A Sector Rotation Strategy that Beats the Market Handily Especially During Crises

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Outline

- 9 sector ETFs, AGG & SPY

- Daily returns from 1998 to present

- Hidden Markov model

- VIX high and low volatility states

- ETF high and low volatility states

- Special attention to three crisis: Dot Com, Financial Crisis, COVID-19

Select SPDR Sector ETFs

- Materials (XLB)
- Energy (XLE)
- Financial (XLF)
- Industrial (XLI)
- Technology (XLK)
- Consumer Staples (XLP)
- Utilities (XLU)
- Health Care (XLV)
- Consumer Discretionary (XLY)

Hidden Markov Model

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- Kim and Nelson (1999)

$$y_t = x_t \mu_{S_t} + e_t, \qquad t = 1, 2, \dots, T$$

$$e_t \sim N\left(0, \sigma_{S_t}^2\right)$$

$$\mu_{S_t} = \mu_0(1 - S_t) + \mu_1 S_t$$

Transition matrix $\begin{bmatrix} P_{0,0} & P_{0,1} \\ P_{1,0} & P_{1,1} \end{bmatrix}$

$$\sigma_{S_t}^2 = \sigma_{S_0}^2(1 - S_t) + \sigma_{S_1}^2 S_t$$

Prior Research

- Engle and Hamilton (1990)

- Hamilton (2010) Regime Switching Models

- Chong and Phillips (2015) investigated and constructed long-only sector ETF portfolios using macroeconomic factors

- Alexiou and Tyagi (2020) examined the performance of various sector rotation strategies in the US and European markets

- Kim and Nelson (1999) comprehensive methodology for the estimation of regime switching models

- Kritzman (2012) regime shifts implications for dynamic strategies

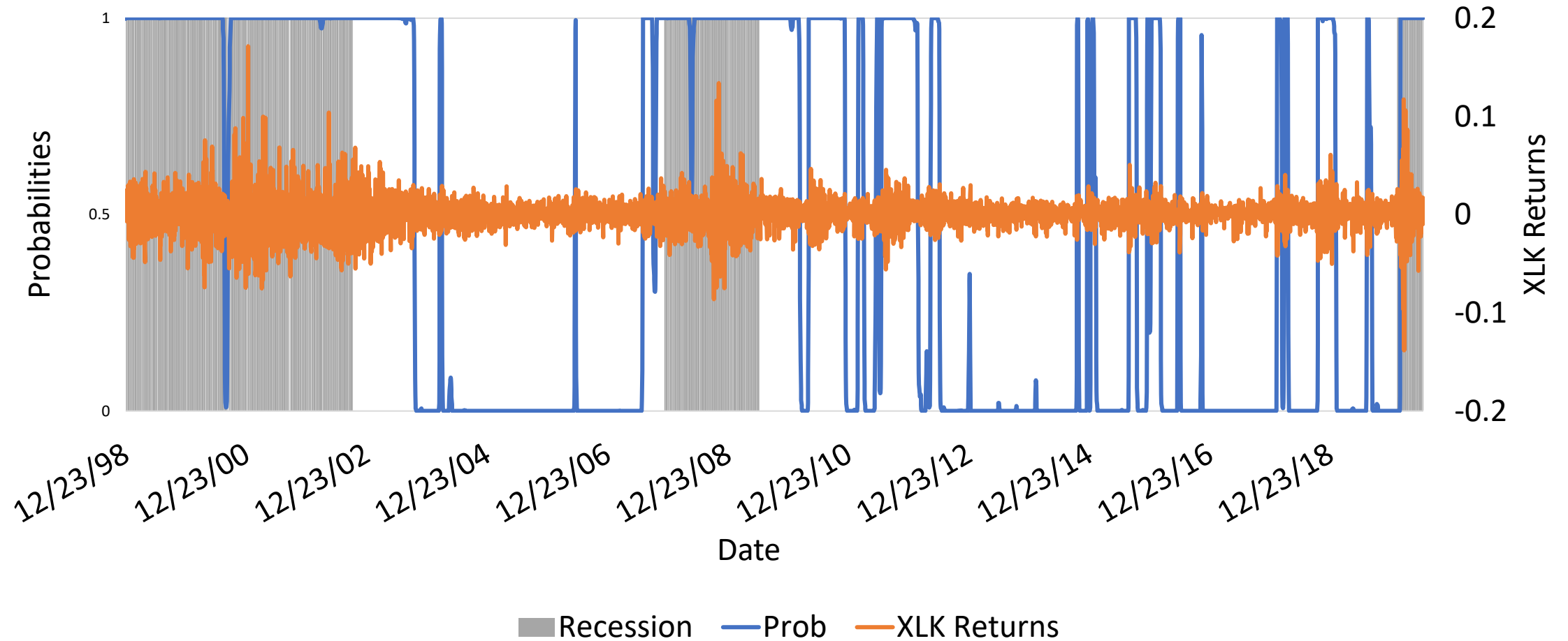- diBartolomeo (2020) regime shifts and factor portfolios

