# Risk Allocation
Volatility Targeting
# (or practical Risk Parity)

Historical returns of stocks and bonds
1 year rolling

Native SP500 — Native 10y
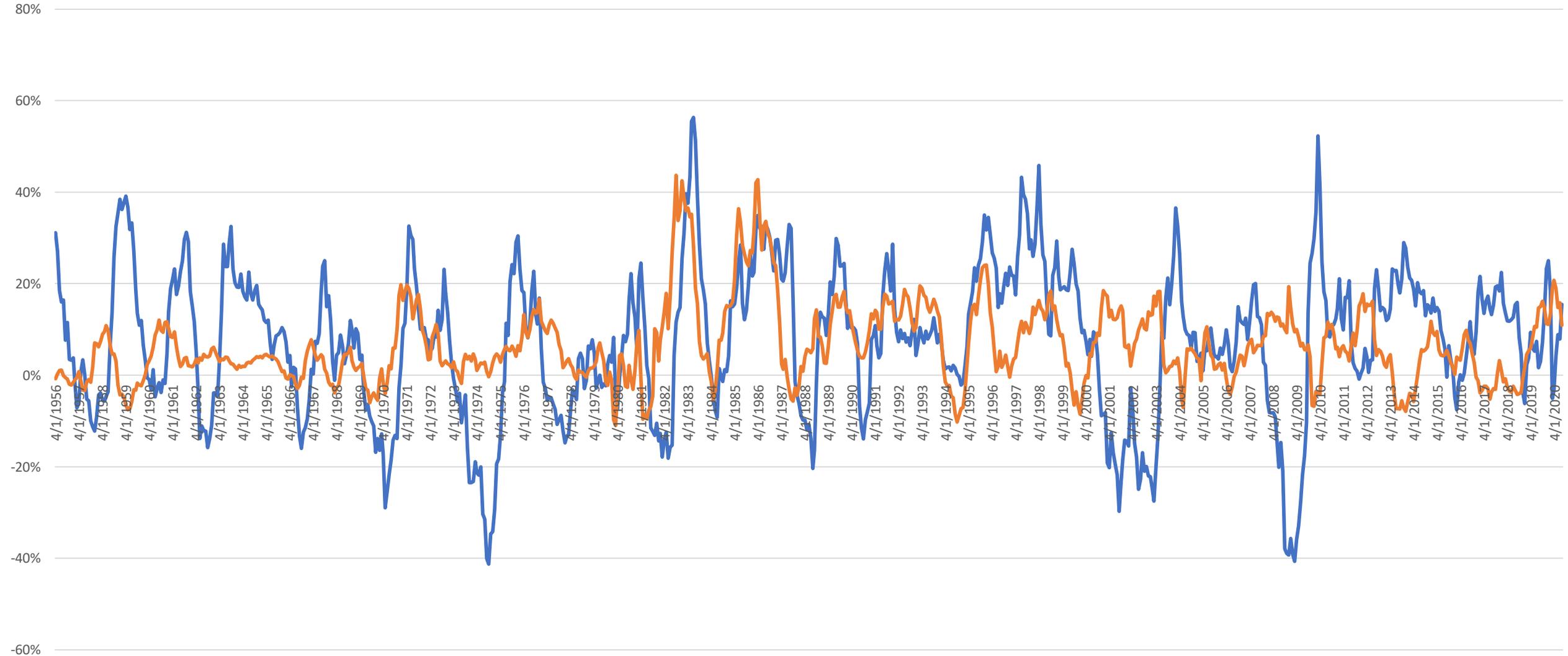
