
The Tax-Loss Harvesting Life Cycle

A 43-Year Retrospective of Equity Indexing
Strategies for Taxable Investors

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References to returns, risk, performance, tracking error, and other such characteristics describing portfolios in this presentation are based on indexes and hypothetical portfolios, not actual portfolios. It is important to note that they are for illustrative purposes only. Past performance, whether illustrative or actual, is not a guarantee of future performance. Please refer to the important disclosures within and at the end of this presentation.

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An Examination of Tax-Loss Harvesting Strategies

1 How does tax-loss harvesting work?

2 How effective has tax-loss harvesting been over time?

3 What is the relative importance of direct versus deferred benefits?

Sources: Aperio Group's research papers, "The Tax-Loss Harvesting Life Cycle" and "The Two Different Benefits of Tax-Loss Harvesting: Direct and Deferred," which are available at aperiogroup.com.

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Tax-Loss Harvesting in US Equity Markets

How It Functions in a Taxable Asset Allocation

In a taxable asset allocation, a tax-loss harvesting strategy allows investors to:

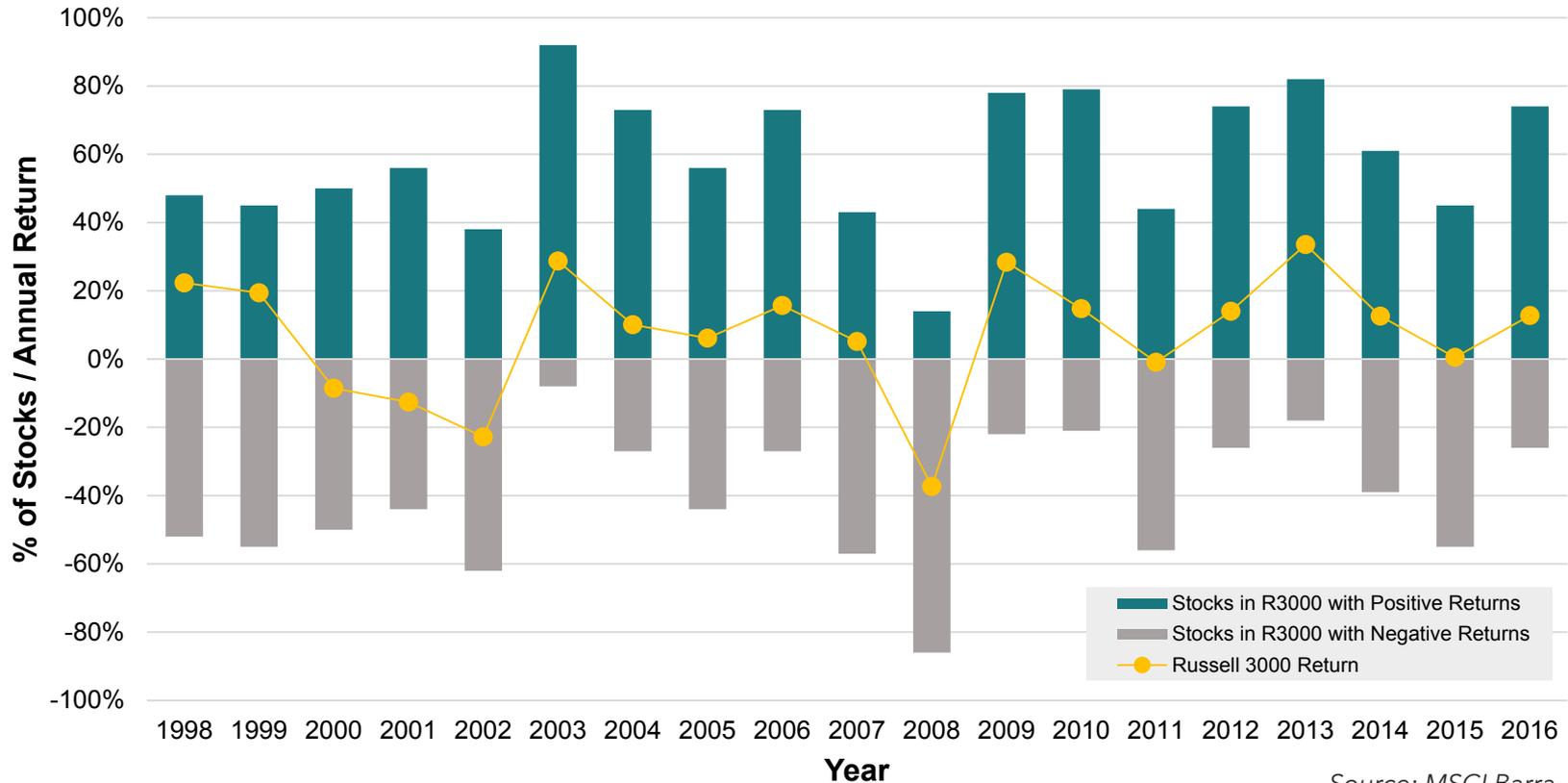
- Delay tax payments, or to avoid them entirely.
- More fully retain realized returns from tax-inefficient classes.

Tax-loss harvesting in public equity investing benefits from the number of stocks in a diversified portfolio, low correlation between securities, and high individual stock volatility.

Tax-Loss Harvesting Fueled by Abundance of Losers

% of Russell 3000 Stocks up/down in a Calendar Year

Since 1998, the average % of stocks that declined in value was 41%.



Source: MSCI Barra

Note: Data as of 12/31 of each year. Past performance is not indicative of future returns. See disclosure page for important information.

The Goal of Tax-Loss Harvesting

The strategy aims to realize losses on individual stocks in conjunction with an investment objective, such as:

- Earning index returns.
- Tilting on quality factors.
- Lowering carbon footprint.

Tax-loss harvesting may materially affect return-risk profiles of standard strategies.

Objective, Reward, and Risk

OBJECTIVE

Seeks to maximize the value of losses while generating index-like returns.

REWARD

Harvested losses are used to offset gains from tax-inefficient asset classes—delaying or avoiding taxes.

RISK

The divergence between the tax-loss harvesting portfolio return and the index return as reflected by the tracking error.

