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Loss Harvesting or Gain Deferral? A Surprising Source of Tax Benefits of Tax-Aware Long-Short Strategies

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KEY FINDINGS

- The high magnitude of net losses observed for tax-aware long-short factor strategies is achieved by deferring the realization of taxable gains while continuing to realize tax losses as a part of the natural strategy portfolio turnover.
- Much like tax-agnostic factor strategies, tax-aware factor strategies mostly trade in accordance with the alpha model, which explains the ability of tax-aware long-short factor strategies to outperform their benchmarks before tax.
- Tax-aware long-short factor strategies primarily rely on liquidating loss positions and creating new positions when following the recommendations of factor-based alpha models.

ABSTRACT

Liberman et al. (2023) showed that tax-aware long-short factor strategies, within the first three years since inception, can realize cumulative net capital losses exceeding 100% of initially invested capital, all while generating a significant pre-tax alpha. This article explores the mechanism behind these remarkable results. Surprisingly, in tax-aware long-short factor strategies, net capital losses arise not from an increased realization of capital losses but rather from the deferral of capital gains, especially short-term gains on long positions. Despite reducing the gain realization, these strategies still allocate most of their turnover to trading in the direction of the alpha model, which explains their strong pre-tax performance. To achieve alignment with the alpha model, these strategies mostly rely on creating new positions and liquidating loss positions while avoiding the liquidation of gain positions.

In a recent article, Liberman, Krasner, Sosner, and Freitas (2023), hereafter referred to as LKSF, show that tax-aware long-short factor strategies can be highly effective at realizing net capital losses while simultaneously achieving significant pre-tax alpha. What exactly is the trading process underlying this result? Due to the popularity of direct-indexing strategies, realization of net capital losses by a tax-aware strategy is generally expected to be a consequence of loss harvesting. (For recent examples of the literature on direct indexing see Chaudhuri et al. 2020; Anderson and Kourtidis 2022; Israelov and Lu 2022; Shalett et al. 2022; Sosner et al. 2022; Bouchey et al. 2023).

As a result, one might infer that the strategies described in LKSF are merely another variation on loss harvesting. However, as we will see in this article, for tax-aware

long-short factor strategies, loss realization works quite differently from traditional long-only loss harvesting.

Why does this distinction matter? Tax-aware long-short strategies represent a nascent yet promising area of tax-efficient investing. Before adopting this novel approach, investors and their advisers should develop a better understanding of the process upon which these strategies rely for their net tax-loss realization. We argue that, in the context of tax-aware long-short strategies, conventional terms like "tax-loss harvesting" or "loss harvesting" are misnomers and, as a result, hinder rather than facilitate the understanding of these strategies.

What exactly is loss harvesting? An early study by Berkin and Ye (2003) offers the following definition: "'Loss harvesting' refers to realizing losses by selling shares that have fallen below the original cost to generate tax credits." Over time, especially in connection with direct indexing strategies where the underlying passive index turnover is generally low, loss harvesting has evolved to represent trading executed solely to achieve a tax result. Hence, a more recent definition in Israelov and Lu (2022) states that "[t]ax-loss harvesting (TLH) is the strategic act of realizing some losses for the specific purpose of offsetting an existing or future potential capital gain in order to reduce capital gains tax liabilities." In this context, loss harvesting is often described as an "overlay" (see, for example, Shalett et al. 2022). In other words, it is not inherently part of the pre-tax economics of a passive index, but rather constitutes a series of trading decisions driven by tax considerations. In accordance with the prevailing terminology, when we use the term "loss harvesting" in this article, we are referring to this purely tax-motivated "overlay" activity.

In contrast to direct indexing, for *factor* investing, portfolio turnover is primarily driven by the underlying investment strategy. *Tax-aware factor* strategies, first described in Apelfeld et al. (1996), are designed to balance alpha-model-induced turnover with the tax consequences of trading, all aimed at enhancing after-tax strategy returns. Furthermore, in a seminal article on *tax-aware long-short factor* investing, Sialm and Sosner (2018) show that, for actively managed factor strategies, the main effect of tax awareness is a reduction in the realization of capital gains, mostly short-term capital gains. In their article, it is this reduction in realized short-term gains that transforms the total realized net *gains* observed for a simulated *tax-agnostic* long-short factor strategy into total realized net *losses* for a *tax-aware* long-short factor strategy. In other words, the results in Sialm and Sosner (2018) suggest that gain deferral, rather than loss harvesting, is the primary source of tax efficiency observed for tax-aware factor strategies.

While Sialm and Sosner (2018) offer an initial insight into the source of net loss realization in tax-aware long-short factor strategies, they do not specifically address either the magnitude of the cumulative net capital losses achievable by the strategy or the changes in trading patterns that drive their results. In a subsequent study, LKSF showed that tax-aware long-short factor strategies can realize cumulative net capital losses exceeding 100% of initially invested capital within just two to three years of inception. This prompts a question: *Can such a substantial level of net loss realization still be attributed to gain deferral rather than loss harvesting?* Furthermore, LKSF showed that their tax-aware long-short factor strategies, based on a simple value-momentum-quality factor model, were realizing information ratios as high as 0.4, net of transaction and financing costs, at the same time as they were achieving a cumulative net capital loss well in excess of 100% of initially invested capital. This raises a second question: *How can a strategy continue to pursue the implementation of a factor-based alpha model when realizing tax losses of such significant magnitude?*

This article provides evidence that the answer to the first question posed in the previous paragraph is "yes." It then delves into the mechanics of tax-aware rebalancing to address the second question. Using LKSF as a starting point, we conduct a detailed analysis of gain and loss realization patterns. We find that the high magnitude of net

losses observed for tax-aware long-short factor strategies is achieved by deferring the realization of taxable gains while continuing to realize tax losses. Importantly, these losses are realized as part of the natural strategy portfolio turnover. Further examination of trading patterns of the strategies reveals that, much like tax-agnostic strategies, tax-aware strategies mostly trade in accordance with the alpha model. This explains the ability of tax-aware long-short factor strategies to outperform their benchmarks before tax.

The remainder of this article is divided into four sections. The first section describes our strategy simulation methodology. The second section compares a tax-aware long-short factor strategy and a corresponding tax-agnostic strategy in terms of their gain and loss realization patterns and pre-tax returns. The third section examines the propensity of the tax-aware and tax-agnostic strategies to trade in the direction of the factor-based alpha model. The last section concludes and summarizes key findings.

SIMULATION METHODOLOGY

We model a *composite long-short strategy* that closely follows the methodology described in LKSF. LKSF constructed two types of tax-aware long-short strategies: relaxed-constraint (RC) and composite long-short (CLS). These two strategies represent alternative approaches to long-short factor investing that differ in the way they implement index beta. RC strategies express index beta using *individual stocks*. For example, a 150/50 strategy would hold 150% of its net asset value (NAV) in long stock positions and 50% of its NAV in short stock positions. In contrast, CLS strategies implement index beta by holding an *index fund*, such as a passive mutual fund or an ETF, and only use individual stocks to put on equally sized long and short extensions. For example, a 150/50 strategy would hold 100% of its NAV in an index fund, 50% of its NAV in long stock positions, and the same 50% of its NAV in short stock positions.

We focus on CLS, rather than RC, strategies because they allow us to completely isolate trades driven by the alpha model from those driven by index beta. In contrast, trades of RC strategies combine alpha and beta motives, thus, reducing the accuracy of the analysis of alpha-driven trading, which is one of the main objectives of this article. Having said that, we find that gain and loss realization patterns for RC and CLS strategies look very similar. For the sake of brevity, we only show CLS strategy results.

