Tax-Loss Harvesting: Alpha, Cash Drag, and Optimization

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Abstract

This paper investigates the efficacy of Tax-Loss Harvesting (TLH) strategies applied to a Direct Indexing portfolio tracking the S&P 500 over the period 2014-2024. We compare active harvesting strategies against a passive benchmark under specific wash-sale constraints. Our results demonstrate that while harvesting generates theoretical alpha, the "cash drag" mandated by the IRS Wash Sale Rule significantly erodes these gains in a strong bull market. We further analyze the impact of different cash-flow scenarios, finding that a charitable giving liquidation strategy maximizes final wealth retention.

1   Introduction

Tax-loss harvesting is a widely utilized active management strategy aimed at enhancing after-tax returns by realizing capital losses to offset gains. The central premise is that the tax savings generated from realized losses can be reinvested, creating a compounding "tax alpha." However, regulatory constraints—specifically the IRS Wash Sale Rule— prohibit the immediate repurchase of "substantially identical" securities within 30 days of a loss realization. This creates a mandatory lockout period, introducing tracking error and opportunity cost, commonly referred to as "cash drag."

In this study, we simulate the performance of a tax-aware Direct Indexing portfolio constructed from the top 50 constituents of the S&P 500. We aim to quantify the trade-off between the tax benefits of harvesting and the performance drag caused by wash-sale compliance. We evaluate this trade-off across two distinct investor lifecycles: a standard income-withdrawal model and a tax-efficient charitable giving model.

2   Data and Benchmark Construction

Our universe consists of the top 50 constituents of the S&P 500, selected to ensure high liquidity and data availability. Daily Adjusted Close prices were sourced via `yfinance`

for the period January 1, 2014, to January 1, 2024.

2.1 Benchmark Portfolio

The benchmark is a passive, equal-weighted portfolio of the universe, rebalanced monthly. It incurs no transaction costs and performs no tax harvesting. This serves as the control group (R_B) against which the active strategies (R_A) are measured.

2.2 Tax Modeling Assumptions

To isolate the economic value of the tax benefit, we model the "Tax Alpha" as an immediate capital injection.

- **Tax Rate (τ):** A flat rate of 20% is applied to all realized gains and losses.
- **Tax Credit:** Upon realizing a loss of L, the portfolio is immediately credited with cash equal to $L \times \tau$. This simulates an investor who uses these losses to offset external gains elsewhere, effectively freeing up capital for immediate reinvestment.

3 Methodology and Strategies

We evaluate three distinct active strategies to test the sensitivity of returns to wash-sale constraints.

3.1 Strategy 1: Greedy (No Wash Rule)

This strategy scans the portfolio daily. If any position's price drops more than 5% below its cost basis, it is liquidated to realize the loss. Crucially, the strategy **immediately repurchases** the same security.

- **Hypothesis:** This represents the theoretical upper bound of Tax Alpha (TA_{ideal}), as it maintains perfect market exposure while harvesting all available losses.
- **Constraint:** This violates the IRS Wash Sale Rule and is for theoretical comparison only.

3.2 Strategy 2: Greedy (With Wash Rule)

This strategy strictly adheres to IRS regulations. When a loss is harvested: 1. The security is sold. 2. The ticker is added to a "Restricted List" for 30 days. 3. The proceeds are held in **Cash** (yielding 0%) until the restriction expires.

- **Hypothesis:** This strategy will suffer from "Cash Drag" (CD), defined as the return difference between the market and cash during the lockout period.

3.3   Strategy 3: Optimized Tax-Aware

We implement a convex optimization framework (`cvxpy`) to minimize tracking error against the benchmark.

- **Objective:** Minimize $(w - w_B)^T \Sigma (w - w_B)$

- **Constraint:** $w_i = 0$ if $i \in$ Restricted List.

- **Mechanism:** Instead of holding cash, the optimizer attempts to reallocate capital to other correlated stocks in the universe to maintain market exposure.

4   Empirical Results (2014-2024)

The simulation covered a decade characterized by a strong equity bull market. The results for the **Income Withdrawal Scenario** (5% annual withdrawal) are summarized below:

Strategy	Final Wealth	Total Tax Paid	Realized Losses
Baseline (Passive)	$29,779,543	$2,789,422	$1,769,279
Greedy (No Wash)	**$32,570,308**	$2,675,905	$6,439,701
Greedy (With Wash)	$25,184,912	$4,417,664	$22,607,123
Optimized	$25,700,917	$4,378,182	$22,543,163

Table 1: Comparison of Final Wealth and Tax Metrics (Income Scenario)

4.1   The "Cash Drag" Penalty

The most striking finding is the underperformance of the compliant strategies. The **Greedy (With Wash)** strategy underperformed the baseline by over $4.5M.

- **Analysis:** In a rising market, the opportunity cost of being out of the market (Cash Drag) exceeds the 20% value of the harvested tax credit. The "No Wash" strategy's outperformance confirms that the *harvesting* itself is valuable, but the *regulatory friction* destroys that value in this specific universe and market regime.