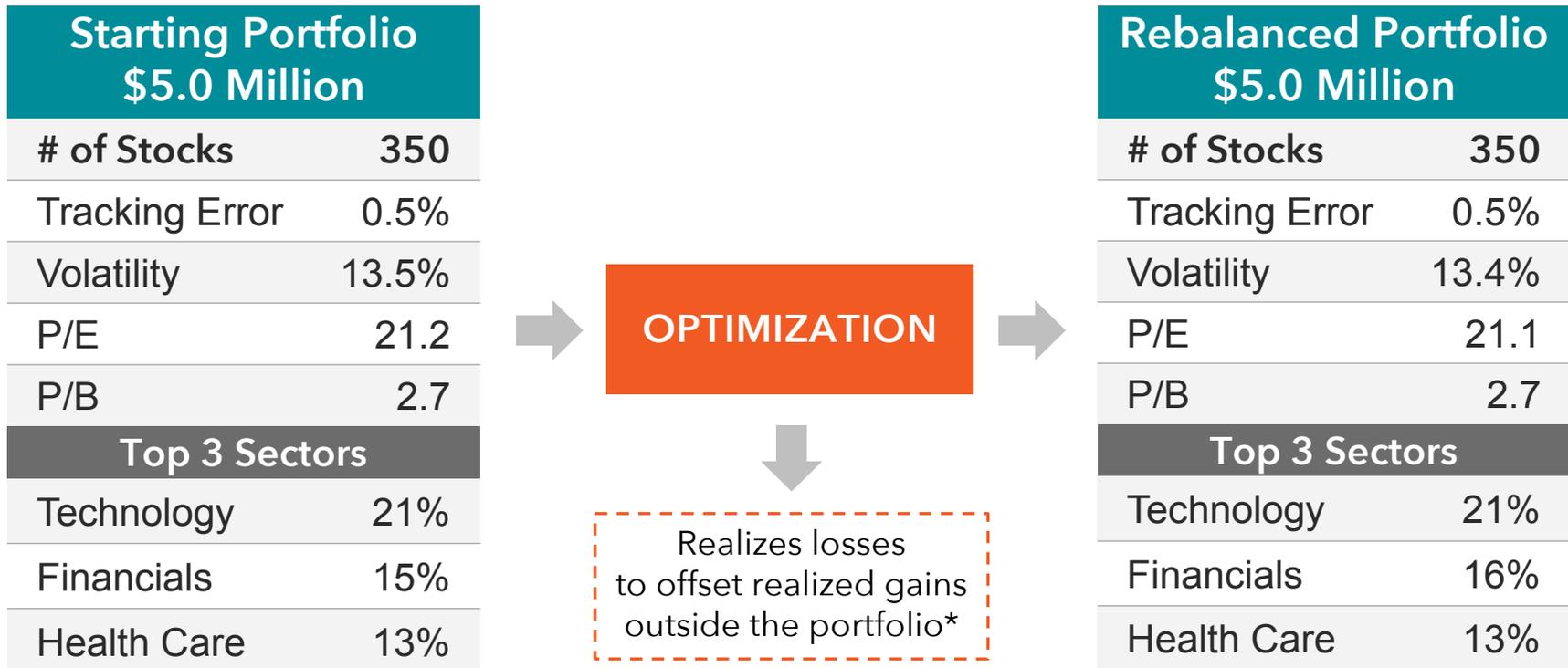
Optimal Strategy Is Facilitated by Factor Models

Constraining tracking error reduces the risk of this strategy.

- A pair of securities with similar exposures to risk factors—such as size, valuation, or industry—tends to have increased correlation.
- Quantitative tax-loss harvesting replaces a security that has lost value with a security that has similar risk factors.
- This keeps tracking error in check.

How Tax-Loss Harvesting Works

As stocks decline in value, Aperio sells a basket of stocks to realize losses and then buys a replenishment basket of similar stocks so the portfolio continues to track its index.



*Individual results will vary based on size, age, and other account-specific items.

This information is solely to illustrate Aperio's investment process. Such information should not be relied upon as investment advice regarding a particular investment, sector, industry, or markets in general. There is no guarantee estimates will be achieved. See endnotes for more information.

2

A 43-Year Retrospective of Return and Risk in Simulated US Equity Tax-Loss Harvesting Strategies

The Value of Tax-Loss Harvesting

To date, most appraisals have been based on Monte Carlo simulation or individual experience.*

This study complements those perspectives with a detailed historical analysis that emphasizes the spectrum of potential investor experiences rather than simple averages.

	Broader What If?	Actually Happened	Potential to Mislead
Monte Carlo Simulation	X		X
Historical Study		X	X

Our emphasis is on ranges of observed outcomes (as opposed to simple averages) because investors' experiences vary.

The focus of the study is a tax-loss harvesting strategy that tracks the S&P 500.

*Both approaches deliver useful, but incomplete, information: anecdotes are necessarily limited in scope, and Monte Carlo simulations rely on idealized assumptions about return and risk.

Empirical Study: Rolling 20-Year Strategies

Methodology

1. Launch a tax-loss harvesting strategy in the S&P 500 each month between January 1973 and February 2016.
2. Track return and risk at annual horizons as strategies evolve.
3. Aggregate results by horizon.

Horizon (years)	# of Observations
5	468
10	408
20	288

Assumptions

Capital Gains Rate

Long-term: 23.8%

Short-term: 43.4%

Some Limitations of This Study

- Potential model bias: Our analysis relies on a model created in 1998 to construct portfolios going back to 1973.*
- Our tax treatment of the benchmark is approximate.
- The results reflect the period in which the study was run. The future may differ from the past.
- The strategies in our historical study are robotic, while live strategies may reflect real-time judgment.
- Tax-loss harvesting strategies may have higher management fees than straightforward indexing, and that cost can diminish their benefits.

*See disclosure pages for more information on back-testing.

Performance Metrics

Tax Alpha

The difference between after-tax returns of a portfolio and its benchmark

Tracking Error*

The indicator of how well the portfolio will track the benchmark pre-tax

Tax Information Ratio

The risk-adjusted excess return due to loss harvesting

*Our portfolio construction process controls forecast tracking error, which indicates how effectively pre-tax portfolio returns are expected to mimic benchmark returns. In a tax-loss harvesting strategy, forecast tracking error tends to drift upward over time. In our study, we quantify this drift.

Two Varieties of Tax Alpha

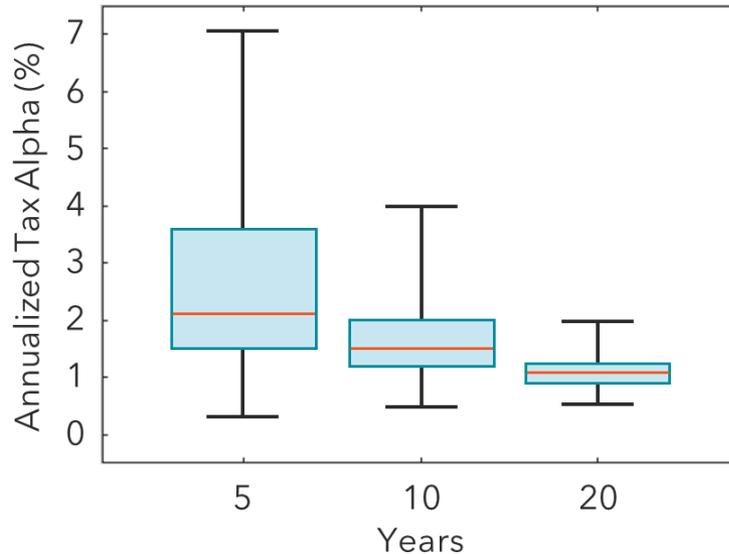
Tax alpha comes in two varieties, depending on its disposition:

- 1. *Estate/donation disposition:*** wealth is either bequeathed or donated to a charitable organization (taxes are never paid in this situation).
- 2. *Liquidation disposition:*** payment of taxes is delayed but not indefinitely.