Returns do not auto-correlate
## 2y correl with 1y lag
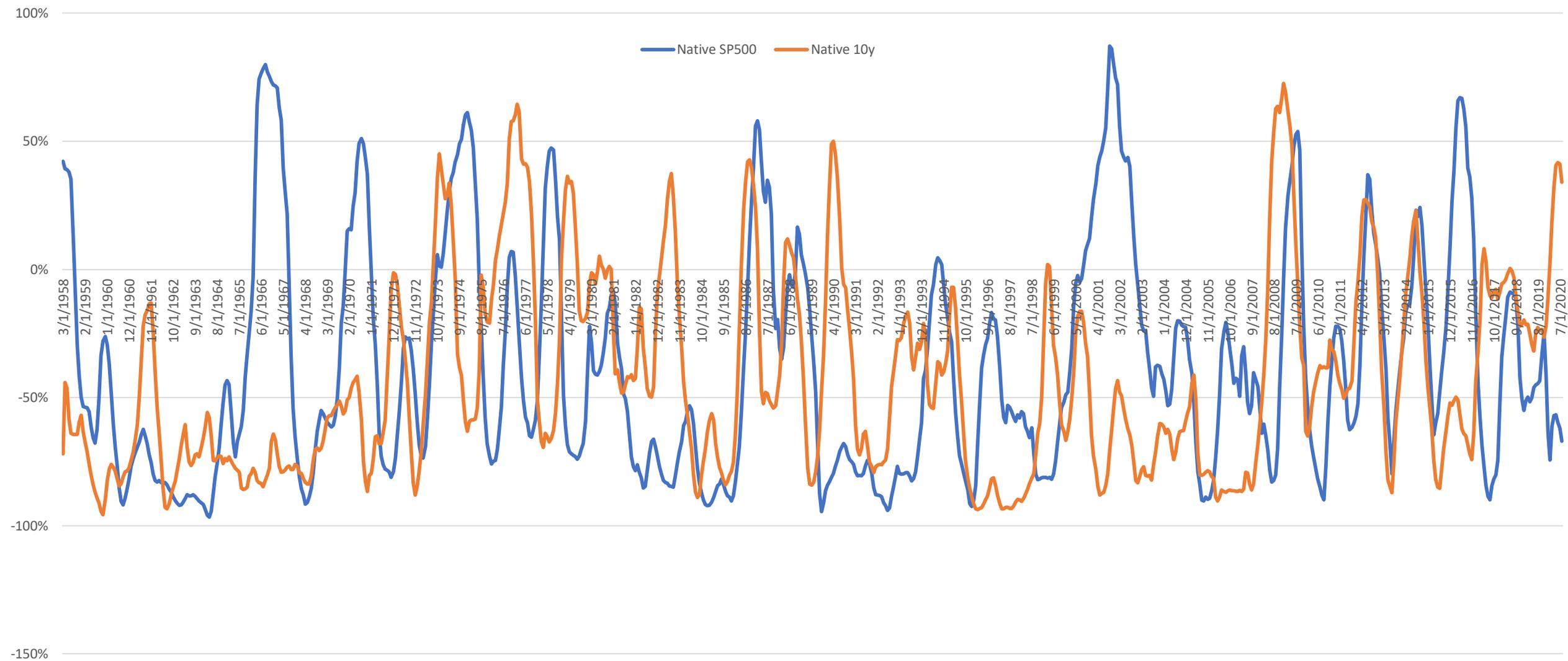
Volatility is more stable than returns
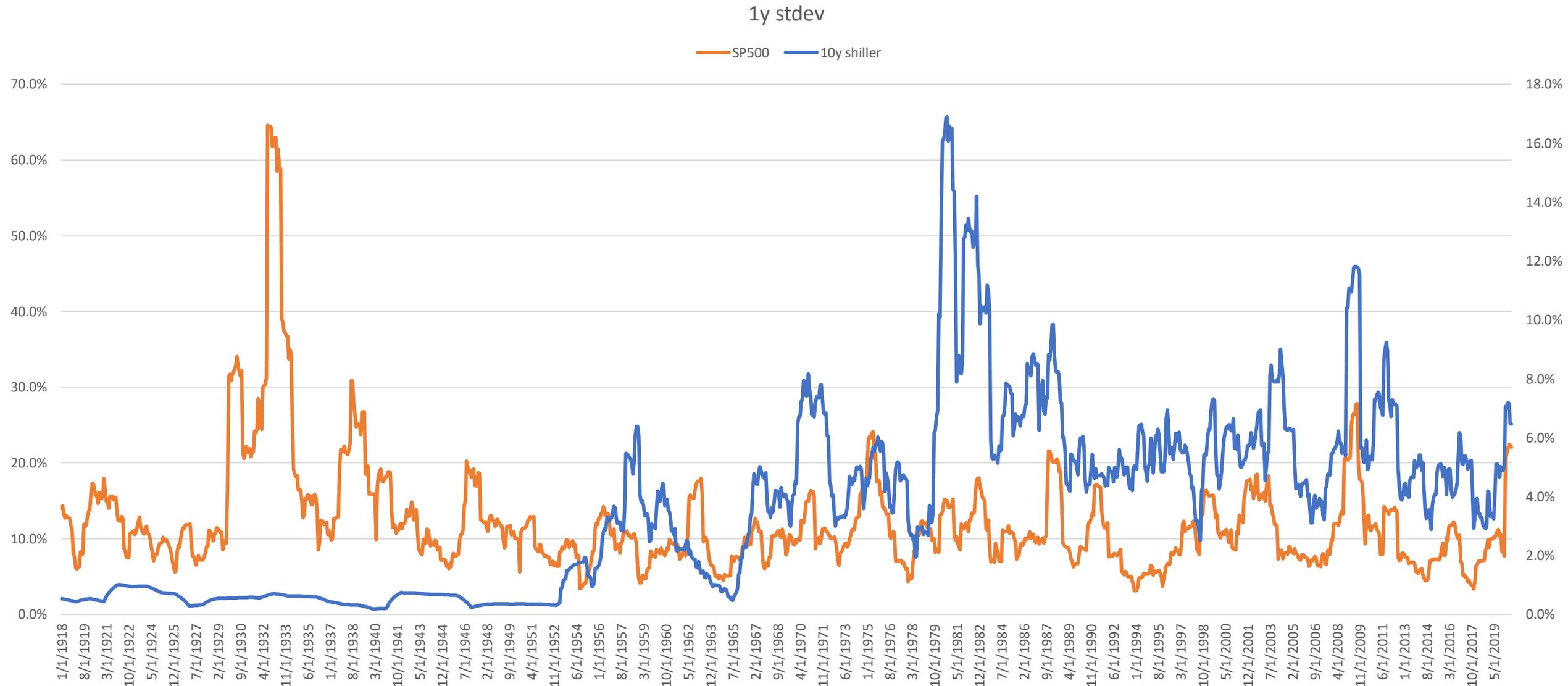
Stock to bond historical correlation