VIX Switching
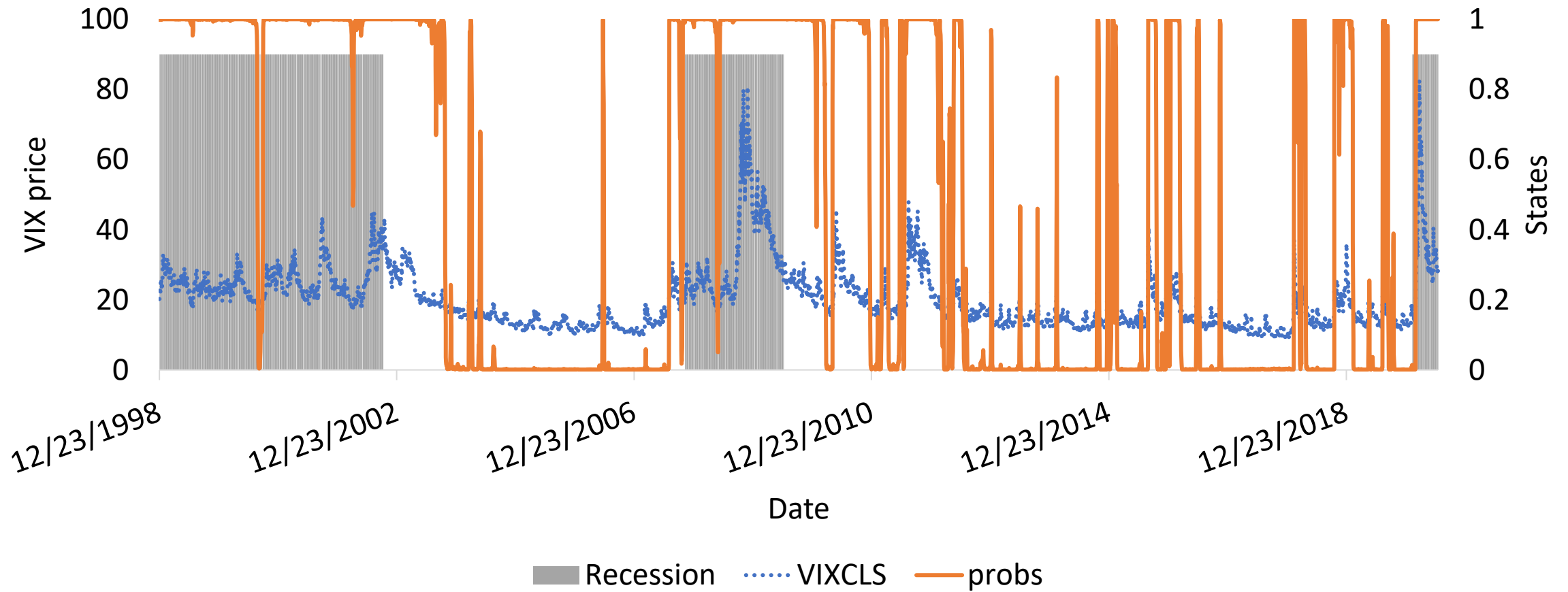
XLK ETF switching

XLK "Self switching"