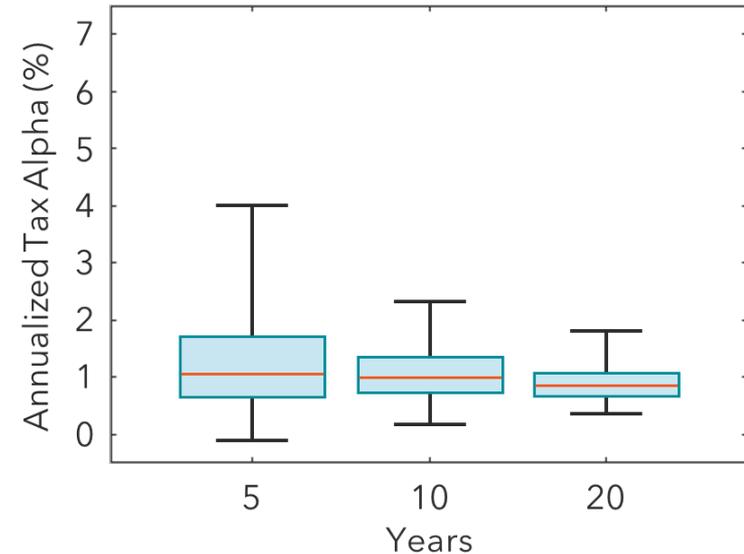
Tax Alpha

January 1973-February 2016

Estate/Donation



Liquidation



Years	5	10	20
Median	2.09	1.50	1.05

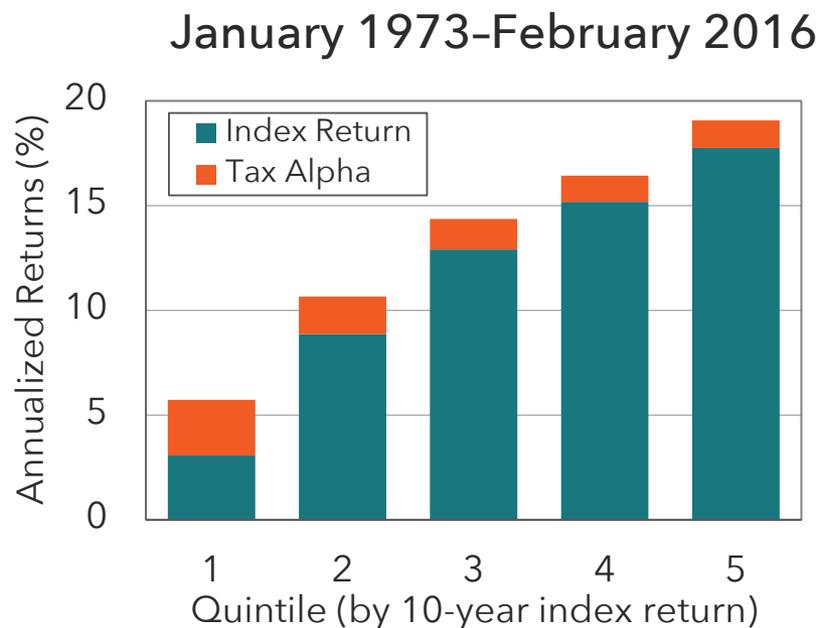
Years	5	10	20
Median	1.09	1.02	0.88

Note: Tax alpha excludes any fee differential between a tax-loss harvesting strategy and a simple index strategy. A difference could lower tax alpha.

Ranges of annualized tax alpha of a historically simulated S&P 500 tax-loss harvesting strategy at 5-, 10-, and 20-year horizons over the period from January 1973 to February 2016. The estate/donation disposition is shown in the left panel, and the liquidation disposition is shown in the right panel. Simulated returns are gross of fees. Round-trip trading costs of 12 basis points are assumed.

Sources: Barra USE3 Multi-Factor Model and the Barra After-Tax Mean-Variance Optimizer.

Regime Dependence of Tax Alpha



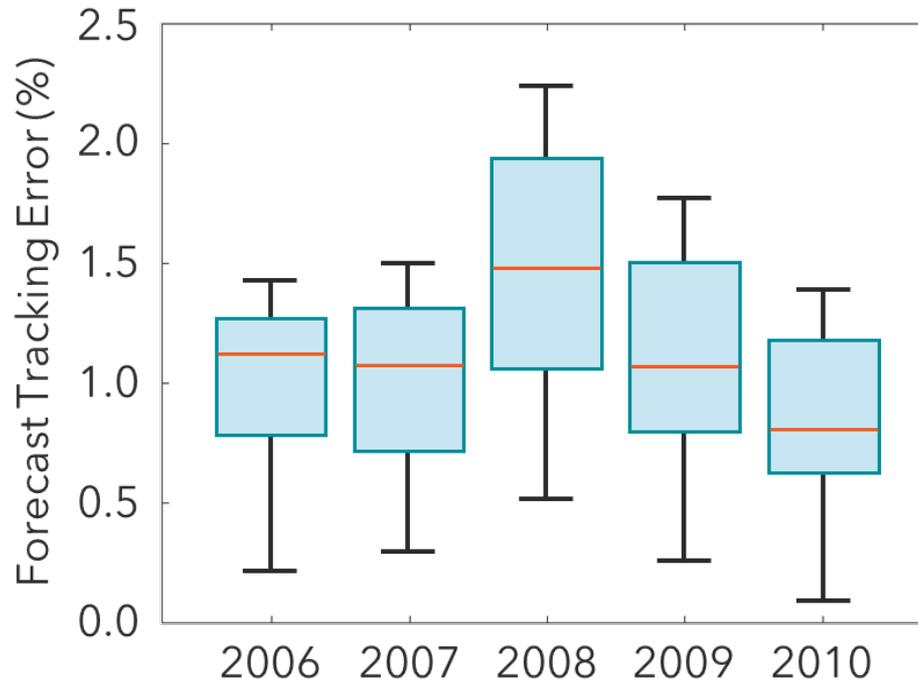
Average tax alpha sorted by average index return

	1	2	3	4	5
Average Index Return	3.07	8.86	12.91	15.18	17.75
Average Tax Alpha	2.66	1.80	1.46	1.25	1.32

Ranges of annualized estate/donation tax alpha (orange bars) of historically simulated S&P 500 tax-loss harvesting sorted by index returns (teal bars) over the period from January 1973 to February 2016. Simulated returns are gross of fees. Round-trip trading costs of 12 basis points are assumed.

Sources: Barra USE3 Multi-Factor Model and the Barra After-Tax Mean-Variance Optimizer.