2y correl SP500 vs 10y
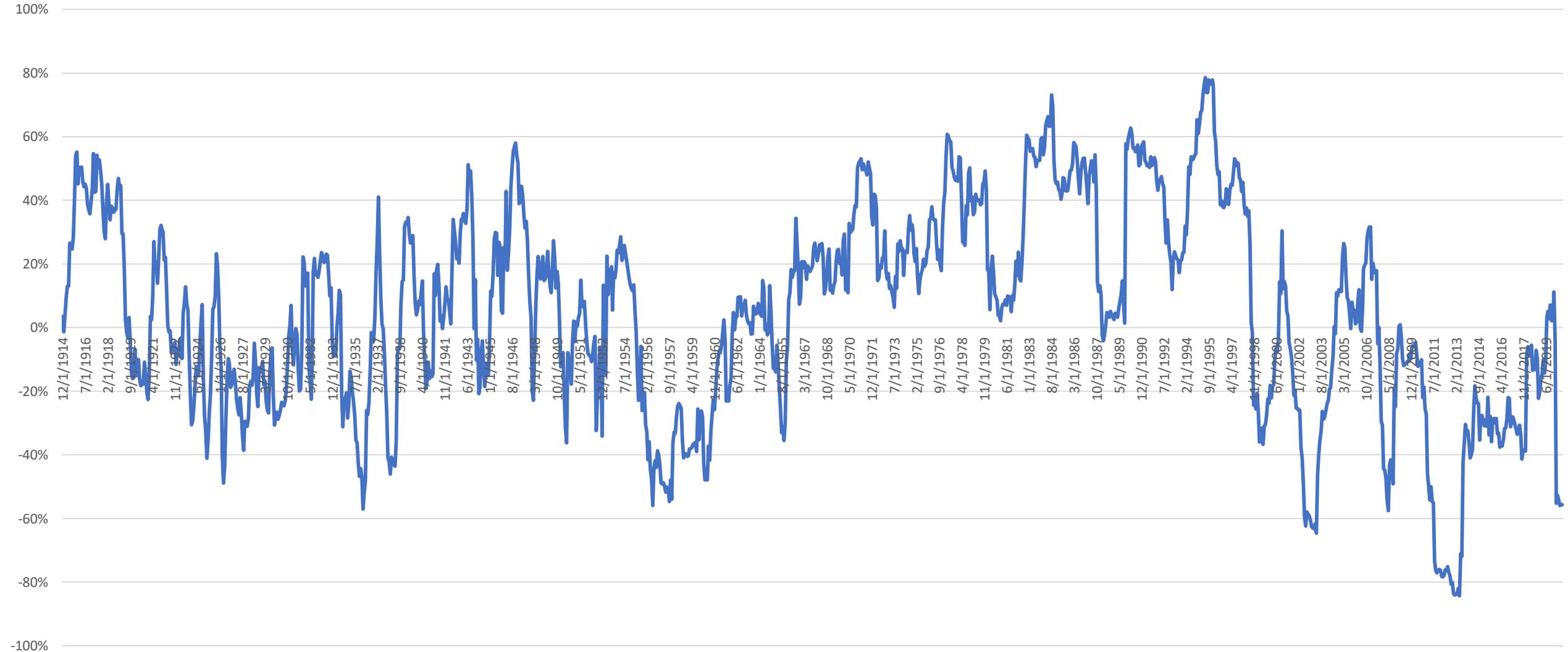
CAPM vs. Risk Allocation assumptions