LKSF modeled strategies with three levels of leverage and tracking error (TE)—150/50 at 2% TE, 200/100 at 4% TE, and 250/150 at 6% TE. In this article, we present only the 250/150 6% TE strategy. The results for lower leverage strategies are qualitatively the same, and, therefore, we omit them here for brevity.

Following LKSF, our CLS strategies consist of a passive index fund, a hypothetical Russell 1000 fund, and a beta-zero long-short portfolio of individual stocks, also known as a market-neutral portfolio. The leverage of the long-short portfolio comprised of individual stocks is 150% of the NAV long and 150% of the NAV short. The target annual volatility of this long-short portfolio is 6%. That is, the overall CLS strategies have a beta of 1.0 with respect to the Russell 1000 index and a TE of 6% to this index.

We construct two types of 250/150 CLS strategies: tax-aware and tax-agnostic. The two strategies are identical in every respect, including the alpha model, risk model, transaction-cost model, market beta, TE, leverage, and rebalancing schedule. The only difference is that the tax-agnostic strategy removes the tax term from the objective function of the long-short portfolio optimization routine, focusing exclusively on maximizing net-of-transaction-costs alpha, subject to volatility, leverage, and beta-zero constraints. Modeling the two strategies side by side allows us to isolate and study the effects of tax awareness on trading patterns in a strictly controlled environment.

We rebalance the strategy portfolios monthly. In each monthly rebalance, we adjust the weights of the index fund and the long-short stock portfolio to maintain

a beta-one index exposure as well as the target leverage and TE of the overall CLS strategy.[1] All the trading associated with alpha and tax management is executed solely within the long-short component of the strategy.[2] Expected pre-tax returns are derived from an alpha model based on value, momentum, and quality investment themes, or factors, with each factor receiving an equal risk weight.[3]

For each strategy, we simulate 34 three-year-long histories. The simulations begin in January of each year from 1986 to 2019, with the last three-year simulation starting in January 2019 and ending in December 2021. Once a strategy is seeded on the first day of the simulation, there are no contributions or redemptions of capital during the simulation period.

Appendix A provides further details of the strategy simulations.

GAIN AND LOSS REALIZATION PATTERNS AND PRE-TAX RETURNS

We begin by summarizing cumulative gains and losses realized by the tax-agnostic and tax-aware long-short factor strategies during the first three years since inception—a period over which the tax-aware strategy reliably achieves a cumulative net capital loss of 100% or more. As a preview, Exhibit 1 shows our main result:

> *For tax-aware long-short factor strategies, net capital losses arise not from increasing the realization of capital losses but rather from deferring the realization of capital gains, mostly, short-term gains on long positions.*

While we will rely on three-year simulations, it's important to note that all conclusions drawn from these simulations also apply to ten-year histories. For brevity, we have chosen to include only the three-year results in the main text. However, for completeness, the chart confirming the main result with ten-year histories is provided in Appendix B.

Exhibit 1, Panel A, compares total *gross realized gains* (aggregated across long-term and short-term characters) of tax-agnostic and tax-aware strategies. As can be seen from the exhibit, there is a drastic drop in the realization of capital gains: The median three-year cumulative gain for the tax-agnostic strategy is about 140% compared to only about 30% for the tax-aware strategy. The 10th to 90th percentile ranges for the two strategies are not even close to overlapping.

Exhibit 1, Panel B, compares total *gross realized losses* (aggregated across long-term and short-term characters) of tax-agnostic and tax-aware strategies. The median three-year cumulative loss for the tax-agnostic and tax-aware strategy is quite similar, at around 150% and 160%, respectively. The 10th to 90th percentile ranges for the two strategies overlap almost exactly.

In Exhibit 1, Panel C, we *net all realized capital gains and losses* across all characters. First, we note that the median three-year cumulative result for the tax-agnostic

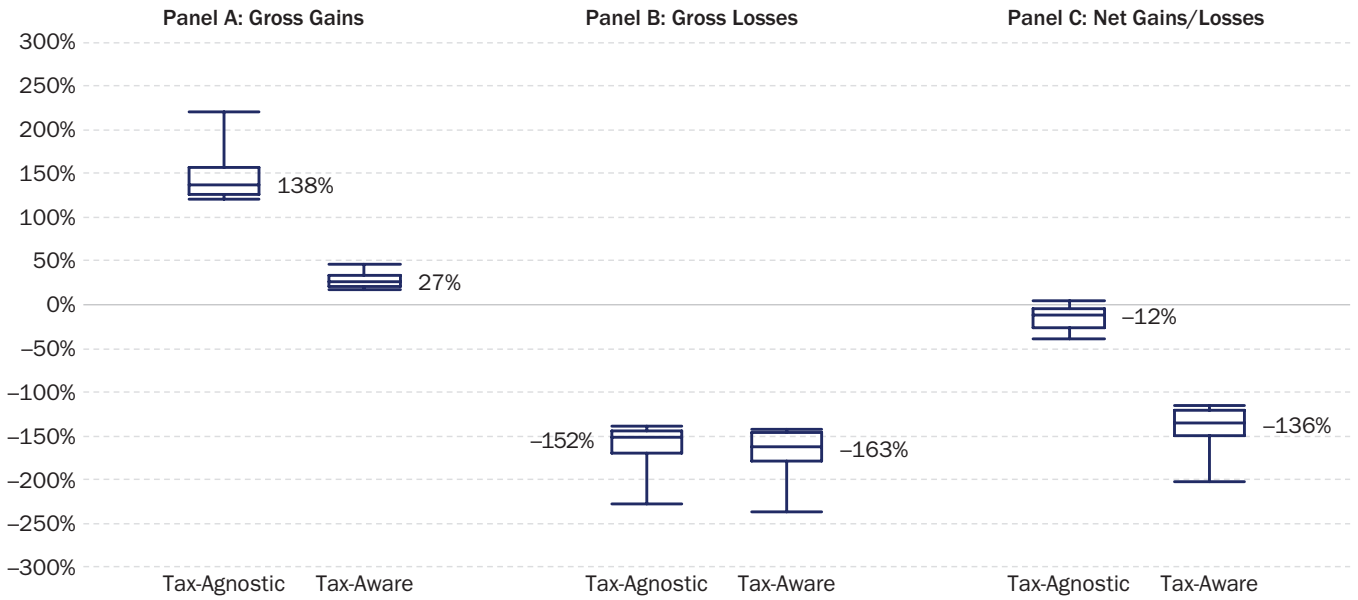
[1] In theory, adjustments between the index fund and long-short components of the CLS strategy can result in reduction in tax efficiency of the overall strategy. However, in practice, we find the tax impact of these adjustments to be negligible.

[2] Whereas there could be opportunities for realizing losses on the index fund component of the CLS strategy, we leave this topic for future research. Realizing a loss on an index fund would require replacing it with another economically similar fund, and whether one fund is "substantially identical" to another for the purposes of wash sale rule is a complex legal issue (see, for example, Matthews 2016). For example, Aked et al. (2019) mention wash sales as a potential problem but abstract away from it in their analysis of loss harvesting with ETFs.

[3] Asness et al. (2015, p. 45) discuss value, momentum, and defensive investment styles and emphasize the importance of combining them together in one portfolio: "While each of the styles employed is strong by itself, they also naturally diversify each other […] to provide even stronger performance."