Tracking Error by Date



Measured in September each year

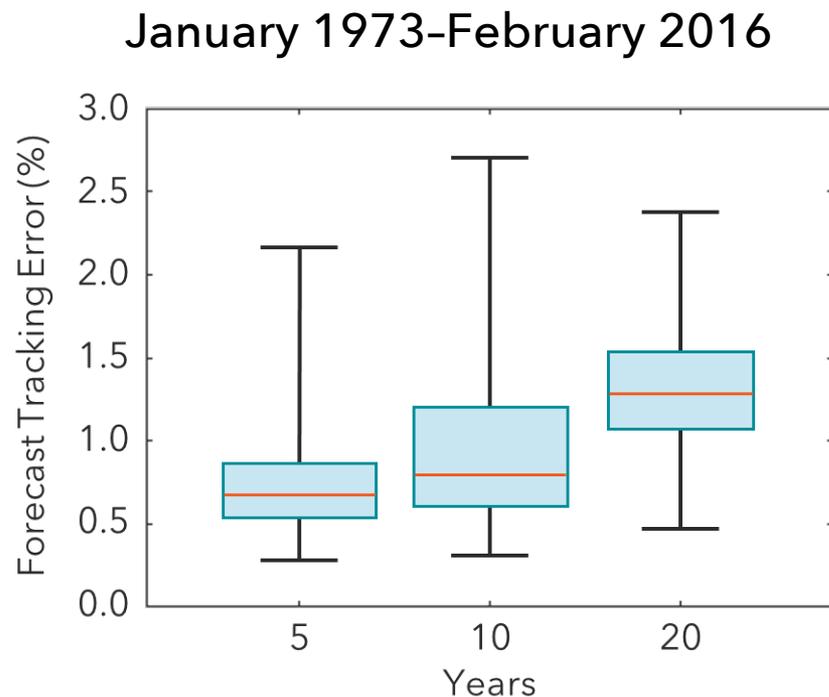
Years	2006	2007	2008	2009	2010
Median	1.12	1.07	1.48	1.07	0.81

Forecast pre-tax, post-rebalance tracking error

Ranges of forecast tracking error of a historically simulated S&P 500 tax-loss harvesting strategy before, during, and after the financial crisis. Strategy horizons at each date vary from two months to 20 years.

Sources: Barra USE3 Multi-Factor Model and the Barra After-Tax Mean-Variance Optimizer.

Tracking Error by Horizon



Years	5	10	20
Median	0.68	0.80	1.29

*Forecast pre-tax,
post-rebalance
tracking error*

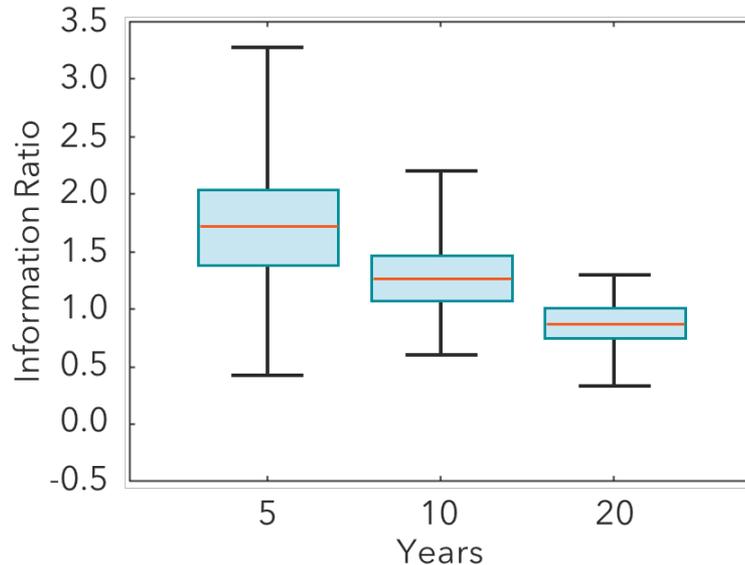
Ranges of forecast tracking error of a historically simulated S&P 500 tax-loss harvesting strategy at 5-, 10-, and 20-year horizons over the period from January 1973 to February 2016.

Sources: Barra USE3 Multi-Factor Model and the Barra After-Tax Mean-Variance Optimizer.

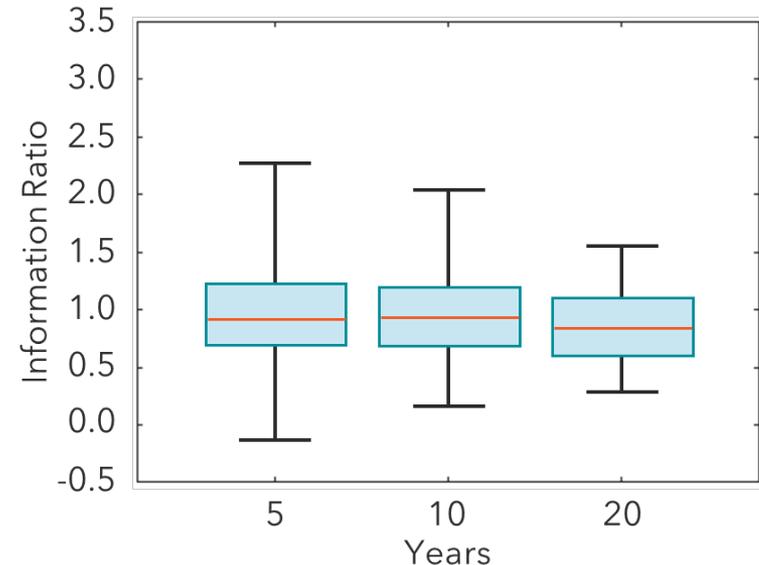
Risk-Return Ratios: Tax Alpha/Tracking Error

January 1973-February 2016

Estate/Donation



Liquidation



Years	5	10	20
Median	1.73	1.28	0.88

Years	5	10	20
Median	0.92	0.93	0.83

Note: While the estate/donation measurement can be described as a tax information ratio, given the treatment of the final tax payment in the liquidation scenario, that version is more accurately described as a risk-return ratio. Tax alpha excludes any fee differential between a tax-harvesting strategy and a simple index strategy. Such a difference could lower tax alpha.

Ranges of annualized estate/donation tax information ratios of a historically simulated S&P 500 tax-loss harvesting strategy at 5-, 10-, and 20-year horizons over the period from January 1973 to February 2016. Simulated returns are gross of fees. Round-trip trading costs of 12 basis points are assumed. Sources: Barra USE3 Multi-Factor Model and the Barra After-Tax Mean-Variance Optimizer.

Study Observations

Tax Alpha

- **At a 10-year horizon, tax alpha was uniformly positive** for the 408 strategies.
- On an annualized basis, tax alpha was greatest in turbulent and declining markets.
- Over the life cycle, cost basis decreased and prices increased, leading to lower tax alpha at longer horizons.

Tracking Error

- Forecast tracking error showed **strong dependence on market volatility**.
- It had a discernable drift, by an average of 0.28 basis points/month, or 0.67% over 20 years.

Tax Information Ratio

- Tax information ratios were **uniformly positive at all horizons for estate/donation**.
- The median value at a 20-year horizon (estate) was 0.88, which compares favorably with top-quartile active managers.
- The lowest value at a 20-year horizon was 0.27.