Portfolio Construction Rules

- Switching states:
    - VIX
    - "Self" for each ETF

VIX Switching

V1 the low vol state

- High VIX States   →   Hold AGG
- Low VIX States   →   Hold equal weighted Sector ETFs

V2 reverse V1 positions

Self Switching

S1 Fixed weights

- High Volatility States for **all** ETFs → Hold AGG Only
- Low Volatility States → Hold Fixed1/9 weight for Low Vol ETFs + AGG

S2 Reverse S1 positions

S3 Variable weights

- High Volatility States for **any** ETFs → Hold AGG + High Vol ETFs
- Low Volatility States → Hold equal Variable weight Low Vol ETFs

S4 reverse S3 positions

Self Switching

- **S1:** Rule: > Only keep ETFs that are in a <u>low vol state</u> in the resultant portfolio.
- > Assign <u>exactly</u> 1/9 weight to each ETF that is present in the resultant portfolio.
- > Shift the remaining or residual weight to AGG.

- **S3:** Rule: > Only keep ETFs that are in a <u>low vol state</u> in the resultant portfolio.
- > Distribute the entire portfolio weight evenly among all ETFs that are in the low vol state and are part of the resultant portfolio.
- > Only when there are <u>no ETFs in a low vol state</u>, shift the entire weight to AGG.

Summary Statistics for Daily Closing returns (in %)

Sector	Mean	Std	Skewness	Kurtosis	25%	50%	75%
XLB	0.04	1.56	-6.84	609.29	-0.7	0.07	0.82
XLE	0.03	1.81	-25.36	1404.67	-0.82	0.05	0.96
XLF	0.03	1.95	101.42	2366.06	-0.71	0.05	0.79
XLI	0.04	1.39	-18.41	774.49	-0.57	0.07	0.7
XLK	0.04	1.65	38.19	853.61	-0.64	0.09	0.76
XLP	0.03	1	13.38	955.38	-0.43	0.05	0.51
XLU	0.03	1.25	27.87	1314.86	-0.55	0.09	0.66
XLV	0.04	1.18	9.03	946.53	-0.52	0.07	0.63
XLY	0.05	1.42	-7.82	732.97	-0.58	0.08	0.72
Tbill	0.0048	0.0050	0.8764	-0.5444	0.0003	0.0032	0.0078
AGG	0.02	0.31	-2.71	103.31	-0.12	0.02	0.18
SPY	0.03	1.24	-0.04	10.42	-0.48	0.06	0.59
Equal Wgt	0.04	1.21	-0.14	12.26	-0.44	0.08	0.58

ETF returns in VIX states

Annual Risks and Returns using VIX as a signal							
ETF	t-stat	Avg Return 0	Vol State 0	#ObsState 0	Avg Return 1	Vol State 1	# Obs State 1
XLB	1.47*	17.63	14.86	2823	1.56	32.11	2588
XLE	1.75*	18.76	18.87	2823	-3.40	36.40	2588
XLF	2.31**	23.82	16.22	2823	-7.74	41.19	2588
XLI	2.44**	20.49	12.34	2823	-3.29	28.99	2588
XLK	2.26**	22.74	13.25	2823	-3.53	35.11	2588
XLP	1.91*	13.60	9.45	2823	0.25	20.58	2588
XLU	1.80*	16.00	12.70	2823	0.23	25.39	2588
XLV	2.35**	18.93	11.61	2823	-0.55	24.21	2588
XLY	1.70*	19.47	12.03	2823	2.46	30.03	2588

Returns in VIX states

Stat	Low Mean	Low Std	Low #	High Mean	High Std	High #
Tbill	0.42%	0.46%	2784	0.53%	0.54%	2620
AGG	1.24%	20.76%	2784	2.56%	39.83%	2620
SPY	5.27%	64.41%	2784	1.00%	165.85%	2620
Eq Wgt	6.60%	63.32%	2784	0.54%	160.70%	2620