EXHIBIT 1

Three-Year Cumulative Gains and Losses Realized by the Strategies, as Percentage of Initially Invested Capital



NOTES: This exhibit shows total aggregate gains and losses realized during the first three years since inception as a percentage of initially invested capital. The boxes show the 25th, 50th, and 75th percentiles of aggregate gains and losses across 34 three-year-long vintages and the whiskers show their 10th and the 90th percentiles.

long-short factor strategy is a *net loss* of about 10%. However, this net loss is not statistically significant because the 90th percentile result is a small net gain. So, statistically speaking, the tax-agnostic long-short factor strategy modeled herein has the propensity to defer all its active pre-tax returns generated by the long-short component of the CLS strategy (and we will show shortly that the strategy does realize substantial active pre-tax returns). This phenomenon characteristic of long-short factor strategies was first brought to light in Liberman et at. (2020): The CLS strategy separates alpha from beta and thus avoids realizing gains on the passive index appreciation.[4] At the same time, the turnover of the factor strategy might not be high enough to realize all the pre-tax returns of the long-short component as taxable gains.[5]

Further, Exhibit 1, Panel C, shows that during the first three years since inception, the tax-aware long-short strategy realizes a very significant median net loss of about 130% of initially invested capital. The entire 10th to 90th percentile range for the strategy is below a 100% loss. This ability of tax-aware long-short factor strategies to realize net capital losses has been previously described in Sialm and Sosner (2018)

[4] Liberman et al. (2020) find that their CLS strategy partially defers and partially realizes the economic profit in an average year. That is, in Liberman et al. (2020), on average, there is an annual realized net gain, not a net loss, like we see here. However, their simulation runs for a 33-year-long continuous period from 1985 to 2018, whereas our simulations run for three years only. We expect that over the long run some of the gains initially deferred by the tax-agnostic long-short strategy will be realized, resulting in the net capital gain observed in Liberman et at (2020).

[5] Note that, while the statement that separating alpha from beta avoids realizing gains on the passive index appreciation is mechanically true, the tendency of the long-short component of the tax-agnostic CLS strategy to defer its pre-tax profits might be specific to the factor strategy modeled in this article. Other tax-agnostic factor strategies could potentially realize a larger portion of the long-short component's profits as taxable gains. We do not expect that this would qualitatively impact our conclusions about the source of tax efficiency of tax-aware strategies. Therefore, we leave further exploration of this topic for future research.

and Liberman et al. (2020). Both articles show that even tax-agnostic long-short factor strategies are relatively tax-efficient, and that introduction of tax-aware rebalancing can further enhance their tax efficiency. It is worth emphasizing once again that, as we have seen in Exhibit 1, Panels A and B, the main source of this tax efficiency is in deferral of capital gains, not in a greater realization of capital losses.

Exhibit 2 provides further intuition behind this result. It shows *gross* gains and losses by side—long and short positions. Within long positions, realized gains and losses are further categorized by character—long-term and short-term. All the realized gains and losses on short positions are treated as short-term.[6]

Exhibit 2, Panels A, B, and C, show gross realized losses. There is not much difference between the tax-agnostic and tax-aware strategies in terms of long-term losses in either of the three categories of losses.

With realized losses out of the way, we can focus on the main source of differences between the tax-agnostic and tax-aware strategies—gross realized gains. These are shown in Exhibit 2, Panels D, E, and F. Although there is a difference between long-term gains realized by the tax-agnostic and tax-aware strategies, the most significant reduction in gross realized gains, which we have seen in Exhibit 1, comes from the reduced realization of short-term gains, particularly short-term gains on long positions.

In summary, the evidence presented in Exhibit 2 shows that, surprisingly, the most significant contributor to the difference in net realized losses between the tax-aware and tax-agnostic long-short factor strategies is not an increase in realized losses but rather a reduction in realized short-term gains, especially on long positions. As a result, characterizing the net loss realization within these strategies as "loss harvesting" misrepresents the true impact of tax awareness.

Considering the significant deferral of short-term gains achieved by the tax-aware strategy in the first three years since inception, can it still generate pre-tax profits during this time? In Panels A and B, respectively, Exhibit 3 shows the median annualized and three-year cumulative pre-tax alpha over the corresponding three-year period. During the three-year period since inception, the median tax-aware strategy delivers 12.1% less in cumulative pre-tax alpha than the tax-agnostic strategy (or 2.5% less when annualized). Nonetheless, the tax-aware strategy still outperforms the benchmark index 75% of the time, with median cumulative pre-tax alpha as high as 13.1% (or 3.2% annualized). Importantly, the left tail of performance distribution, that is, the 10th percentile of alpha, is similar for both the tax-aware and tax-agnostic strategies.

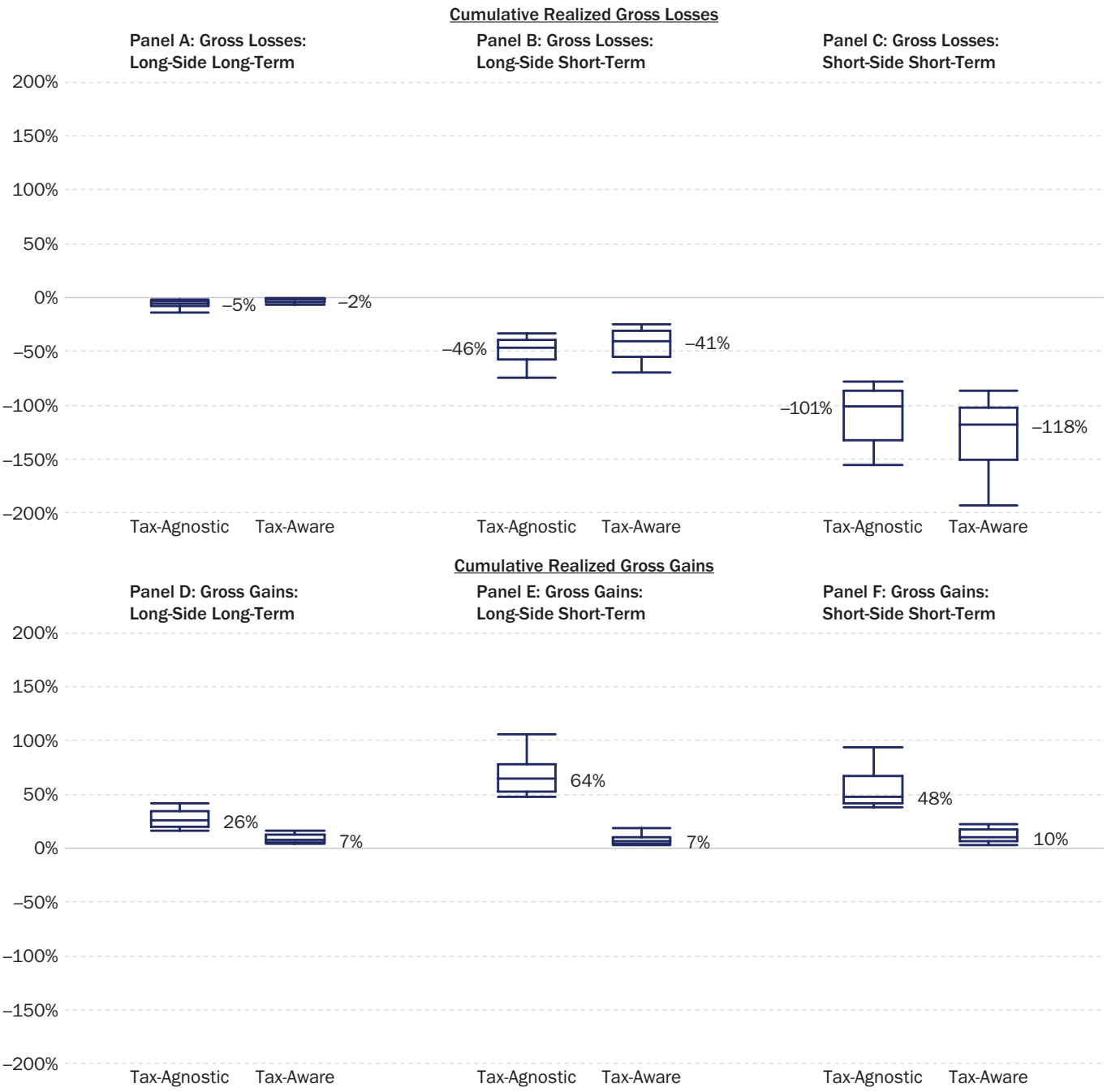
Importantly, from an after-tax-return perspective, the tradeoff is likely to be well worth it. By investing in the tax-aware instead of the tax-agnostic strategy, over a three-year period, an investor gives up about 12% in pre-tax return and, in return, achieves an approximately 125% greater cumulative net loss (see Exhibit 1, Panel C). If this net loss is fully utilized to offset long-term gains taxed at a 23.8% rate, its value to the investor is 30%, which is more than two times greater than the reduction in pre-tax return.[7]