3

Direct and Deferred Components of Tax Alpha

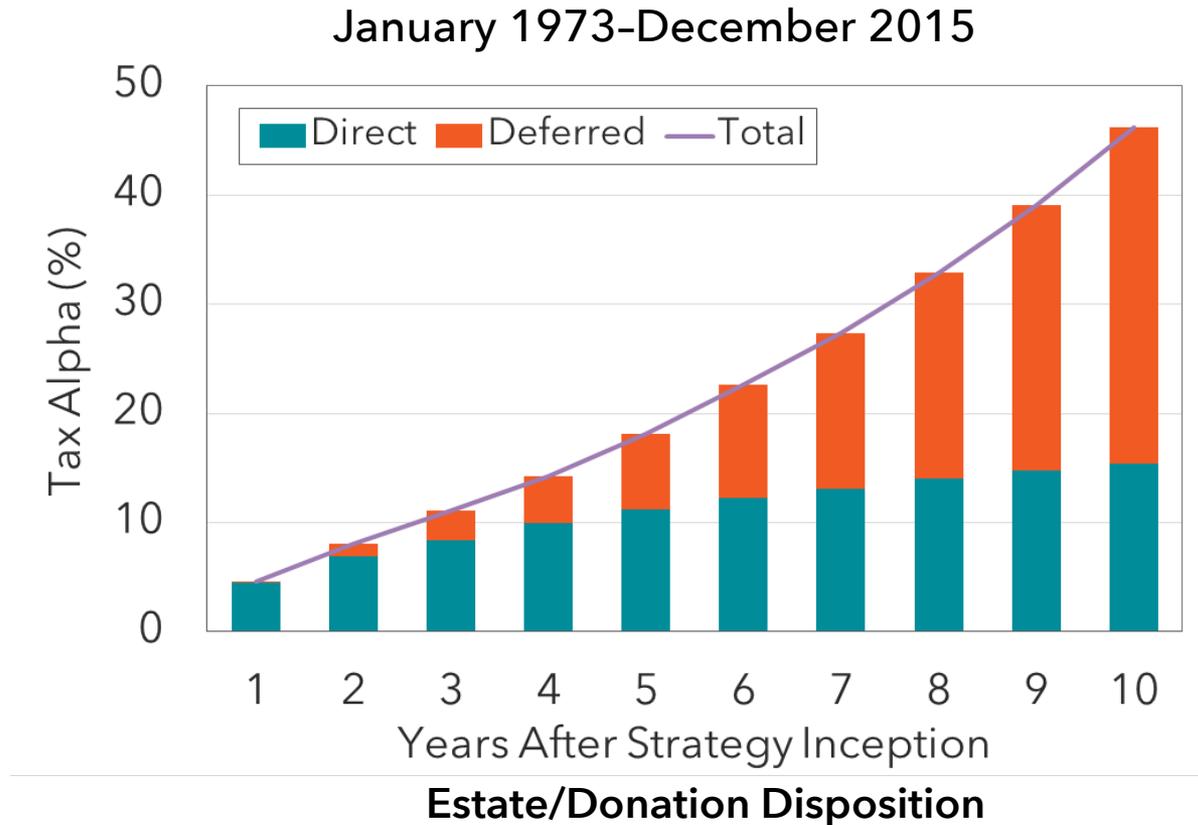
How Important Are Direct Versus Deferred Benefits?

Tax-loss harvesting provided benefits through both immediate reduction in tax liability (direct) and the time value of postponing tax liability (deferred).

- ***Direct:*** accumulated tax savings when capital gains are offset with harvested losses
- ***Deferred:*** reinvestment of tax savings*

*This includes the difference in return between the portfolio and its benchmark.

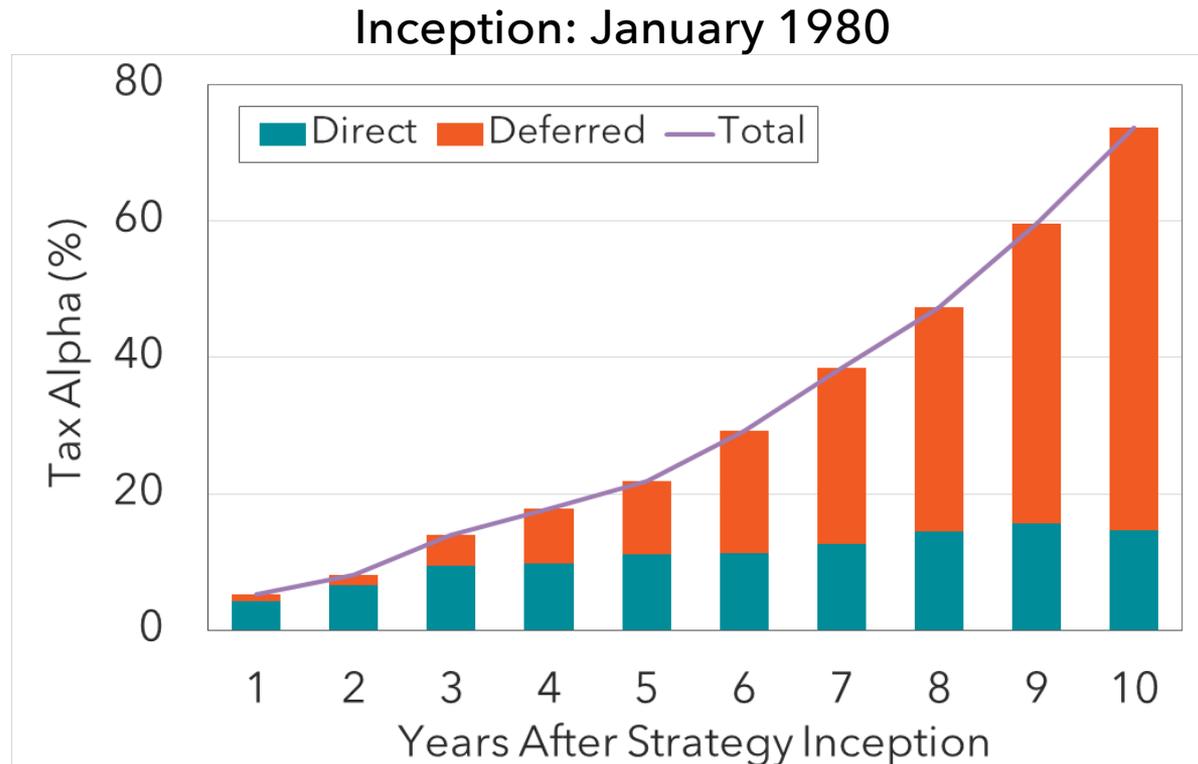
Average Direct and Deferred Components



The average path illustrated in this slide may not be representative of individual experiences.