- Returns are not stable
- Optimal portfolio assumes perfect knowledge of:
  - Future volatility
  - Future returns
- Volatility is more predictable (i.e. constant) than returns
- Volatility is a measure of risk

→ You can manage your risk but you can't manage your returns
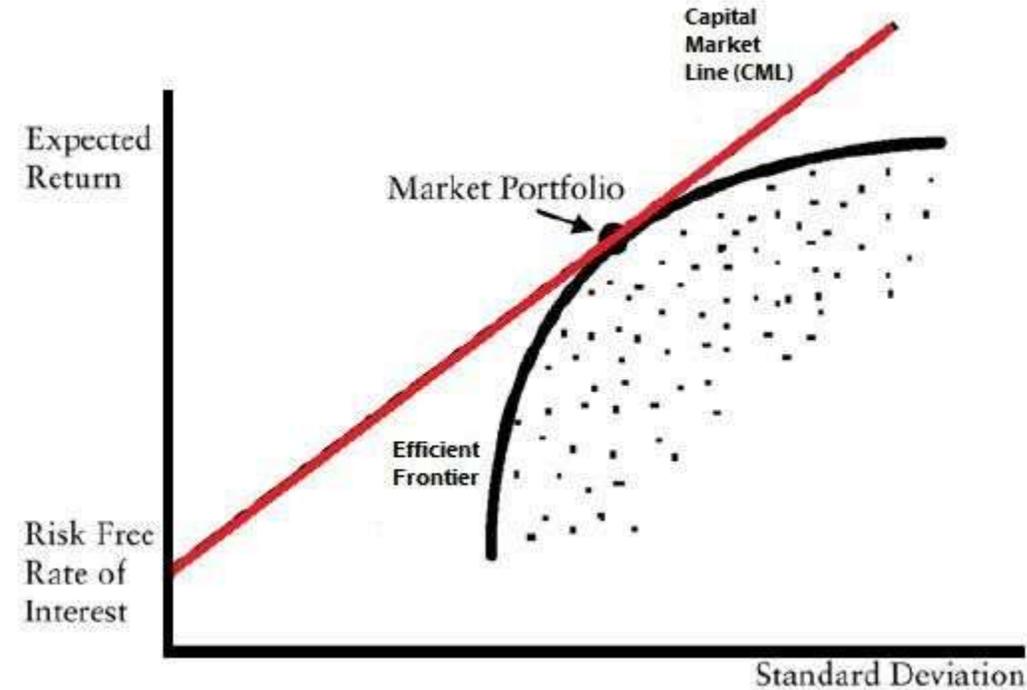
SP500 Volatility adjusted vs. native