ETF returns in low and high volatility states

	Annual Risks and Returns using individual ETFs as a signal						
ETF	t-stat	Avg Return 0	Vol State 0	#ObsState 0	Average Return 1	Vol State 1	#ObsState 1
XLB	2.37**	20.94	15.57	3838	-16.89	38.71	1573
XLE	2.01**	17.80	19.97	4547	-42.56	55.01	864
XLF	1.34*	16.80	15.20	4107	-16.72	56.66	1304
XLI	3.10**	22.13	13.17	3785	-21.18	34.57	1626
XLK	2.92**	25.39	13.95	3563	-19.16	40.21	1848
XLP	2.66**	15.14	9.63	3890	-13.05	25.46	1521
XLU	3.24**	19.42	13.10	4620	-55.57	40.81	791
XLV	1.98**	16.24	12.25	4201	-13.39	32.34	1210
XLY	1.96**	20.16	12.49	3439	-4.06	33.44	1972

Portfolios using VIX Switching

Comparing VIX portfolios with the SPY Buy and Hold portfolio				
Period	Portfolio	Annual Return (in %)	Annual Risk (in %)	Sharpe Ratio
Overall	SPBH	8.00	19.67	0.41*** (30.14)
	V1	11.03	8.60	1.28*** (94.1)
	V2	2.78	17.76	0.16*** (11.76)

Portfolio using Self Switching

Comparing self-switching portfolios with the SPY Buy and Hold portfolio				
Period	Portfolio	Annual Return (in %)	Annual Risk (in %)	Sharpe Ratio
Overall	SPBH	8.00	19.67	0.41*** (30.14)
	S1	14.63	9.48	1.54*** (113.21)
	S2	-0.85	15.83	-0.05*** (-3.68)
	S3	13.85	12.82	1.08*** (79.39)
	S4	-5.20	20.48	-0.25*** (-18.38)

Recession Periods

- The Millennium Recession (December 1998 – September 2002)

- The Great Recession (December 2007 – June 2009)

- Covid-19 (February 2020 – Present)

Portfolio in Crises using VIX

		VIX-switching portfolios against SPY Buy and Hold		
Period	Portfolio	Annual Return (in %)	Annual Risk (in %)	Sharpe Ratio
Millennium Recession	SPBH	-7.48	22.04	-0.34*** (-10.40)
	V1	2.73	14.60	0.19*** (5.81)
	V2	-12.10	23.95	-0.51*** (-15.60)
Global Financial Crisis	SPBH	-20.55	37.21	-0.55*** (-10.96)
	V1	5.15	11.22	0.46*** (9.17)
	V2	-16.95	37.30	-0.45*** (-8.97)
Covid-19 Recession	SPBH	4.75	49.67	0.10* (1.02)
	V1	8.15	14.40	0.57*** (5.81)
	V2	-3.85	51.89	-0.07* (-0.71)

Crisis portfolios using Self switching

|		Self-switching portfolios against SPY Buy and Hold		
Period	Portfolio	Annual Return (in %)	Annual Risk (in %)	Sharpe Ratio
Millennium Recession	SPBH	-7.48	22.04	-0.34*** (-10.40)
	S1	6.18	6.76	0.91*** (27.84)
	S2	-1.88	16.54	-0.11** (-3.37)
	S3	2.73	14.60	0.19***(5.81)
	S4	-12.10	23.95	-0.51***(-15.60)
Global Financial Crisis	SPBH	-20.55	37.21	-0.55***(-10.96)
	S1	8.40	11.19	0.75***(14.94)
	S2	-20.35	35.94	-0.57***(-11.36)
	S3	9.83	16.03	0.61*** (12.15)
	S4	-19.73	39.25	-0.50***(-9.96)

Crisis portfolios using Self switching (continued)

	Self-switching portfolios against SPY Buy and Hold		
	SPBH	4.75	49.67	0.10*(1.02)
	S1	12.43	13.95	0.89*** 9.08)
Covid-19 Recession	S2	-8.20	51.67	-0.16*(-1.63)
	S3	9.83	13.94	0.70***(7.14)
	S4	-5.48	52.89	-0.10*(-1.02)