Average direct benefits (teal bars) and deferred benefits (orange bars) of a standard tax-loss harvesting strategy for an estate/donation disposition in the S&P 500. Tax alpha (purple line) is the sum of the direct and deferred benefits. Averages are based on a tax-loss harvesting strategy launched monthly between January 1973 and December 2015.

Direct and Deferred Benefits: Bull Market

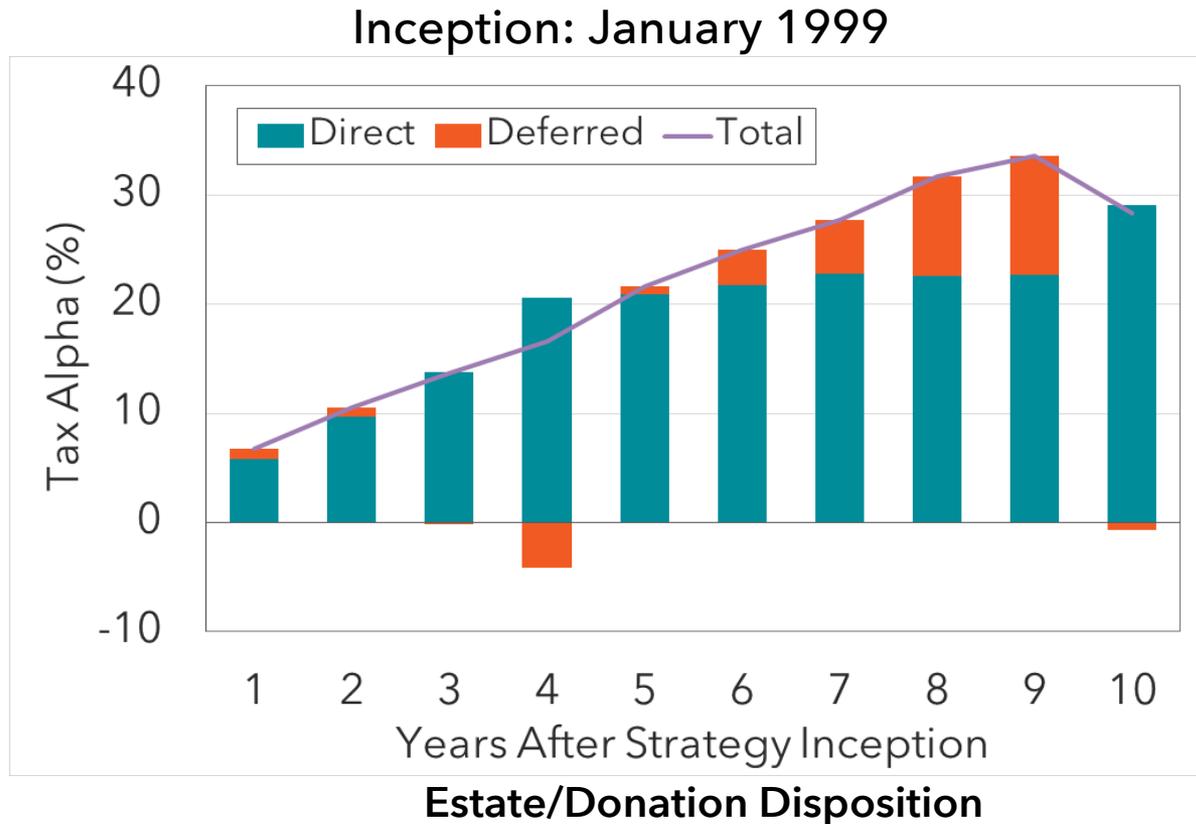


Estate/Donation Disposition

The silhouette of this particular path bears strong resemblance to the average experience shown on the previous slide.

Direct benefits (teal bars) and deferred benefits (orange bars) of standard tax-loss harvesting strategies for an estate/donation disposition in the S&P 500 launched in January 1980. Tax alpha (purple line) is the sum of the direct and deferred benefits.

Direct and Deferred Benefits: Bear Market



This silhouette of this particular path differs materially from the average.

Direct benefits (teal bars) and deferred benefits (orange bars) of standard tax-loss harvesting strategies for an estate/donation disposition in the S&P 500 launched in January 1999. Tax alpha (purple line) is the sum of the direct and deferred benefits.

Summary

1 How does tax-loss harvesting work?

A tax-loss harvesting strategy allows taxable investors to:

- Delay tax payments, or to avoid them entirely.
- More fully retain realized returns from tax-inefficient classes.

An abundance of securities that declined in value has made US equity a natural setting for tax-loss harvesting.

Optimal tax-loss harvesting is facilitated by factor models.

2

How effective has tax-loss harvesting been over time?

Tax Alpha

- Was uniformly positive at a 10-year horizon for the 408 strategies.
- Was higher in bear markets.

Tracking Error

- Was sensitive to market conditions.
- Drifted by an average of 0.28 basis points/month, or 0.67% over 20 years.

Tax Information Ratio

- Was uniformly positive at all horizons for estate/donation.
- Had a median value of 0.88 at a 20-year horizon (estate), which compares favorably with top-quartile active managers.

3

What is the relative importance of direct versus deferred benefits?

Tax-loss harvesting provided benefits through both immediate reduction in tax liability (direct) and the time value of postponing tax liability (deferred). Benefits varied depending on time horizon and market conditions.

Conditions That Provided Greater Value

	Time Horizon	Market Conditions
Direct	Earlier in life cycle	Turbulent, declining markets
Deferred	Later in life cycle	Calm, upward-trending markets

Executive Summary

Tax-loss harvesting allowed investors to more fully retain realized gains from tax-inefficient classes by delaying or avoiding payments.

At a 10-year horizon, tax alpha was uniformly positive for the 408 estate strategies tested, and higher in bear markets.

The direct and deferred benefits varied depending upon time horizon and market conditions. Direct provided more value early and in bear markets. Deferred benefits were seen more later and in bull markets.

Investor experiences vary. However, in our historical study, tax-loss harvesting paid off for taxable investors.

Thank You



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Notes for Individual Slides

Slide 5

This slide illustrates that regardless of the type of year the market has (up, down, or flat), there will always be stocks with positive returns as well as those with negative returns. We believe that, in any given year, even in an up-market year, there will be opportunities to utilize tax-loss harvesting strategies.

Slide 9

This illustration is a graphical representation of the optimization process following the sale of securities in a hypothetical taxable investor's portfolio. For the purposes of realizing tax losses, we will seek to purchase a replacement group of securities of similar quantitative characteristics such that the portfolio, following the tax sales, may continue to have the same or similar characteristics, including tracking error, volatility, P/E, P/B, and top-three sector weightings. An individual investor's results, including your results, may differ. This is not a recommendation or solicitation or offer to purchase securities. Investment in securities entails risk, including the risk you may lose some or all of your investment.

