Volatility Targeting Using VIX

with applications to portfolio management

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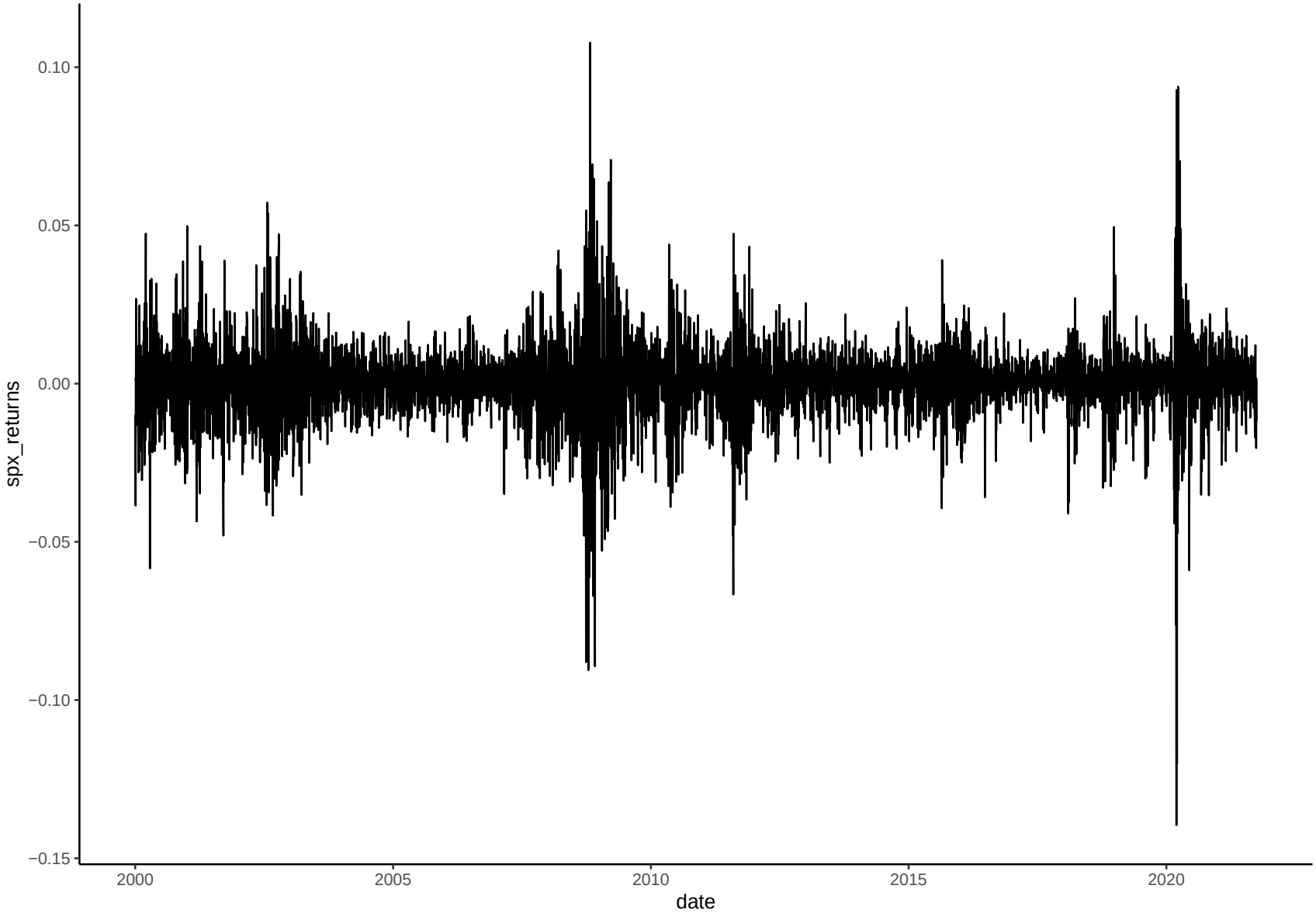
Introduction

- It is well known that volatility clusters in markets tends to "cluster" [Ding and Granger, 1996]. That is, current high volatility predicts future high volatility, while the same is true for low volatility.
- Using this empirical fact, one can construct a trading strategy that leverages up during periods of low volatility and leverage down during periods of high volatility.
- In this presentation, we employ the trading strategy described by [Harvey et al., 2018].
  - We first replicate their strategy on SPX using VIX as our measure of volatility, we then apply it to other long-only portfolios such as Value and Momentum as described by Kenneth R. French's website [French, 2021].

