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# Tax Aware Backtest Framework

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# Idea

- Backtest Framework that properly accounts for US tax laws:
  - Long/Short Term Capital Gain Taxes
  - Wash-Sale Rule
  - Qualified and Non-Qualified Dividend Taxes
- Realistic performance metrics for Taxable Account

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# Challenges

- Work with UNadjusted prices to compute taxes on dividends and taxes on capital gains
- Handle reinvestment of dividends
- Model regular withdrawals to pay taxes

# Example: Specify Tax Rules

## Capital Gains

short.term.tax = 35/100

long.term.tax = 15/100

long.term.min.holding.period = 365

wash.sale.min.holding.period = 30

## Dividends

qualified.tax = 15/100,

qualified.min.holding.period = 60

nonqualified.tax = 35/100

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## Example: Specify Tax Cash Flows

### Tax Cash Flows

`at = custom.date.bus('1st day in April', prices)`

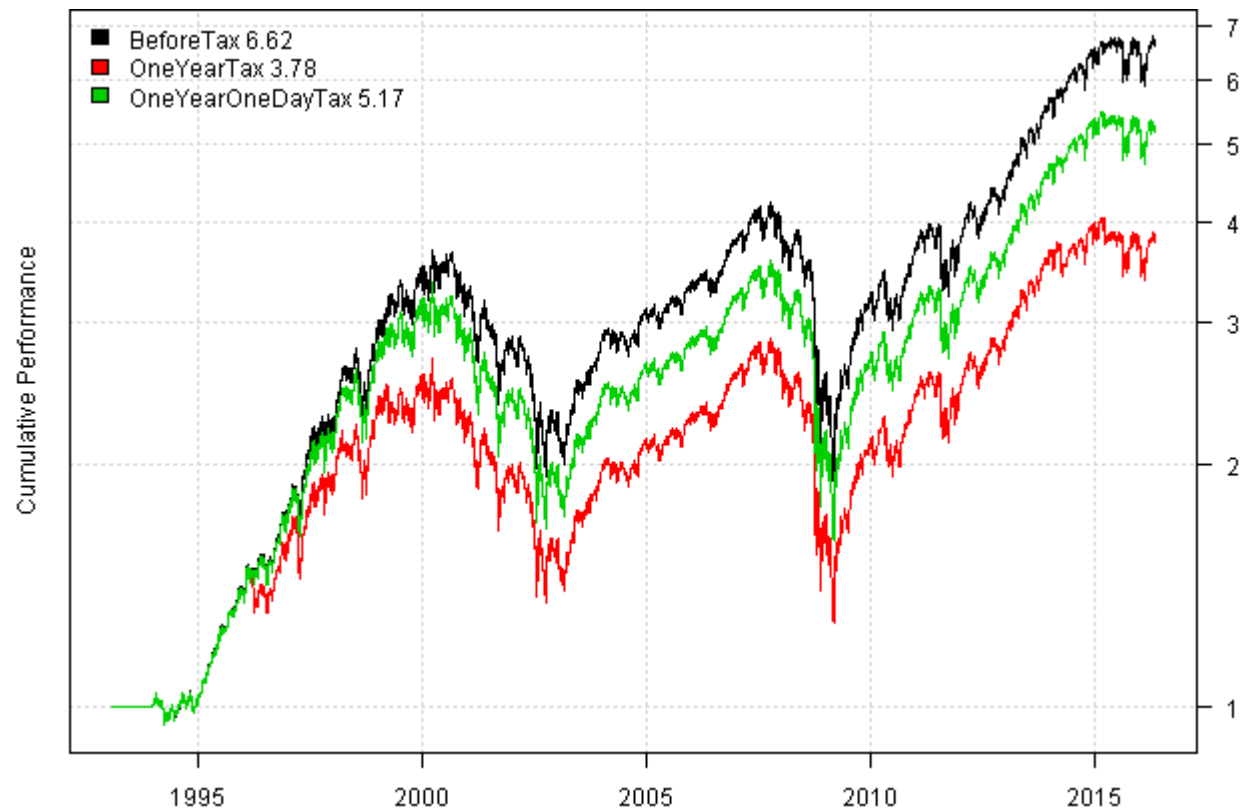
`cashflow.fn = tax.cashflows`

`invest = 'update'`

`type = 'fee.rebate'`

# Example of Impact of Taxes

Annually rebalanced strategy: Long-term versus Short-term capital gains



# Example of Impact of Taxes

	Before Tax	One Year Tax (Short-term)	One Year One Day Tax (Long-term)
CAGR	8.4%	5.9%	7.3%
Implied Tax Rate		29.8% $= 1 - 5.9/8.4$	13.1% $= 1 - 7.3/8.4$

# The Real Impact is Not that extreme

Monthly allocation across 9 Sector ETFs:  
equal weight and minimum variance

	EqWt	EqWt.Tax	MinVar	MinVar.Tax
CAGR	5.8%	5.3%	6.2%	5.3%
Implied Tax Rate		8.3%		14.5%
Turnover	28.9%		143.2%	



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# Summary

- First example was artificial; in reality, the difference between before-tax and after-tax performance will not be that huge.
- The Tax Aware Backtest Framework is a tool to evaluate strategy performance in taxable account. It does NOT suggest optimal tax decisions.
- You should specify the tax rates that are applicable to your own personal situation

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## Future Work

- Adjust Long-term capital gain holding period for leap years.
- Rcpp Parallel version of the Tax Aware Backtest Framework to suggest optimal tax decisions.

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# The End

Please visit my blog at

[systematicinvestor.github.io](http://systematicinvestor.github.io)

for more examples and ideas.

Download R Code at [systematicinvestor.github.io/rfinance2016](http://systematicinvestor.github.io/rfinance2016)