Slide 12

- The performance of a taxable strategy is sensitive to its age as well as market attributes such as turbulence. We address this by aggregating characteristics of tax-loss harvesting strategies over many historical periods and at different investment horizons.
- Study assumptions: We launch long-horizon, tax-loss harvesting strategies in the S&P 500 monthly over the period from January 1973 to February 2016. To avoid risk associated with leverage, we disallow short positions, and we set tax rates to the highest US federal level as of February 2016. Our portfolio construction process relies on factor-based, mean-variance optimization, and we rebalance monthly.

Slide 13

To create the after-tax returns for the benchmark, we constructed back-tested portfolios that approximated the performance of an index fund in a separately managed account. These portfolios had very high aversion to tracking error. Portfolio trading was optimized in order to follow index changes and corporate actions, as well as dividend reinvestment.

Notes for Individual Slides

Slide 14

- The most tangible measure of the effectiveness of tax-loss harvesting index tracking is the spendable benefit to the investor: tax alpha, the difference between after-tax returns of a portfolio and its benchmark.
- Like many quantitative investment strategies, tax-loss harvesting strives to generate return while controlling risk. In a standard tax-loss harvesting strategy, tracking error is an important performance metric, as risk is measured as tracking error against a benchmark.

Slide 16

- We present ranges of tax alpha observed in our study. To highlight the aging process of tax-loss harvesting strategies, we show outcomes at horizons of 5, 10, and 20 years. At each horizon, we generate a box-and-whiskers plot, which identifies the median outcome, the 25th and 75th percentiles delimiting the interquartile range, and the worst and best cases at the extremes. We believe this provides a concise presentation of the ranges of historical outcomes at fixed horizons achieved by strategies in different periods. We also examine the relationship between index return and tax alpha in slide 17.
- Historically observed tax alpha generated in our empirical study is shown here. The chart in the left panel shows that estate/donation tax alpha was uniformly positive over the 43-year study period at horizons of 5, 10, and 20 years. As the strategy aged, the median annualized return declined and the range of outcomes compressed. Post-liquidation tax alpha is shown in the right panel. The results were uniformly positive at 10- and 20-year horizons. However, at a 5-year horizon, the tax-loss harvesting strategy underperformed its benchmark for strategies beginning September 1974, November 1995, August 1998, and July 2003. In three of the four cases, the tax alpha was relatively low prior to liquidation. For the strategy beginning August 1998, severe market losses in year five led to a preponderance of short-term gains at liquidation. In contrast to the estate/donation disposition, median liquidation after-tax returns showed little horizon dependence, since liquidation costs tended to decline as the investment horizon grew. This can be explained, at least in part, by the prevalence of short-term gains in younger tax-loss harvesting strategies.

Notes for Individual Slides

Slide 17

We explore the relationship between tax alpha and index return. Like the purchase of bonds or put options, tax-loss harvesting performs best when markets are turbulent and in decline. This figure shows average tax alpha (orange bars) sorted by quintiles of index returns. As the index averages (teal bars) decline, the average tax alpha increases.

Slide 18

We look at the characteristics of forecast tracking error of tax-loss harvesting strategies.* Forecast tracking error is an essential input to the construction of a tax-loss harvesting portfolio, and it is sensitive to prevailing market volatility. For example, in the turbulence of 2008, tracking errors of tax-loss harvesting strategies of all horizons tended to increase. Then, as volatility levels normalized in 2009, tracking error of tax-loss harvesting strategies tended to diminish. This is illustrated in the figure on this slide, which shows ranges of tracking error by date (and not by horizon). Nevertheless, there is an identifiable drift in the tracking error of a tax-loss harvesting strategy as it ages. Using an analysis that controls for period-specific effects, we find that tracking error of the S&P 500-tracking tax-loss harvesting strategy increased, on average, by 0.0028% per month. That translates to an average of 0.67%, over an investment horizon of 20 years.

*We focus on forecast pre-tax, post-trade tracking error since it is an essential element of our portfolio construction process, and it avoids technical complications inherent in realized tracking error, after-tax tracking error, and pre-trade tracking error. Realized tracking error is averaged over disparate volatility regimes. After-tax tracking error intertwines tax alpha and pre-tax tracking return. Pre-trade tracking error can be artificially high due to unresolved corporate actions.

Slide 19

We illustrate tracking error drift by reverting to a horizon-based presentation. The average upward drift of 0.67% for 20-year strategies in their golden years corresponds roughly to the change in median value from the youthful five-year strategies. The largest tracking errors we observed were just over 2.5%, and they correspond to dates just before the bursting of the Internet bubble (to put this in perspective, a typical active strategy has a tracking error of 5% or more). As a consequence of the run-up in equity prices that preceded that crisis, tax-loss harvesting strategies included substantial amounts of appreciated equity. In order to avoid a tax bill, optimized tax-loss harvesting strategies were forced to increase tracking error. When the bubble burst and equity values fell, tracking error decreased to more ordinary levels.

Notes for Individual Slides

Slide 20

- The tax information ratio is average tax alpha per unit of realized tracking error; it is analogous to the risk-adjusted return measure used to evaluate active managers. We show ranges of historical tax alpha for the estate/donation disposition at horizons of 5, 10, and 20 years. The decline and compression that accompany the aging process reflect both the corresponding effects in tax alpha shown in the left panel on slide 16.
- The tax information ratio for the liquidation case uses the average tax alpha after liquidation for the numerator and the realized tracking error for the estate/donation case for the denominator of the risk/return ratio. The realized tracking error of the estate/donation case is used because a portfolio can only be liquidated once, which makes calculating a series of liquidation returns difficult.

Slide 22

The data presented in this article are based on a sequence of 10-year S&P 500 tax-loss harvesting strategies with monthly inception dates beginning with January 1973 and ending with December 2005. The initial investments are all cash, and dividends are reinvested. Portfolios are constructed using Barra's tax-aware optimizer. For the sake of reproducibility, we include the optimizer settings that we used to construct our portfolios in the table to the right.

Setting Name	Value
Short-Term Capital Gains Rate	43.4%
Long-Term Capital Gains Rate	23.8%
Tax_Mult, Short_Mult, Long_Mult	1
Risk Aversion	1
Risk Aversion Ratio	0.1
Transaction Costs	6 bps
Asset Upper Bound	None
Asset Lower Bound	0%
Max Assets	None
Max Turnover	None
Baseline Strategy	Standard

Slide 24

This figure shows average sizes of the direct and deferred components of tax alpha of S&P 500 tax-loss harvesting strategies at horizons ranging from one year to 10 years from strategy inception. The averages were obtained from historical simulations over the 43-year period from January 1973 to December 2015. At shorter horizons, the direct benefits (teal bars) dominated delayed benefits (orange bars), while the reverse was true at longer horizons. The average total benefit (purple line) grew inexorably with horizon. Before six years, the total benefit of tax-loss harvesting was dominated by the direct benefit, on average; while after six years, the deferred benefit provided the majority of the value.