	Risk SP500	Native SP500
Returns	6.3%	6.4%
Vol	12.0%	12.1%
Sharpe	0.53	0.53

10y Volatility adjusted vs 10y

	Native 10y	Risk 10y
Returns	6.1%	6.4%
Vol	6.4%	6.4%
Sharpe	0.96	1.00
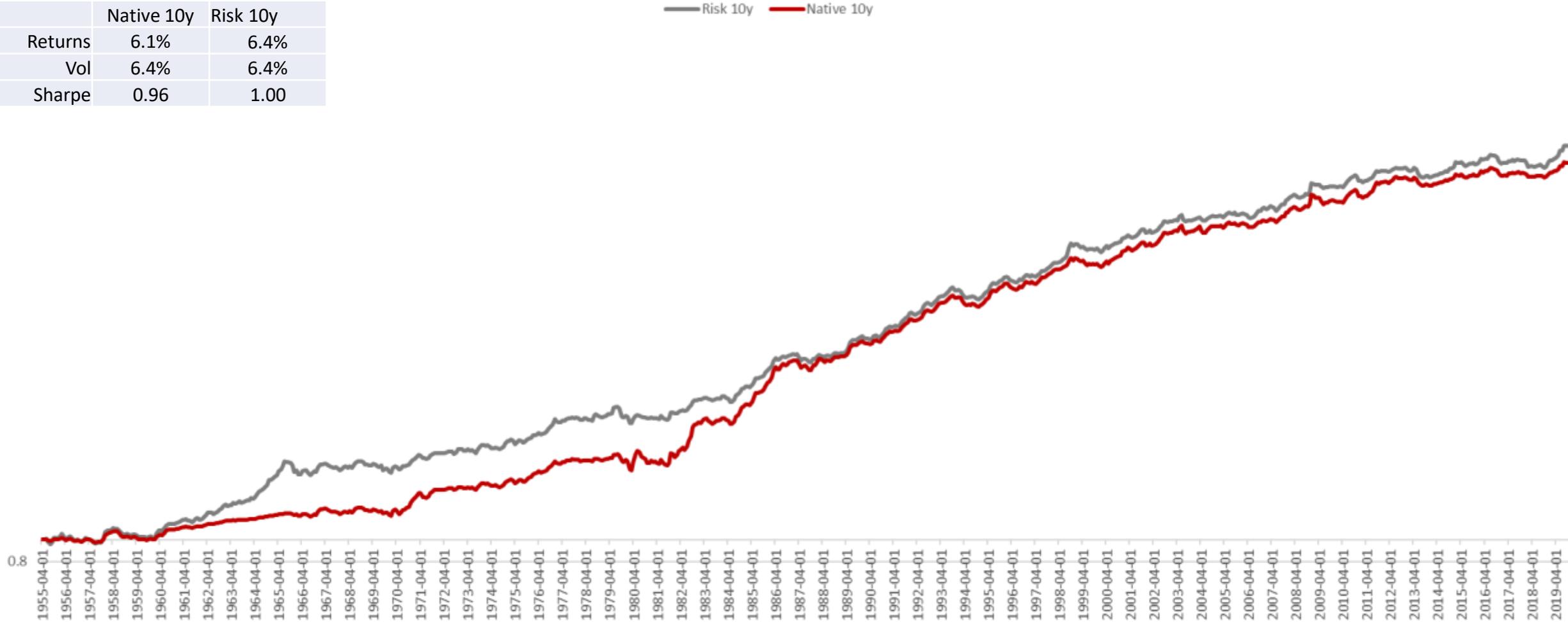
60/40 Stock/bonds vs. 40/60 risk stock/bonds
since 1955 risk outperforms by ~200bps

	60/40	Risk 40/60
Returns	6.5%	8.4%
Vol	7.9%	7.9%
Sharpe	0.83	1.06

	Risk SP500	Native SP500
Returns	6.3%	6.4%
Vol	12.0%	12.1%
Sharpe	0.53	0.53
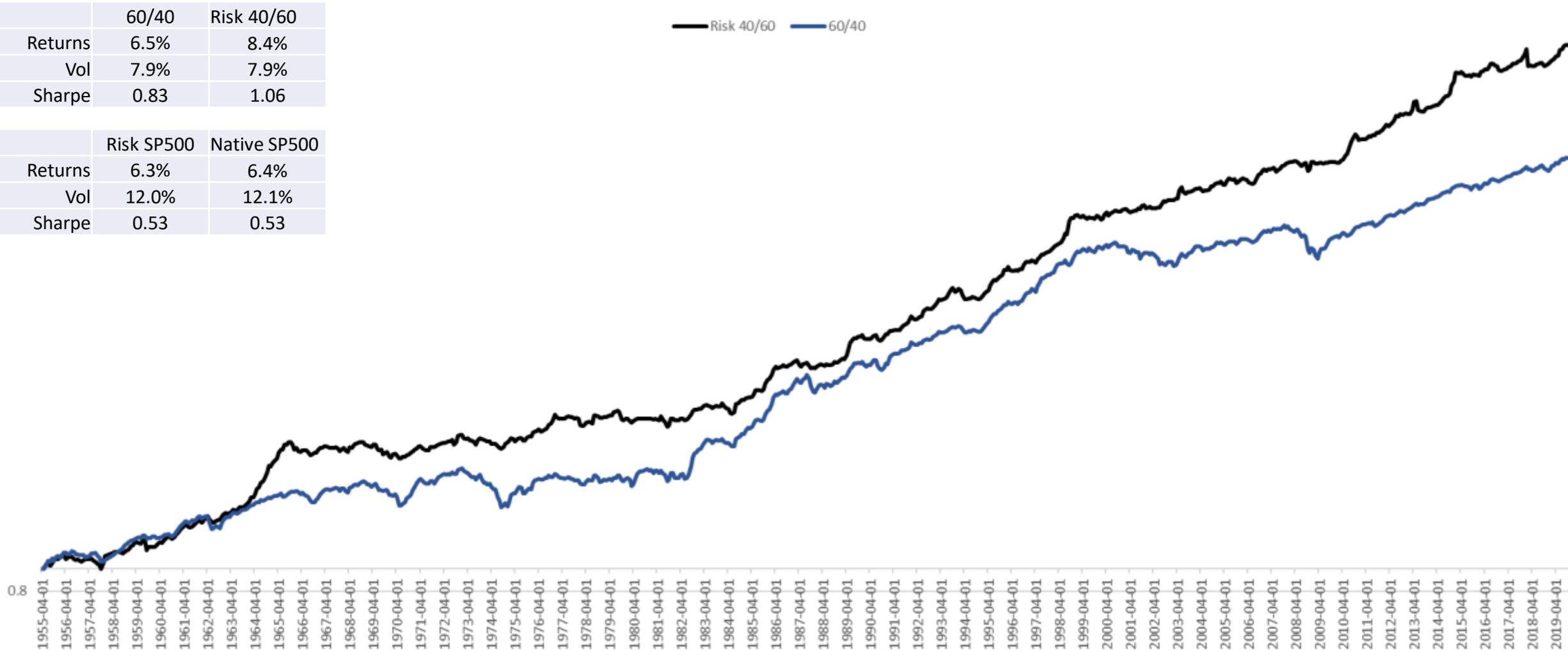
Adding gold to 40/60 risk portfolio