[6] Treas Reg. § 1.1233-1(a)(3) provides that "the period for which a taxpayer holds property delivered to close a short sale determines whether long-term or short-term capital gain or loss results." In trading strategies, like the ones modeled in this study, short sales are closed through buy-to-cover transactions in which stocks are purchased and delivered immediately without accruing a holding period. Therefore, under Treas Reg. § 1.1233-1(a)(3), covering short positions results only in short-term gains or losses.

[7] The value of the loss can be far greater than 30% if it is used, in part or in full, to offset short-term gains taxed at a 40.8% rate rather than long-term gains taxed at a 23.8% rate, or if the investor resides in a state with a high state tax rate.

EXHIBIT 2

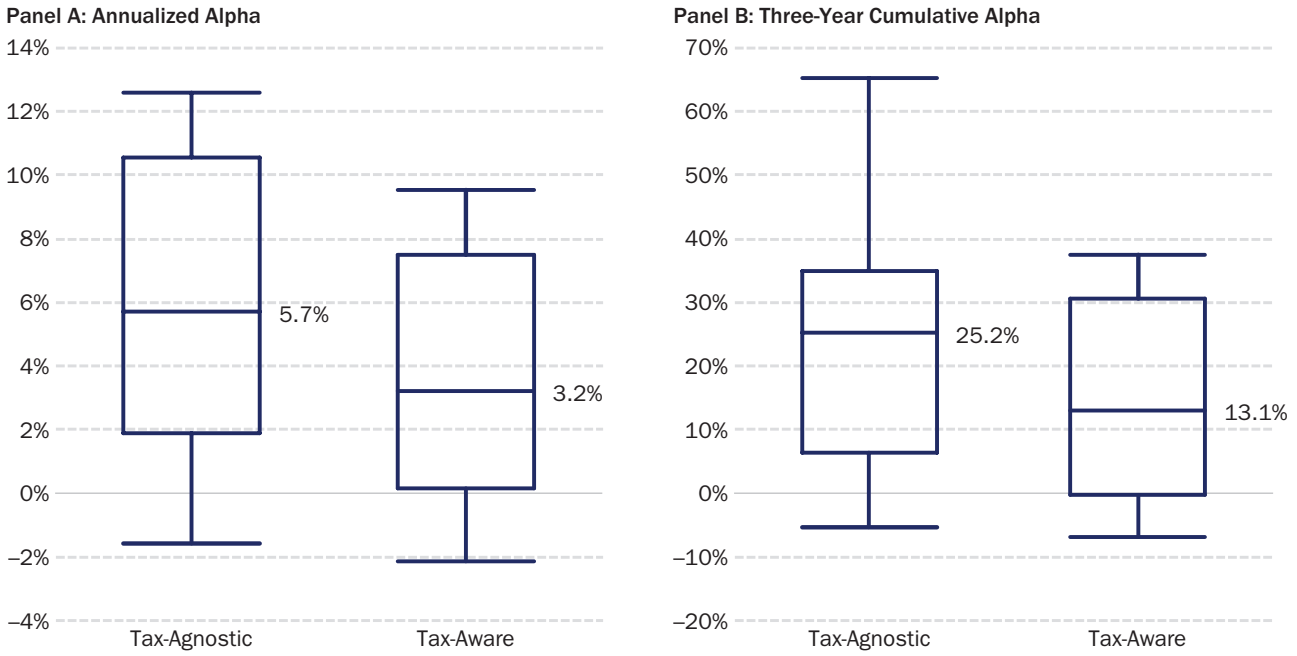
Three-Year Cumulative Gross Gains and Losses Realized by the Strategies, as Percentage of Initially Invested Capital



NOTES: This exhibit shows total aggregate gains and losses realized during the first three years since inception as a percentage of initially invested capital. The boxes show the 25th, 50th, and 75th percentiles of aggregate gains and losses across 34 three-year-long vintages and the whiskers show their 10th and the 90th percentiles.

EXHIBIT 3

Pre-Tax Alpha Realized by the Strategies



NOTES: This exhibit shows annualized and cumulative pre-tax alpha realized during the first three years since inception. Cumulative alpha is calculated as the geometrically compounded return of a strategy minus the geometrically compounded return of the Russell 1000 benchmark index. Annualized alpha is computed by taking the respective cumulative returns (plus 1.0), raising them to the power of 1/3, and then subtracting the annualized return of the benchmark from the annualized return of a strategy. The values shown are medians across 34 three-year-long vintages.

TRADING PATTERNS OF TAX-AGNOSTIC AND TAX-AWARE PORTFOLIOS

As we have seen in the previous section, capital gain and loss realizations are quite different between the tax-agnostic and tax-aware strategies. In this section, we explore how these differences arise from portfolio turnover patterns. Of particular interest for us is the extent to which the tax-aware strategy's trades follow the alpha model recommendations.

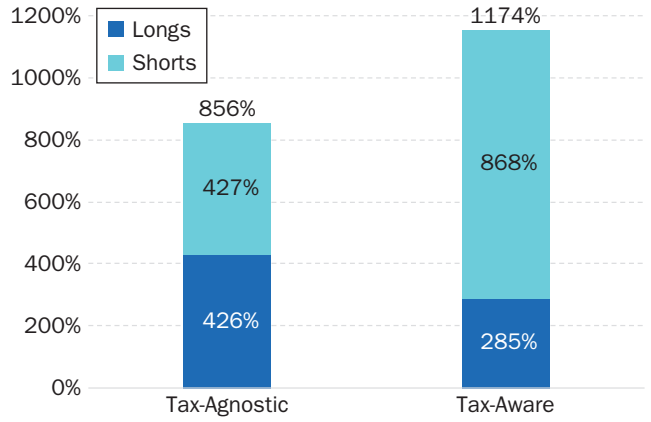
Exhibit 4 shows the median annual portfolio turnover, measured as annualized total dollar trading volume as a percent of the NAV, during the first three years since inception. The turnover is decomposed along two dimensions: long portfolio positions versus short portfolio positions and gain-realizing trades versus loss-realizing trades.