Number of ETFs

S3 # ETFs
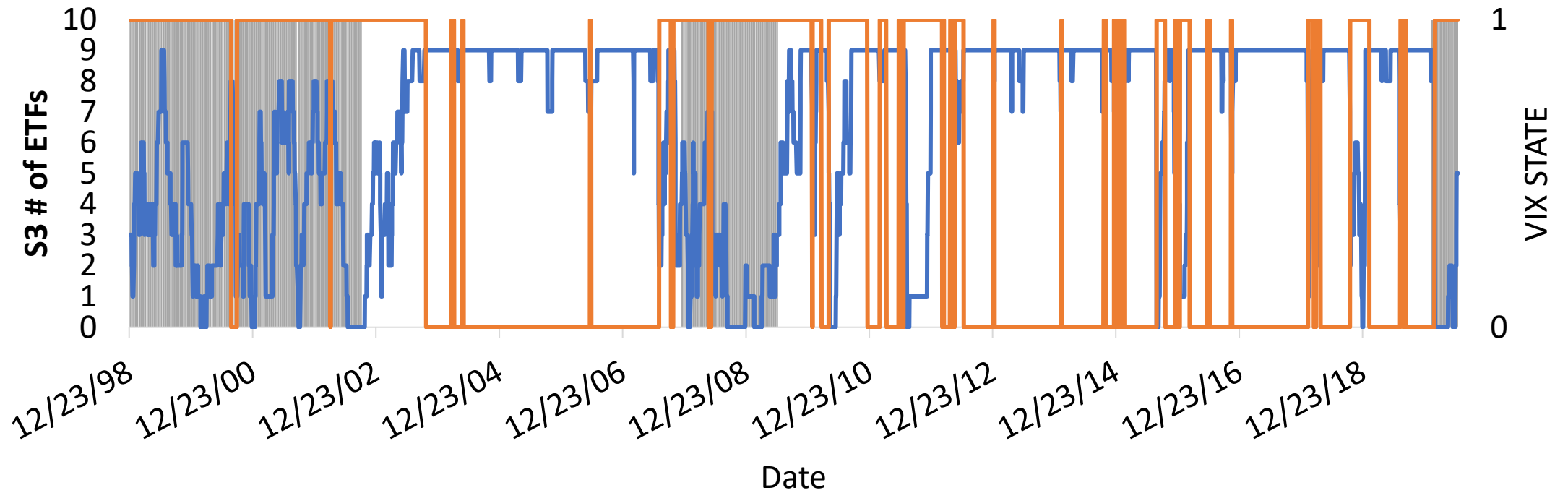
Legend: Recession — S3 # of ETFs — VIX state

S3 % of the time the number of Active ETFs in Crisis

# ETFS	Total	Millennium	Financial	Covid-19
0	6%	11%	28%	60%
1	5%	10%	15%	9%
2	5%	14%	20%	12%
3	4%	8%	13%	1%
4	5%	17%	9%	0%
5	5%	12%	4%	5%
6	5%	13%	6%	0%
7	4%	7%	5%	1%
8	7%	7%	0%	2%
9	53%	1%	0%	10%

S3 % of the time the ETF was active in Crisis

ETF	Full Period	Millennium	Financial	Covid-19
XLB	71%	51%	2%	22%
XLE	84%	80%	25%	13%
XLF	76%	56%	10%	13%
XLI	70%	45%	12%	13%
XLK	66%	3%	22%	25%
XLP	72%	29%	26%	18%
XLU	85%	66%	59%	23%
XLV	78%	40%	59%	36%
XLY	64%	15%	0%	12%

S3 % of the time the ETF was active in Crisis

ETF	Full Period	Millennium	Financial	Covid-19
XLB	71%	51%	2%	22%
XLE	84%	80%	25%	13%
XLF	76%	56%	10%	13%
XLI	70%	45%	12%	13%
XLK	66%	3%	22%	25%
XLP	72%	29%	26%	18%
XLU	85%	66%	59%	23%
XLV	78%	40%	59%	36%
XLY	64%	15%	0%	12%

Conclusions

- Switching from sector ETFs to bonds in high volatility states measured by VIX outperforms buy and hold

- Switching performance improves when sectors are rotated based upon their own volatility states

- In times of crisis rotating ETFs significantly enhance returns.

Conclusions (continued)

- Returns and volatility are negatively correlated

- This negative relationship can be used to construct high return switching portfolios

- The performance is the best when individual volatility states are used