Monthly rebalancing and volatility calculation

	SP&10y& gold	SP&10y
Returns	8.5%	8.5%
Vol	7.7%	7.8%
Sharpe	1.12	1.10
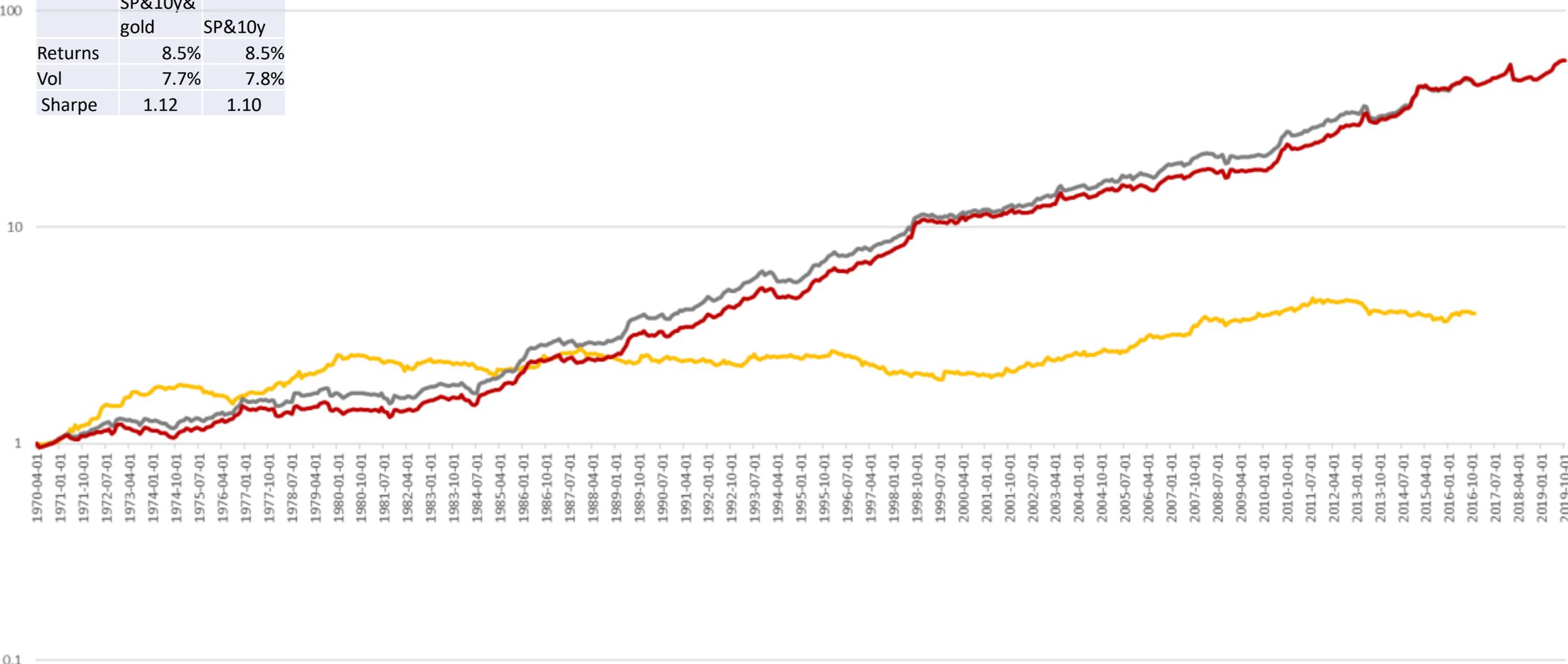
SP500 40% + 10 y 50% + Gold 10%