During our sample period, the equity market experienced significant appreciation. For example, the median three-year cumulative Russell 1000 index return was 44.4%, while the 25th and the 75th percentiles were 28.5% and 57.4%, respectively. One would expect that a tax-aware strategy would reduce its trading activity in long positions, which in rising markets tend to appreciate, and instead seek to implement alpha model recommendations using short positions, which in rising markets tend to depreciate. In contrast, a tax-agnostic strategy would disregard the potential realization of accumulated gains and losses, leading to a balanced turnover across long and short positions within the portfolio. This is exactly what we observe in Exhibit 4, Panel A. Whereas for the tax-agnostic strategy, the turnover is

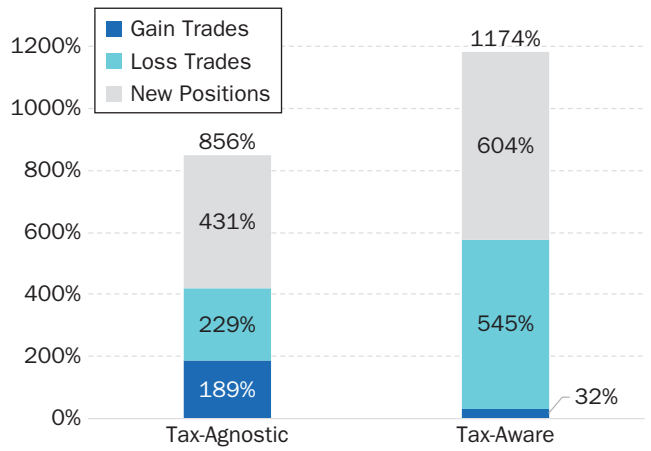
EXHIBIT 4

Strategy's Annualized Turnover Decomposition

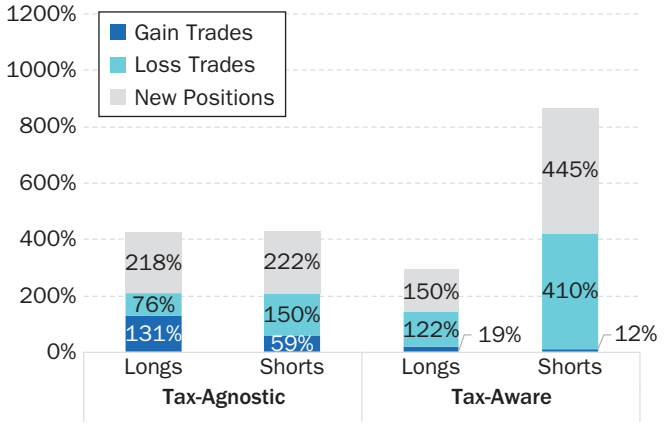
Panel A: Turnover Decomposition by Long and Short Positions



Panel B: Turnover Decomposition by Gain- and Loss-Realizing Trades



Panel C: Turnover Decomposition by Both Long and Short Positions and Gain- and Loss-Realizing Trades



NOTES: This exhibit shows annualized portfolio turnover during the first three years since inception. The turnover is defined as the sum of absolute value of all the buy and sell transactions divided by the NAV. The values shown are medians across 34 three-year-long vintages.

evenly divided between long and short positions, for the tax-aware strategy, only a quarter of the turnover comes from long positions, with three quarters coming from short positions.[8]

Exhibit 4, Panel B, decomposes the turnover along the second dimension of gain versus loss realization. For the tax-agnostic strategy, the volume of trading in gain and loss positions is similar and accounts for about half of the turnover, with the remaining half represented by opening new positions. For the tax-aware strategy, new positions also represent approximately half of portfolio turnover, but the other half is almost entirely due to trading loss positions. The tax-aware strategy barely trades gain positions. This observation is consistent with the gain deferral we saw in Exhibits 1 and 2.

Finally, Exhibit 4, Panel C, performs the decomposition along both dimensions—longs versus shorts and gain realization versus loss realization. The tax-agnostic strategy's decomposition is very symmetric: Long- and short-position turnover is virtually identical. The same symmetry can be observed for the trading of new positions and existing positions within both longs and shorts. The only lack of symmetry arises due to the strong market performance, which intuitively leads to more gain-realizing trades for the longs and more loss-realizing trades for the shorts. For the tax-aware strategy, most of the trading activity comes from the shorts, where practically all the trading of existing positions occurs within loss positions. For long positions, tax awareness drastically reduces the volume of gain-realizing trades and increases the volume of loss-realizing trades.

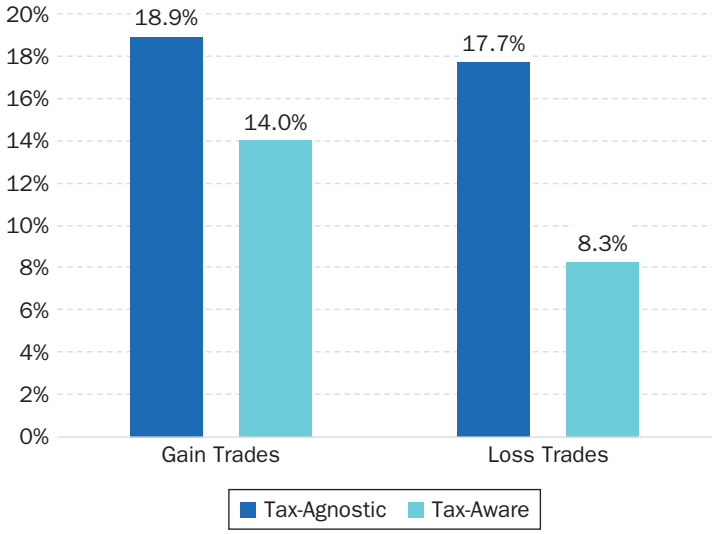
The results presented in Exhibit 4 raise two questions. First, if there is so much trading volume in loss-realizing trades, why didn't we see any increase in aggregate loss realization in Exhibits 1 and 2? Second, with such significant changes in trading patterns, how does the tax-aware strategy manage to retain any capacity for alpha generation?

Exhibit 5 helps answer the first question. It shows median realized dollar gain (or loss) as a fraction of size of the trade. The results are aggregated across long and short positions but separated by

[8] It is worth mentioning that, although the higher turnover leads to higher transaction costs, the impact on net-of-costs pre-tax returns is relatively small. An observed increase in the annual turnover by 320% results in an increase of 32 bps in annual transaction costs, assuming 10 bps transactions costs per dollar traded (see Appendix A for further details). Over a three-year period, this increase in transaction costs contributes about 1% to the 12.1% reduction in cumulative pre-tax alpha reported in Exhibit 3.

EXHIBIT 5

Realized Gains and Losses as a Percent of Trade Value



NOTES: This exhibit shows median realized gain or loss per dollar traded for tax-aware and tax-agnostic portfolios during the first three years since inception. For example, a median gain-realizing trade in a tax-agnostic portfolio will realize an $18.9 gain per each $100 position traded, and a median loss-realizing trade in a tax-agnostic portfolio will realize a $17.7 loss per each $100 position traded. The values shown are medians across 34 three-year-long vintages.

gain- and loss-realizing trades. In comparison to the tax-agnostic strategy, the tax-aware strategy tends to have a lower gain and loss realization per dollar traded, especially within loss-realizing trades. Although the loss-realizing turnover of tax-aware strategy is more than double that of the tax-agnostic strategy (see Exhibit 4, Panel B), the amount of loss realized per dollar traded by the former is less than half of what the latter realizes. As a result, the overall loss realization of the two strategies is almost identical (as previously seen in Exhibit 2, Panels A, B, and C).[9] Effectively, the tax-aware strategy "enthusiastically" trades loss positions even when built-in losses are relatively small, which, in turn, inhibits the build-up of losses over time.

Exhibit 6 provides an answer to our second question—the question on the preservation of alpha. The exhibit shows median levels of annualized trading volume as a percentage of the NAV, directed both toward and away from the alpha model.

The concept is straightforward: We start with initial pre-rebalance positions and generate two types of trades. The first type implements the theoretical alpha model portfolio as is, disregarding any real-world penalties and constraints. The second type implements the actual optimized tax-agnostic or tax-aware portfolio. An actual portfolio trade may align with the direction of theoretical alpha model trade, or it may go in the opposite direction to satisfy optimization penalties and constraints (such as tracking error and zero beta). We refer to the former as "trades toward the model" and to the latter as "trades away from the model."