Notes for Individual Slides

Slides 25 and 26

- The two benefits may act differently in different market conditions. In a rising market, reinvestment of the saved taxes generates a deferred benefit through compounding. Since losses are abundant in turbulent periods when markets tend to decline, direct and deferred benefits of tax-loss harvesting tend to accrue at different times. The combination of the two, which for the purposes of this presentation we'll call "total tax alpha," provides the full value, the excess over index return earned by a tax-loss harvesting investor.
- The historical trajectories that contribute to the averages shown on slide 24 represent a wide range of outcomes. On slides 25 and 26, we show two actual trajectories, neither of which resembles the average. On slide 25, we look at a portfolio launched in January 1980. The S&P 500 returned more than 30% that year, and it prospered over the ensuing decade. Direct benefits of tax-loss harvesting accumulated more and more slowly, while the growth of deferred benefits accelerated. On slide 26, we look at a portfolio launched in January 1999. Turbulence in the wake of the Internet bubble and the global financial crisis led to larger direct benefits of tax-loss harvesting. However, the poor performance of the market led to lower deferred benefits.
- Taken together, the two historical trajectories illustrate the tendency of tax alpha to be higher in bear markets. The annualized tax alpha for the portfolio that was launched into the bull market of the 1980s was 1.72%. In contrast, the portfolio that ran over the turbulent period beginning in 1999 earned 2.92% in tax alpha.
- Even though the annualized tax alpha was higher in the turbulent period beginning in 1999 than in the bull market of the 1980s, the cumulative tax alpha was higher in the bull market. That is due to compounding effects. For the bull market run starting in January 1980, the annualized after-tax portfolio return was 18.4% and the annualized index return was 16.7%, with a difference of 1.7% per year. On a cumulative basis, the returns were 440.5% and 366.8%, respectively, with a difference of 73.6%. For the turbulent market run starting in January 1999, the annualized after-tax portfolio return was 1.1% and the annualized index return was -1.8%, with a difference of 2.9% per year. On a cumulative basis, the numbers were -16.5% and 11.8%, respectively, with a difference of 28.4%.

Notes for Individual Slides

Slide 29

- Tax-loss harvesting can generate value for taxable investors by facilitating delay, or even avoidance, of tax payments.
- This study quantifies the value that has been created historically through the simulation of tax-loss harvesting strategies that tracked the S&P 500 during the 43-year period from January 1973 to February 2016.
- We highlight the life cycle of a tax-loss harvesting strategy as well as path dependence and sensitivity to market conditions by presenting ranges of simulated tax alpha, tracking error, and tax information ratios at horizons of 5, 10, and 20 years.
- Over the 43-year study period from January 1973 to February 2016, the strategy's tax alpha was uniformly positive, gross of fees, on an estate/donation basis at horizons up to 20 years. With the exception of a 5-year horizon, the same was true post-liquidation. An important difference between the two dispositions is that the median estate/donation return declined as the strategy aged, while the median liquidation return was relatively insensitive to horizon. Tax-loss harvesting delivered its strongest returns in turbulent periods when markets were in decline.
- Our preferred measure of relative risk, forecast tracking error, tended to drift upward as our strategy aged, by an average of 0.67% at a 20-year horizon. 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.

Slide 31

- Financial markets are rife with uncertainty. We believe that tax-loss harvesting stands apart from other investment strategies by having a clearly defined profile of return and risk. We further believe that, based upon the simulated data described in this article, ultra-high-net-worth investors in the US who employed a disciplined loss-harvesting strategy that tracked the S&P 500 over the past half century may have been almost uniformly rewarded.

Disclosure

The information contained within this presentation was carefully compiled from sources Aperio believes to be reliable, but we cannot guarantee accuracy. We provide this information with the understanding that we are not engaged in rendering legal, accounting, or tax services. In particular, none of the examples should be considered advice tailored to the needs of any specific investor. We recommend that all investors seek out the services of competent professionals in any of the aforementioned areas.

The performance results reflected in the tables and charts in this report are hypothetical, shown for illustrative purposes only, and not based on actual investments. Furthermore, they do not reflect the deduction of any management fees, which would lower performance returns. The performance does include 0.06% one-way transaction costs (4bps one-way spread + 2bps in trading costs). The use of hypothetical performance has significant limitations, some of which are described below.

Back-testing involves simulation of a quantitative investment model by applying all rules, thresholds, and strategies to a hypothetical portfolio during a specific market period and measuring the changes in value of the hypothetical portfolio based on the actual market prices of portfolio securities. Investors should be aware of the following: 1) Back-tested performance does not represent actual trading in an account and should not be interpreted as such; 2) back-tested performance does not reflect the impact that material economic and market factors might have had on the manager's decision-making process if the manager were actually managing client's assets; and 3) there is no indication that the back-tested performance would have been achieved by a manager had the program been activated during the periods presented in this study. For back-tested performance comparisons, the benchmark returns are simulated using historical constituents' weights and total returns.

The **Russell 3000® Index** is an equity benchmark for US stock performance. It is a capitalization-weighted index covering the largest 3,000 publicly traded US stocks. The index represents approximately 98% of the total market capitalization of the US stock market.

The **S&P 500® Total Return Index** is an unmanaged group of equities representing the large-cap sector of the US domestic market. Index returns reflect reinvestment of dividends but do not reflect fees, brokerage commissions, or other expenses of investing.

With respect to the description of any investment strategies, simulations, or investment recommendations, we cannot provide any assurances that they will perform as expected and as described in our materials. Past performance is not indicative of future results. Every investment program has the potential for loss as well as gain.

Disclosure *(continued)*

In the estate/donation version of the analysis, any portfolio reflects realized capital gains over the course of the holding period, be it 5, 10, or 20 years. At the end of the period, the hypothetical account is presumed to be either passed through an estate (and subject to basis step-up) or donated to a charity for which the taxpayer receives a full income tax deduction. In both cases, any unrealized gain built up since the inception of the portfolio would not be subject to income tax, although it could be subject to estate tax in the estate case. The average after-tax return is generally higher for the estate/donation case than for the liquidation case since, in the former, the final unrealized gain is never subject to income tax. If a portfolio were held over a period where the value declined, then the relationship between the estate/donation and the liquidation cases could conceivably change; so mathematically, it is not always the case that in every situation the after-tax return for the estate/donation disposition would automatically be higher than that for the liquidation disposition.

In the liquidation version of the analysis, the ongoing realized gains or losses are treated the same way they are in the estate/donation case, i.e., taxed on an ongoing basis over the period studied. Then, at the end of any holding period, be it 5, 10, or 20 years, all assets in the portfolio are presumed to be sold off at the end of the final year. The after-tax returns then reflect payment of that final tax liability at the capital gains rate (long-term or short-term, as appropriate) applied to the taxable gain, i.e., the difference between the ending market value and the final cost basis.

Dividends are not subject to taxation for either the loss-harvesting portfolios or the benchmark portfolios, based on the assumption that the dividend payments would, on average, be the same for both strategies.

Tax alpha is reinvested on a monthly basis.

Our historical study benefits from the correction of data errors that may have been present on analysis dates.

We use federal-only tax rates as of February 2016 throughout our study: 23.8% for long-term gains, and 43.4% for short-term gains.