rebalancing weekly

Legend: SP40%/10y50%/Gold10% | ES1 Index | 10y | Gold

	SP40%/10y50%/Gold10%	ES1 Index	10y	Gold
Returns	13.3%	7.7%	8.6%	4.9%
Vol	10.4%	10.8%	10.2%	10.5%
Sharpe	1.28	0.72	0.85	0.47
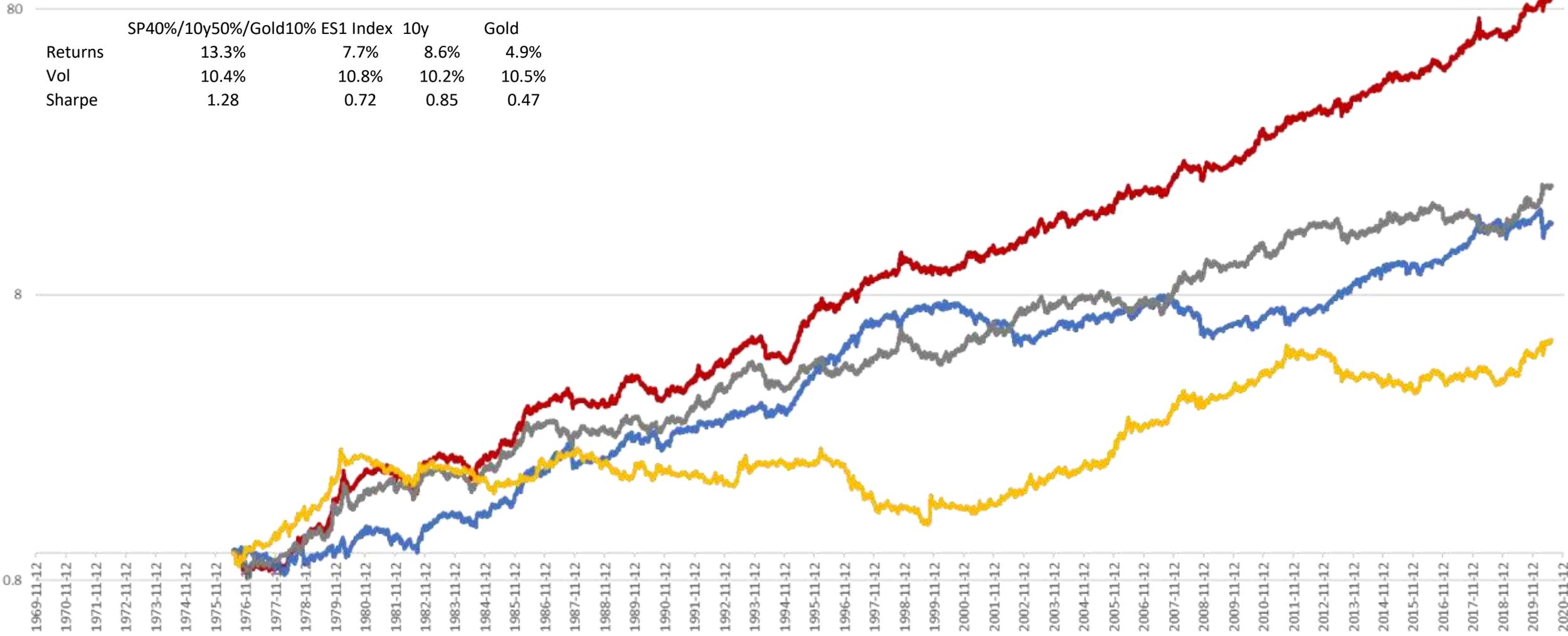
Risk Allocation