Exhibit 6 shows the results for these two categories of trades. In Panel A, the results are aggregated across longs and shorts. Panels B and C plot the results for only long and only short positions, respectively.

Exhibit 6, Panel A, clearly shows that the majority of trading volume for both the tax-aware and tax-agnostic strategies is directed toward the alpha model. As a result, it is not surprising that, whether tax awareness is employed or not, the strategies manage to deliver substantial pre-tax alpha. However, the way the two strategies achieve alpha model exposure is different: Whereas gain- and loss-realizing turnover is similar in magnitude for the tax-agnostic strategy, the tax-aware strategy uses loss-realizing trades to align itself with the alpha model.

[9] In might be helpful to see the formula underlying this calculation:

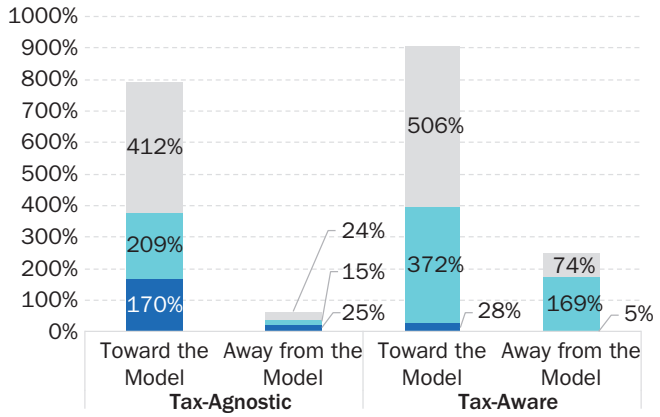
$$\frac{\textit{Realized Gain or Loss}}{\textit{NAV}} = \frac{\textit{Trade Value}}{\textit{NAV}} \times \frac{\textit{Realized Gain or Loss}}{\textit{Trade Value}}$$

That is, realized gains or losses as a percentage of the NAV (or invested capital) equal the product of turnover and the gain or loss realization per dollar traded. If an increase in turnover (the first term on the right side) is offset by a decrease in gain or loss realization per dollar traded (the second term on the right side), gain or loss realization as a percentage of invested capital would not change.

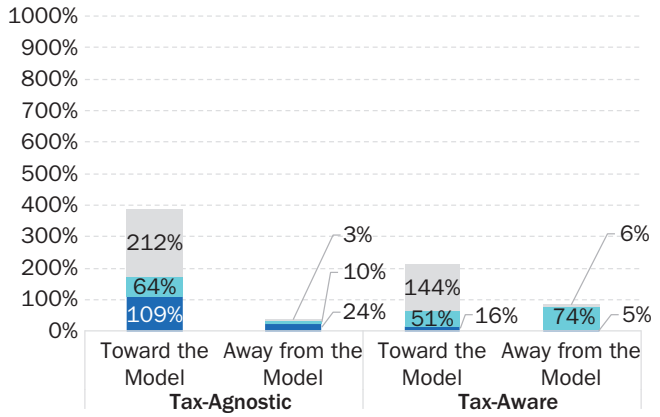
EXHIBIT 6

Strategy's Annualized Turnover Decomposition into Trades toward the Alpha Model and away from the Alpha Model

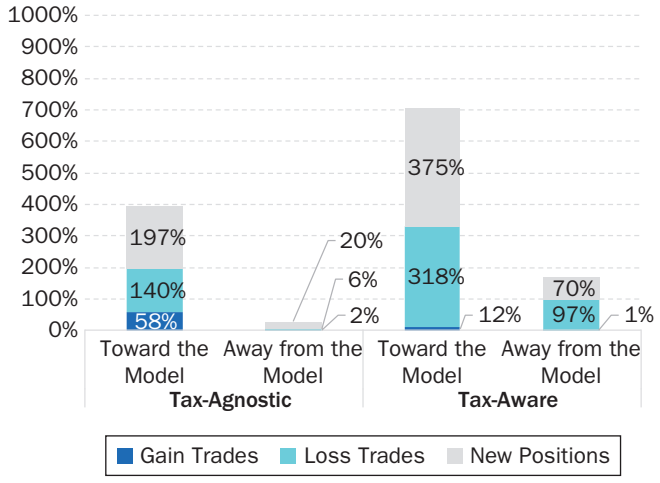
Panel A: Turnover Decomposition Including Both Long and Short Positions



Panel B: Turnover Decomposition within Long Positions



Panel C: Turnover Decomposition within Short Positions



NOTES: This exhibit shows annualized portfolio turnover during the first three years since inception. The turnover is defined as the sum of absolute value of all the buy and sell transactions divided by the NAV. The values shown are medians across 34 three-year-long vintages.

The tax-agnostic strategy exhibits little turnover away from the model. This turnover (which is driven by the optimization penalties and constraints), akin to the turnover toward the model, exhibits a similar magnitude of gain- and loss-realizing trades. The tax-aware strategy realizes a higher level of turnover away from the model than the tax-agnostic strategy. A large portion of this turnover is concentrated within loss-realizing trades. When looking for traces of "loss-harvesting" performed by our tax-aware strategy, one could argue that these loss-realizing trades away from the model indeed represent instances of loss-harvesting. Nonetheless, these trades constitute only a small fraction of the overall trading activity and are, at least in part, executed to satisfy optimization constraints and penalties other than the tax penalty.

Panels B and C in Exhibit 6 provide further insight into the results we see in Panel A. For the tax-aware strategy, turnover in both long and short position, shown in Panels B and C, respectively, is primarily driven by trading toward the model. However, in rising markets, trading toward the model is more disadvantageous from a tax perspective for long positions, which tend to accumulate gains, than for short positions, which tend to accumulate losses. As a result, while the tax-agnostic strategy exhibits similar amounts of turnover toward the model in long and short positions, the tax-aware strategy mostly utilizes shorts to trade toward the model.

Furthermore, due to positive market returns, the tax-agnostic strategy happens to execute more gain-realizing trades among portfolio longs and more loss-realizing trades among portfolio shorts. In contrast, the tax-aware strategy reduces the volume of gain-realizing trades toward the model among portfolio longs and amplifies the volume of loss-realizing trades toward the model among portfolio shorts. In sum, the tax-aware strategy leans into loss-realizing short-position trades to maximize alignment with the alpha model.

Finally, most of the tax-aware strategy's trading away from the model is executed using loss-realizing trades for both long and short portfolio positions. However, among short positions, where most of the loss-realizing trading by the tax-aware strategy takes place, the volume of loss-realizing trades away from the model is dwarfed by the volume of loss-realizing trades toward the model. In other words, for the tax-aware strategy, taxes matter but the dominant driving force behind portfolio turnover is the alpha model.

CONCLUSION

This article was motivated by the findings presented in LKSF, which showed that tax-aware long-short factor strategies can realize cumulative net capital losses exceeding 100% of initially invested capital, all while generating a significant pre-tax alpha. How exactly are these substantial net losses being achieved? And how do the strategies manage to deliver pre-tax alpha in the face of presumably large distortions required for realizing net losses of such magnitude?

We find that, for the tax-aware long-short factor strategy, net losses are realized through a process that might appear surprising to those familiar with traditional direct indexing. To start, it is important to recognize that, in contrast to generally passive direct indexing, factor strategies have a natural turnover. And therein lies a critical difference: For factor strategies, which can opportunistically utilize trades recommended by the factor model, the portfolio rebalancing process does not need to "artificially" generate tax-motivated trades. As a result, the primary effect of applying tax-awareness to long-short factor investing is not "loss harvesting" in its conventional sense—a practice of liquidating positions that the strategy would prefer to continue holding were it not for tax considerations. Rather, tax-awareness causes the deferral of realization of some portion of taxable gains in the context of implementing the pre-tax-return-motivated factor model.