4.2   Charitable Giving Scenario

We also tested a "Charitable Giving" scenario where the investor contributes $1M annually and donates the portfolio at Year 10 (avoiding terminal liquidation tax).

- **Baseline Final Wealth:** $75,963,882

- **No Wash Final Wealth:** $83,256,160

- **Conclusion:** The combination of tax-free donation and tax-loss harvesting (in the ideal case) creates significant wealth compounding.
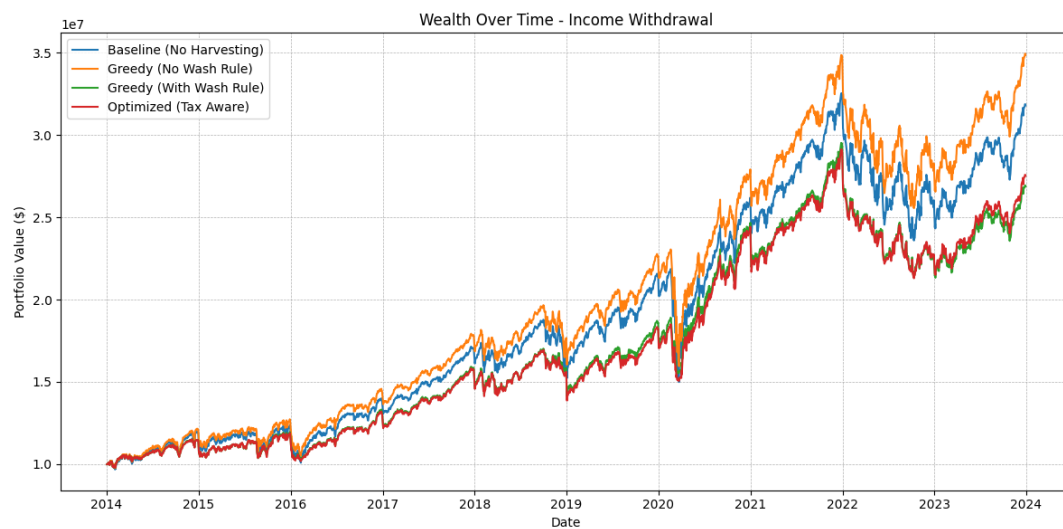
5 Visualizations

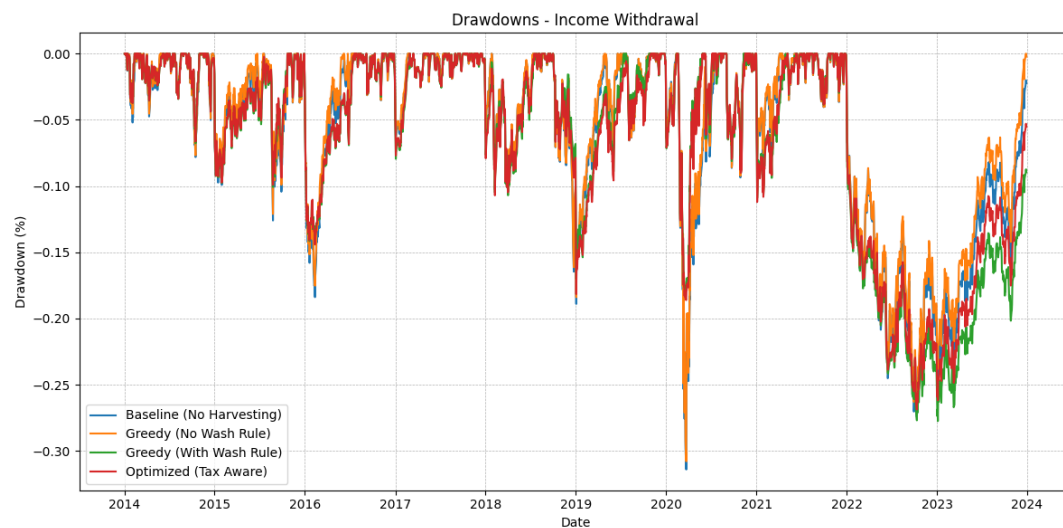Figure 1: Wealth Accumulation over 10 Years (Income Scenario)

Figure 2: Drawdown Analysis

6   Conclusion

Our analysis suggests that for a Direct Indexing portfolio of 50 stocks, standard Tax-Loss Harvesting strategies may be detrimental during strong bull markets due to wash-sale constraints. The "Cash Drag" of waiting 30 days or the tracking error of using imperfect substitutes can outweigh the tax benefits.

Future work should explore expanding the universe to 500+ stocks or using ETFs as substitutes to minimize the time spent in uninvested cash, thereby capturing the tax alpha demonstrated by the "No Wash" theoretical model.

7   References

1. Chaudhuri, S., Burnham, T., & Lo, A. (2020). "An Empirical Evaluation of Tax-Loss Harvesting Alpha."

2. Moehle, N., et al. (2021). "Tax-Aware Portfolio Construction via Convex Optimization."