multiplier	1.0
AS-CF Ratio	1.0
Target Beta	1.0

Table A2 MULTI-FACTOR SPECIFIC SETTINGS

	Multi Factor
Factors	**Benchmark +/–5**
Risk Index Tilts	
Book-to-Price	+
Earnings Yield	+
Momentum	+
Residual Volatility	
Beta	
Earnings Quality	
Profitability	+
Management Quality	+
Leverage	
Size	+

Table A3 CARBON-FREE SPECIFIC SETTINGS

	Carbon Free
Industries	
Energy Reserves	+
Oil Refining	+

APPENDIX B: MEDIAN VALUES FOR ALL METRICS AT ALL HORIZONS

Table B1 AFTER-TAX ACTIVE RETURN

	5 Years	10 Years	20 Years
Estate/Donation			
Index Tracking	1.89	1.57	0.75
Multi Factor	3.45	2.92	2.08
Carbon Free	1.97	1.47	0.66
Liquidation			
Index Tracking	1.05	1.03	0.42
Multi Factor	2.67	2.64	2.11
Carbon Free	1.04	0.95	0.39

Median values of after-tax active return for Russell 1000 strategies beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

Table B2 TAX ALPHA

	5 Years	10 Years	20 Years
Estate/Donation			
Index Tracking	1.90	1.66	0.98
Multi Factor	1.16	1.21	0.66
Carbon Free	1.94	1.65	0.97
Liquidation			
Index Tracking	1.08	0.97	0.63
Multi Factor	1.09	1.06	0.76
Carbon Free	1.09	0.99	0.65

Median values of tax alpha for Russell 1000 strategies beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

Table B3 TRACKING ERROR

	5 Years	10 Years	20 Years
Index Tracking	0.50	0.74	0.89
Multi Factor	1.52	1.65	1.58
Carbon Free	0.98	1.12	1.25

Median values of forecast tracking error for Russell 1000 strategies beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed. Sources: Aperio Group, LLC and Barra USSLOW model.

Table B4 TAX INFORMATION RATIO

	5 Years	10 Years	20 Years
Index Tracking	1.66	1.17	0.57
Multi Factor	1.67	1.28	0.93
Carbon Free	1.39	0.99	0.46

Median values of tax information ratio for Russell 1000 strategies beginning January 31, 1987, and ending October 31, 2018. A round-trip trading cost of 12 basis points is assumed and returns are gross of fees. Sources: Aperio Group, LLC and Barra USSLOW model.

APPENDIX C: ESTIMATING TRACKING ERROR DRIFT

In a loss-harvesting strategy, forecast tracking error tends to increase over time. Because forecast tracking error is sensitive to market attributes such as turbulence, we estimated tracking error using the fixed-effects regression specified below.

$$TE = \sum_{age} (\gamma_{age} \times D_{age}) + \sum_{calendar} (\gamma_{calendar} \times D_{calendar}) + \varepsilon$$

where

TE is tracking error for a portfolio of a specified age forecast at the start of a specified calendar month

D_{age} is a dummy variable indicating the age of portfolio in years

γ_{age} is the sensitivity of tracking error to the dummy variable

$D_{calendar}$ is a dummy variable indicating calendar months

$\gamma_{calendar}$ is the sensitivity of tracking error to the dummy variable

ε is the error term

Table C1 shows the average drift in each strategy, which we estimated using the fixed-effects regression.

Table C1

DRIFT

	5 Years	10 Years	20 Years
Index Tracking	6 bps	24 bps	56 bps
Multi Factor	18 bps	25 bps	27 bps
Carbon Free	10 bps	23 bps	44 bps

ENDNOTES

1. Patrick Geddes, "Tax Awareness Is the Next Big Thing" (blog), Aperio Research.
2. For example, a Monte Carlo simulator may assume that equity returns follow a normal or a log-normal distribution, even though these assumptions are incompatible with the empirically observed rate of extreme events.
3. Tax alpha, the after-tax return difference between a loss-harvesting strategy and its benchmark, includes the pre-tax difference between the loss-harvesting portfolio and its benchmark, which can be either positive or negative.
4. A detailed analysis of tax-managed factor tilts can be found in Goldberg et al. (2019).
5. According to the Midyear 2018 S&P 500 US Scorecard, 85.93 percent of U.S. equity funds tracking S&P indexes underperformed their benchmarks at a 10-year horizon. See us.spindices.com/search/?ContentType=SPIVA.
6. The standard deviation of post-liquidation, after-tax returns is a poor measure of risk because of the lump-sum payment at horizon. Consequently, we do not report tax information ratios for this disposition.
7. We assume long-term and short-term capital gains are taxed at rates of 23.8 percent and 43.4 percent, respectively. We are effectively investigating the question, "How would a tax-managed portfolio have performed had the federal tax rate as of December 2018 prevailed through history?" For comparison, the average long-term capital gains tax rate over our study period was 25.7 percent, according to data from the Tax Policy Center. See www.taxpolicycenter.org/statistics/historical-capital-gains-and-taxes.
8. Because we used as much data as possible, the number of observations depended on horizon. The five-year horizon had 108 observations; the 10-year horizon had 88 observations; and the 20-year horizon had 48 observations.
9. State taxes can make a pronounced difference in tax alpha. For example, had we accounted for California taxes in the study, the median 10-year estate/donation tax alpha would have increased from 1.66 percent to 2.24 percent.
10. By definition, active management leads to deviation from a cap-weighted benchmark. Tracking error is the standard deviation of the return difference of the active strategy and its benchmark. The principle of no arbitrage implies that the standard deviation cannot be zero.

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