We further demonstrate that the tax-aware long-short factor strategy primarily relies on liquidating loss positions and creating new positions while following the recommendations of the factor-based alpha model. While the liquidation of gain positions still occurs, it is substantially reduced. The net result of this trading activity, where gains are deferred but losses continue to be realized, is the realization of net capital losses.

Specifically, the tax-agnostic strategy, which disregards the tax consequences of trading, trades both long and short positions and liquidates gain and loss positions in almost equal amounts. In contrast, the tax-aware strategy, which relies on liquidating loss positions for implementing alpha-model views, tends to trade more actively in the short leg than in the long leg of the portfolio. This is due to the prevalence of losses among short positions in the rising equity market that characterizes our sample period.

In combination, the high diversification of factor strategy portfolios, the presence of short positions in the rising equity market, leverage, and the relatively slow turnover of factor strategies create ample opportunities for balancing pre-tax alpha with effective tax management. This tax management is aimed at delivering pre-tax alpha tax-efficiently rather than creating tax alpha through loss-harvesting.

With recent advances in financial technology, long-short investing is becoming accessible through increasingly smaller separately managed accounts (SMAs). Therefore, now is the time for private wealth advisors to familiarize themselves with tax-aware long-short strategies and understand the underlying mechanisms that allow such strategies to create value for their clients. Our article contributes to the literature that demystifies this novel investment approach. By shedding light on the intricacies of tax-aware long-short strategies, we hope to empower investors and their advisors with a deeper understanding of this emerging investment approach.

APPENDIX A

EMPIRICAL METHODOLOGY

Alpha Model

We model quantitative strategies that combine value, momentum, and quality signals. Value is measured by book-to-market ratio (see, for example, Fama and French 1992). Following Asness and Frazzini (2013) and Asness et al. (2015), we scale the book value

of a company by its most recent market capitalization. Twelve-month momentum effects in equities were first documented in Jegadeesh and Titman (1993) and Asness (1994). Following Asness (1994) and Asness et al. (2015), we measure momentum as the total return over the preceding 12 months, excluding the most recent month. We measure quality using gross profitability, more specifically, gross profits over assets (see Novy-Marx 2013). Also, Asness et al. (2019) use gross profits over assets as one of their many measures of quality. Value, momentum, and quality signals are equal-weighted as we explain shortly.

Every month, we construct a factor-based model portfolio $\tilde{\nu}$ as follows. We first convert the value, momentum, and quality raw signals into three market-neutral factor portfolios using the following sequence of steps: First, for each signal, we rank stocks within each industry according to their signal scores. Second, these within-industry ranks are de-meaned (by subtracting the average rank within an industry) and standardized (by dividing by the standard deviation of the ranks within an industry) to create an industry-neutral portfolio. Finally, market neutrality of the portfolio is ensured by regressing out the market beta using an OLS regression.[10] The market-neutral factor portfolios are denoted by v_{VAL}, v_{MOM}, and v_{QUAL}, respectively.

The value, momentum, and quality factor portfolios are then scaled by their respective forecast volatility:

$$\tilde{\nu}_{VAL} = \frac{1}{\sigma_{VAL}}\nu_{VAL}, \quad \tilde{\nu}_{MOM} = \frac{1}{\sigma_{MOM}}\nu_{MOM}, \quad \tilde{\nu}_{QAUL} = \frac{1}{\sigma_{QUAL}}\nu_{QUAL}$$

To compute forecast volatility, we utilize a covariance matrix produced by the MSCI Barra USE3L risk model. We use the model covariance matrix, Σ, lagged by one month,[11] to compute σ_{VAL}, σ_{MOM}, and σ_{QUAL} as follows:

$$\sigma_{VAL} = \sqrt{\nu'_{VAL}\Sigma\nu_{VAL}}, \quad \sigma_{MOM} = \sqrt{\nu'_{MOM}\Sigma\nu_{MOM}}, \quad \sigma_{QUAL} = \sqrt{\nu'_{QUAL}\Sigma\nu_{QUAL}}$$

This yields three factor portfolios with unit predicted volatility.[12]

We construct the model portfolio as an equal-weighted average of the factor portfolios:

$$\nu = \frac{1}{3}\tilde{\nu}_{VAL} + \frac{1}{3}\tilde{\nu}_{MOM} + \frac{1}{3}\tilde{\nu}_{QUAL}$$

Since all three factor portfolios have the same unit predicted volatility, the model portfolio effectively allocates equal risk to each of the three factors. Similar to factor portfolios, the model portfolio is scaled by its forecast volatility:

$$\tilde{\nu} = \frac{1}{\sqrt{\nu'\Sigma\nu}}\nu$$

Following the methodology originally proposed in Jones et al. (2007), every month we convert the model portfolio ν into a vector of stock-level alphas by multiplying it by the stock-level covariance matrix Σ (from MSCI Barra's USE3L risk model), lagged by one month:

$$\alpha = \Sigma\tilde{\nu}$$

[10] For example, let $\boldsymbol{w}$ be the vector of portfolio weights before beta-adjustment and $\boldsymbol{\beta}$ be the vector of market betas for every stock in the portfolio. A vector of residuals $\boldsymbol{\nu}$ from the regression $\boldsymbol{w} = a\beta + \boldsymbol{\nu}$, by construction, will have a beta of 0 and, thus, be a market-neutral portfolio. We found this beta-adjustment step to be important because, while our portfolios sorted on either value or momentum do not exhibit a systematic positive or negative beta, our quality-sorted portfolio is characterized by a high and persistently negative beta. Therefore, without beta adjustment, the former two portfolios are approximately market-neutral, while the latter is systematically short the market.

[11] Lagging the covariance matrix by a month ensures that the covariance matrix used for the volatility forecasts is available at the time of factor portfolio formation. This is because it takes a few days after the month-end for the risk model to be released.

[12] This is easy to see. For each factor i: $\sqrt{\nu'_i\Sigma\tilde{\nu}_i} = \sqrt{\frac{1}{\sigma_i}\nu'_i\Sigma\frac{1}{\sigma_i}\nu_i} = \frac{1}{\sigma_i}\sigma_i = 1.$

Scaling of the alpha model portfolio by its volatility $\sqrt{\nu'\Sigma\nu}$ leads to a convenient result that the predicted information ratio of an active portfolio is also its predicted correlation with the model portfolio, which in turn can be viewed as a measure of implementation efficiency of the active portfolio (see Israel et al. 2019, Appendix B, for further discussion):

$$IR_w = \frac{w'\alpha}{\sqrt{w'\Sigma w}} = \frac{w'\Sigma\tilde{\nu}}{\sqrt{w'\Sigma w}} = \frac{w'\Sigma\nu}{\sqrt{w'\Sigma w}\sqrt{\nu'\Sigma\nu}}$$

Management Fee, Transaction, Leverage, and Tax Cost Assumptions

All the results in the article are reported gross of management fees.

For transaction costs in portfolio optimization, we use a simple model informed by the research in Almgren et al. (2005). Transaction costs per dollar traded in basis points are modeled as

$$c_{i,t} = 5 + 0.075 \times VIX_t + 2.5 \times srisk_{i,t} \times \sqrt{\frac{T\$_{i,t}}{DTV\$_{i,t}}}$$

where VIX_t is the most recent VIX index level known on the date of the trade, $srisk_{i,t}$ is the specific volatility of stock i as estimated by MSCI Barra USE3L model lagged by one month in percentage points (for example, for 50% volatility, the value substituted into the model will be 50), and $T\$_{i,t}$ and $DTV\$_{i,t}$ are the dollar trade size and dollar daily trading volume of stock i, respectively. This model yields an average cost of approximately 10 bps per dollar traded, which is a reasonable estimate for the US large capitalization stocks and is similar to the 12-bps cost used in Goldberg et al. (2022).