S&P 500's Daily Returns From 2000 to 2021



Strategy Methodology

- This strategy aims to create a "target" volatility for some particular portfolio.
  - We aim to have a target of 20%, annualized.
- We leverage up or down according the 2-day lagged VIX values.
- In essence, if r_t is the excess return[1] of our base portfolio at time t, then the return of our strategy (volatility targetted), r'_t, is

$$r'_t = \left(\frac{20\%}{\sigma_{t-2}}\right) r_t k$$

  where σ_t is the VIX at time t.[2] k is chosen ex-post so our overall backtest will have a historical volatility of 20%.
- Due to the volatile nature of the VIX, we set caps and floors for our leverage constraints, which is a 50% floor and a 200% cap.

[1] Excess of risk-free rate.

[2] To be precise, it's the VIX index divided by 100.

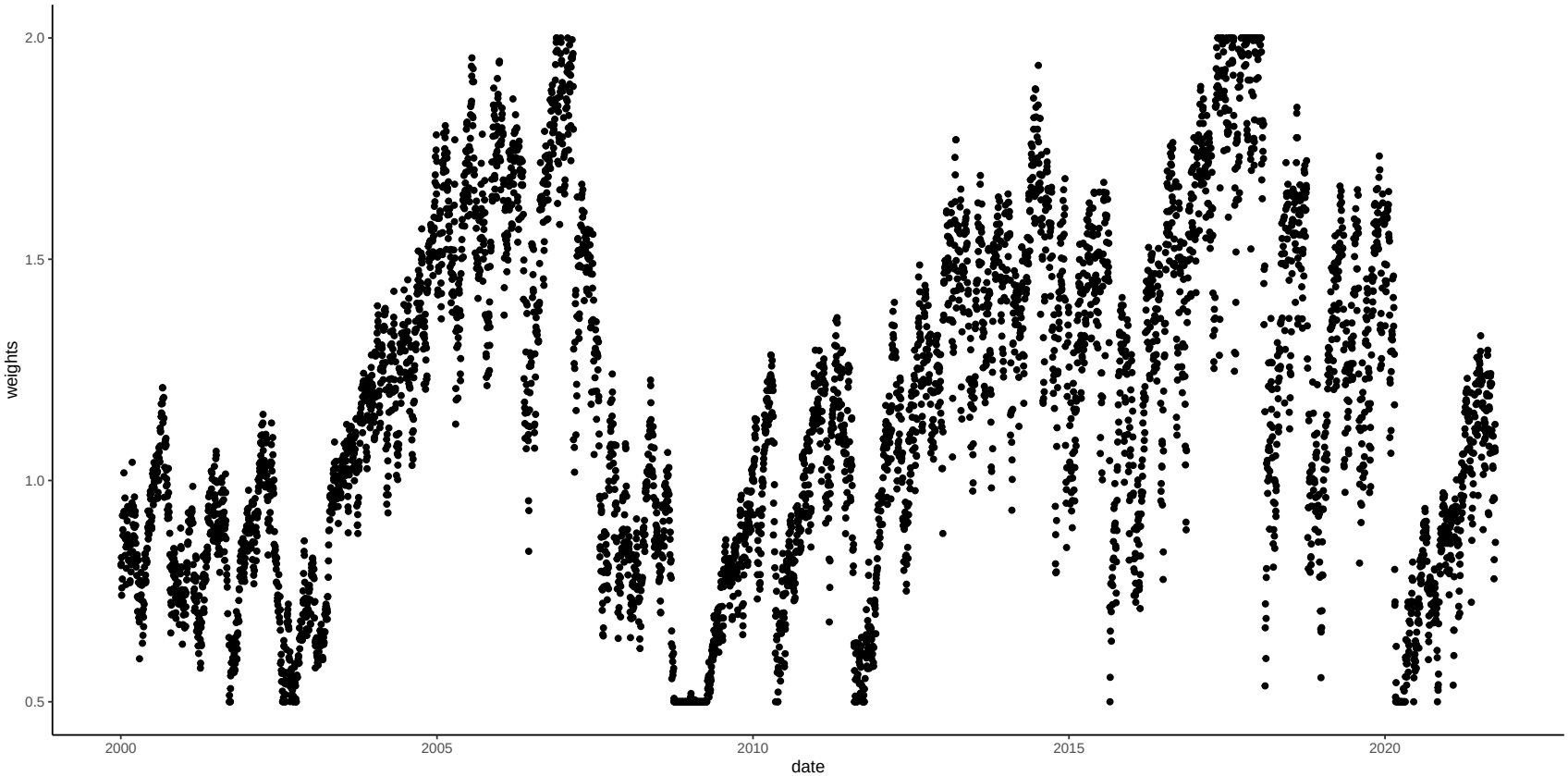
Applying to S&P 500

X	SPX	SPX.Target.Vol
Mean	2.87%	3.36%
Std	20.07%	20.06%
Total Returns	186.79%	207.63%
Sharpe Ratio	0.14	0.17
Turnover	0.00	5.56
Mean Notional	1.02	1.16
Vol of Vol	8.37%	4.51%
Mean Short Fall 1%	-5.23%	-4.41%
Mean Exceedance 99%	5.01%	3.53%

Total P&L

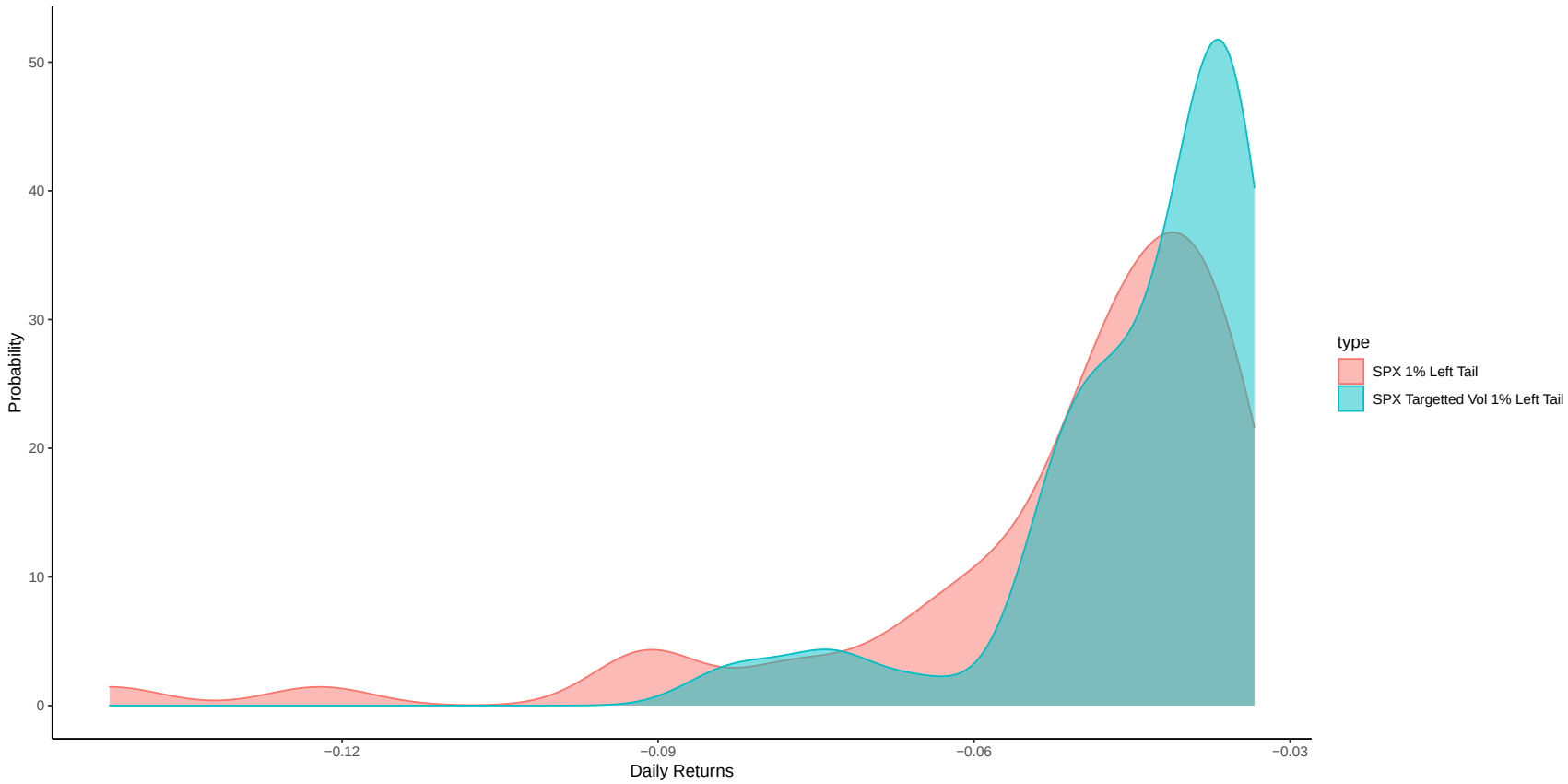
This is different from [Harvey et al., 2018]
as their data starts from 1935.