- Strategy requires the use of leverage

- Cheapest leverage comes from futures (CME generally)

- This has tax implications (not necessarily negative)

- Can be expanded to other markets

- It is helpful to think of decorrelated markets as buckets for risk allocation:
  - Equities (US, foreign)
  - Treasuries (needs to be the risk free asset)
  - Commodities (gold, inflation sensitive or uncorrelated assets)

- It is more active than a buy and hold 60/40 portfolio because risk needs to be rebalanced (ideally weekly)

Gold worst Sharpe ratio
# 10y best with least uncertainty
SP500 most uncertain Sharpe

	SP40%/10y50%/Gold10%	ES1 Index	10y	Gold
Avg Sharpe	1.00	0.70	0.55	0.29
Sharpe Stdev	0.70	0.81	0.65	0.79

Reading list

- https://investors-corner.bnpparibas-am.com/investing/why-target-volatility-strategies-make-sense/
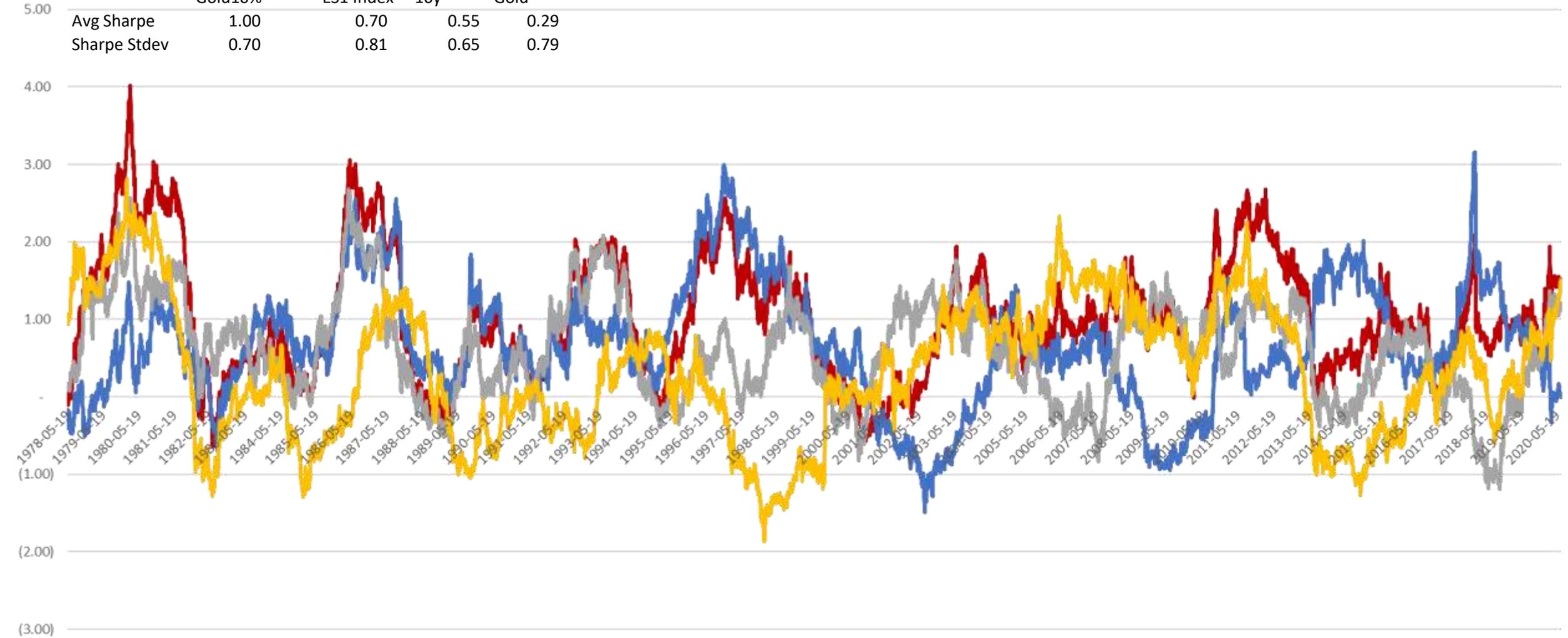
- https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2384583

- https://investors-corner.bnpparibas-am.com/investing/why-target-volatility-strategies-make-sense/

- https://www.bridgewater.com/research-and-insights/risk-parity-is-about-balance

- https://www.bridgewater.com/research-and-insights/engineering-targeted-returns-and-risks