For the cost of financing the long-short leverage, following Sorensen et al. (2007) and Sialm and Sosner (2018), we use a conservative assumption of 100 bps per unit of one-sided leverage per year. For example, for a 150/50 relaxed-constraint portfolio this implies an annual cost of 50 bps (that is, 0.5 times 100 bps).

The tax cost of rebalancing a portfolio is defined as

$$T = t_{LT}g_{LT} + t_{ST}g_{ST}$$

where t_{LT} and t_{ST} are the long-term and short-term capital gains tax rates, respectively, and g_{LT} and g_{ST} are the net long-term and short-term realized capital gains aggregated across all the traded individual tax lots, respectively. Tax cost defined this way rewards the realization of losses and penalizes the realization of gains. Moreover, due to the difference in tax rates, the realization of net short-term losses is rewarded more than the realization of net long-term losses, while the realization of net short-term gains is penalized more than that of net long-term gains. Taxes on dividends and deductions associated with in-lieu dividends on short positions are not incorporated into the optimization problem.[13] As a lot-relief method, we use the HIFO (highest in, first out).

Portfolio Construction

The optimization problem for the long-short component of the composite tax-agnostic and tax-aware strategies is defined as follows:

$$\max_{w_1 \ldots w_N} \sum_i w_i\alpha_i - \gamma T - C$$

[13] Israel et al. (2019) show that taking taxation of dividends into account reduces implementation efficiency of quantitative multi-style strategies, thereby lowering their expected pre-tax returns, and also detracts from the ability to manage the realization of capital gains and losses.

$$s.t.$$

$$\sum_i \sum_j w_i w_j \sigma_{ij} \leq R^2$$

$$\sum_i w_i = 0$$

$$\sum_i |w_i| = 2L$$

$$-0.02 \leq \sum_i w_i \beta_i \leq 0.02$$

where w_i corresponds to the active portfolio weight of security i, T is the tax cost of rebalancing the portfolio in the current period, C is the aggregate transaction cost, σ_{ij} is the covariance between the returns of securities i and j derived from MSCI Barra's risk model, R is the target risk of 6% annually, L is leverage of 1.5, and β_i corresponds to the beta of security i with respect to the Russell 1000 index predicted by MSCI Barra USE3L risk model. Both the covariance and the beta estimates are point-in-time forward-looking estimates. In addition, we lag these estimates by one month to ensure that the risk model data are released before the portfolio construction date.

The key parameter distinguishing between the tax-agnostic and tax-aware strategies is g—the multiplier of tax cost T in the objective function. For the tax-agnostic strategy, this parameter is set to 0, that is, no awareness of the tax cost of rebalancing. For the tax-aware strategy, following Liberman et al. (2023), this parameter is set to –1.

Portfolio rebalancing ensures that the relative weights of the index fund and long-short components are such that the beta of the overall strategy remains close to 1. Specifically, if since the last rebalance the long-short component realizes a positive return, its relative weight is reduced, and vice versa.

APPENDIX B

Main Result with 10-Year Simulation Histories

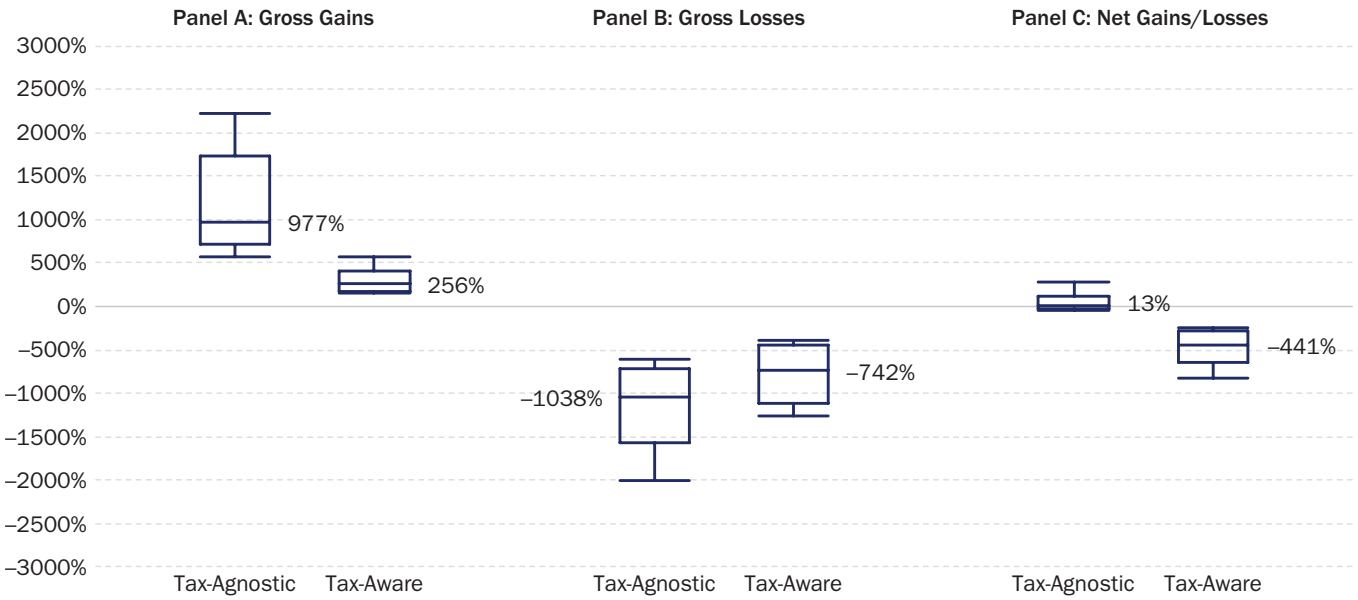
Exhibit B1, Panel A, compares total *gross realized gains* (aggregated across long-term and short-term characters) of tax-agnostic and tax-aware strategies simulated over a 10-year period. The median 10-year cumulative gain for the tax-agnostic strategy is about four times larger than for the tax-aware strategy. The 10th to 90th percentile ranges for the two strategies do not overlap.

Exhibit B1, Panel B, compares total *gross realized losses* (aggregated across long-term and short-term characters) of tax-agnostic and tax-aware strategies. The median 10-year cumulative loss for the tax-aware strategy is, in fact, even lower than for the tax-agnostic strategy. The 10th to 90th percentile ranges for the tax-aware strategy are shifted closer toward 0 (that is, smaller cumulative losses) compared to the tax-agnostic strategy.

Exhibit B1, Panel C, *nets all realized capital gains and losses* across all characters. The median 10-year cumulative result for the tax-agnostic long-short factor strategy is about 0. The tax-aware long-short strategy realizes a very significant median net loss of around 440% of initially invested capital. The entire 10th to 90th percentile range for the strategy is below a 200% loss. As we have seen in Panels A and B, the main source of this net loss is deferral of capital gains, not a bigger realization of capital losses.

EXHIBIT B1

10-Year Cumulative Gains and Losses Realized by the Strategies



NOTES: This exhibit shows total aggregate gains and losses realized during 10 years since inception as a percentage of initially invested capital. The boxes show the 25th, 50th, and 75th percentiles of aggregate gains and losses across 27 10-year-long vintages and the whiskers show their 10th and the 90th percentiles. The first of the 27 vintages covers a period from 1986 to 1995, and the last, from 2012 to 2021.

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