Historical Leverage/Weights



Rolling 30 Day Vol

1% Left Tail of Distribution



Applying to Top Decile of a Momentum Sort

X	Momentum	Momentum.Target.Vol
Mean	8.34%	8.82%
Std	22.40%	21.01%
Total Returns	613.76%	680.54%
Sharpe Ratio	0.37	0.42
Turnover	0.00	5.56
Mean Notional	0.87	1.16
Vol of Vol	10.50%	7.00%
Mean Short Fall 1%	-5.29%	-4.48%
Mean Exceedance 99%	5.28%	3.81%

Applying to Top Decile of a B/M Sort

X	Value	Value.Target.Vol
Mean	6.97%	9.86%
Std	22.00%	22.39%
Total Returns	455.41%	853.70%
Sharpe Ratio	0.32	0.44
Turnover	0.00	5.56
Mean Notional	0.76	1.16
Vol of Vol	12.75%	7.57%
Mean Short Fall 1%	-6.09%	-5.02%
Mean Exceedance 99%	5.78%	4.37%

Discussion

- We see that using VIX to create volatility targetting strategies seem to improve on long-only strategies.
- However, these improvements comes at a significant increase in turnover.
- It could be the case that the increase in trading costs is the source of
- In terms of implementing these strategies, doing it for S&P 500 related assets is the most feasiable due to liquidity constraints.
  - One can trade S&P 500 futures while Momentum and Value portfolios would require trading a lot of stocks.
- Compare the difference in performance of VIX driven volatility targetting compared to standard deviation driven volatility targetting

Zhuanxin Ding and Clive W.J. Granger. Modeling volatility persistence of speculative returns: A new approach. *Journal of Econometrics*, 73(1):185–215, 1996. ISSN 0304-4076. doi: https://doi.org/10.1016/0304-4076(95)01737-2. URL https://www.sciencedirect.com/science/article/pii/030440769501737 2.

Kenneth R. French. Kenneth r. french data library, 2021. URL http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html.

Campbell R. Harvey, Edward Hoyle, Russell Korgaonkar, Sandy Rattray, Matthew Sargaison, and Otto van Hemert. The impact of volatility targeting. *SSRN*, 2018. doi: https://dx.doi.org/10.2139/ssrn.3175538.