QARM CAPITAL

Style Rotation on Swiss Long-Only Equities Factors

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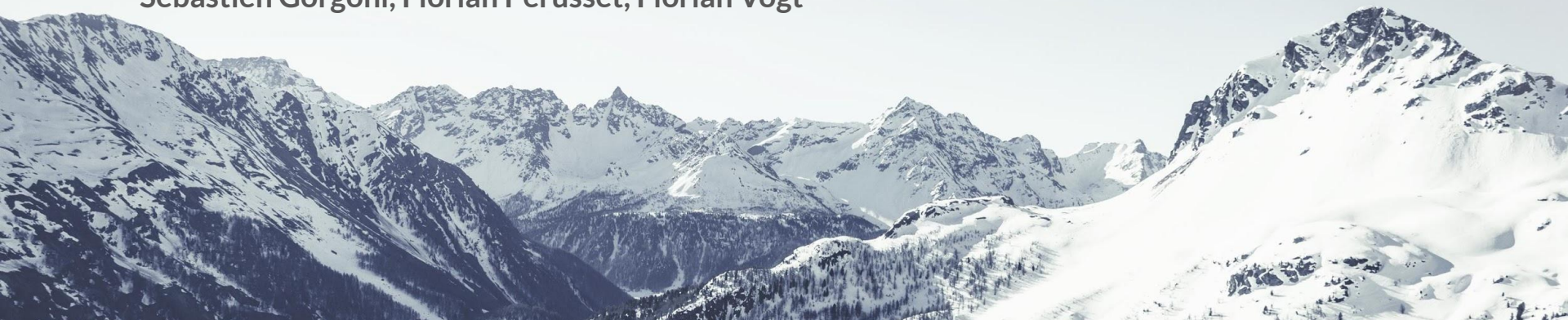

Your Team

As a team of qualified portfolio managers, with strong academic backgrounds at HEC Lausanne, we are aiming to provide excellent investment solutions in the Swiss market.

Florian Perusset

Our Objectives

Mandate: Managing a dynamic long-only portfolio of risk premia on the Swiss market, with a focus on the tracking-error.

Long-Term Vision & Diversification

Higher Returns & Lower Risks

Exposure to the Swiss Market

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Introduction

Rationale of Factor Investing

- New paradigms in the investment industry from the researches of Fama and French in the 1990s
- Factor investment gains increasing interest since then
- Factors anomalies (e.g. returns momentum, size, beta, volatilities, etc.) which can explain and improve the performances of portfolios
- Question: **How to combine these factors at the appropriate time in our portfolios?**
    - Risk-based approach
    - Factor tilting through changing macro environment

Data

Factor Creation: Swiss Performance Index

- Monthly data (Reuters Datastream)
- All companies included in the Swiss Performance Index from 2009
- Data from these companies collected from January 2000:
    - Stock price;
    - Volume traded (liquidity constraint);
    - Fundamental values (EPS, Dividend Yield, PE, Market-to-book, etc).

Factor Timing: US Macroeconomic Data

- Monthly data
- To time the factors: US market
  - 10y LT government bond yield in the US;
  - VIX Index
  - CPI Index
  - Libor in USD at different maturities
- Risk-free rate: Swiss market
  - 1M Libor in CHF
- Collected from the Federal Reserve of Economic Data (FRED)

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Methodology

Factor Construction

Eight popular factors considered:

- Momentum (12-months average return)
- Value (E/P)
- Size (Market cap)
- Profitability (Gross margin)
- Low-Beta (Beta)
- Low-Volatility (12-months rolling variance)
- Dividend (Dividend yield)
- Quality Earnings (EPS)

Take either a long position above or below a certain quantile depending on the factor, and remove illiquid companies

Portfolio Strategies

No Factor Tilting:

- Equal-Risk Contribution

Factor Tilting:

- Ridge Regression
- Momentum of Factors
- Parametric Weights

Equal-Risk Contribution

- Capital allocation which *equalizes the risk contribution* of each asset:

$$\alpha_i MCR_i = \alpha_j MCR_j$$

- The Marginal Contributions to Risk (MCR) is:

$$MCR = \frac{\Sigma \alpha}{\sigma_p}$$

Ridge Regression

- Ulloa, Giamouridis & Montagu (2012): *Risk Reduction in Style Rotation*
- Timing factors by maximizing the information ratio and maintaining a close position to the EW

$$\max_{w} \left(\frac{\bar{R}_{factors}}{\sigma^2_{factors}} - \lambda \sum_{i=1}^{K} w_i^2 \right)$$

- Subject to:

$$\sum_{i=1}^{K} w_i = 1 \qquad\qquad w_{min} \leq w_i \leq w_{max}$$

Momentum of Factors

- Potential persistence in the factors' returns through time
- Long/short: Buy the past 12-months winner and sell the past 12-months losers
- Long-only: Buy the past 12-months winner with an average return above the 50th percentile

Parametric Weights

- Brandt & Santa-Clara (2006). *Dynamic Portfolio Selection by Augmenting the Asset Space*
- Parametrize the portfolio weights as a linear function of observable quantities (e.g. macro data, firm's characteristics, etc.):

$$\alpha_t = \theta z_t$$

- Mean-variance optimization problem:

$$\max_{\{\theta\}} E_t[(\theta z_t)' r_{t+q}] - \frac{\lambda}{2} V_t[(\theta z_t)' r_{t+q}]$$

- Optimal solution:

$$\tilde{\alpha} = \frac{1}{\lambda} \left[\sum_{t=1}^{T} z_t z_t' \otimes r_{t+1} r_{t+1}' \right]^{-1} \left[\sum_{t=1}^{T} z_t \otimes r_{t+1} \right]$$

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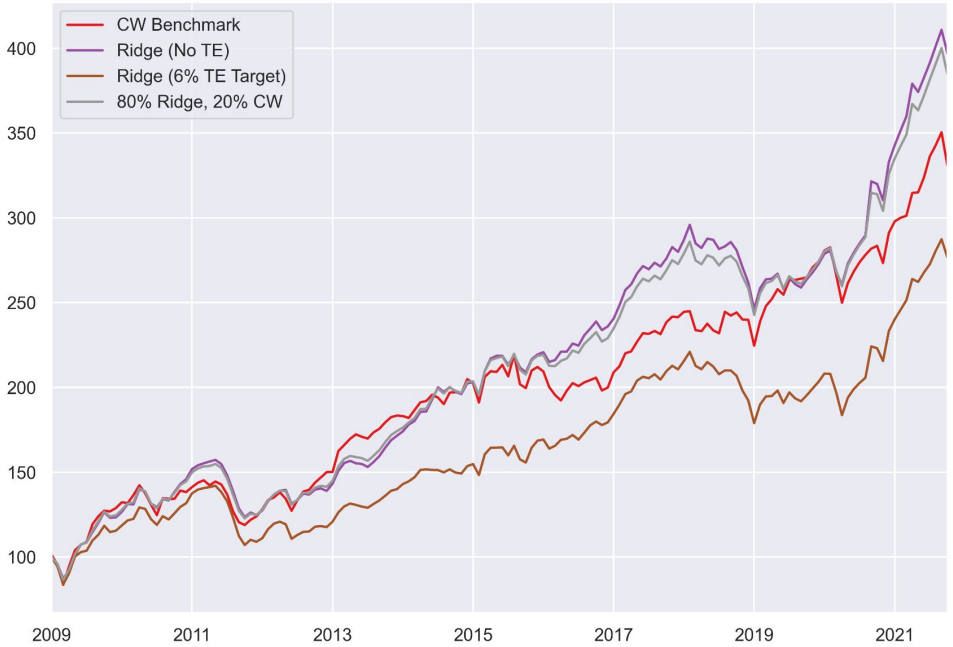
Portfolio Performances

Three Tailor-Made Portfolios

- **Defensive Portfolio** (based on a Ridge regression)
- **Balanced Portfolio** (based on parametric weights with VIX only)
- **Dynamic Portfolio** (based on a momentum of factors)
- Laggard: Equal-Risk Contribution

Defensive Portfolio

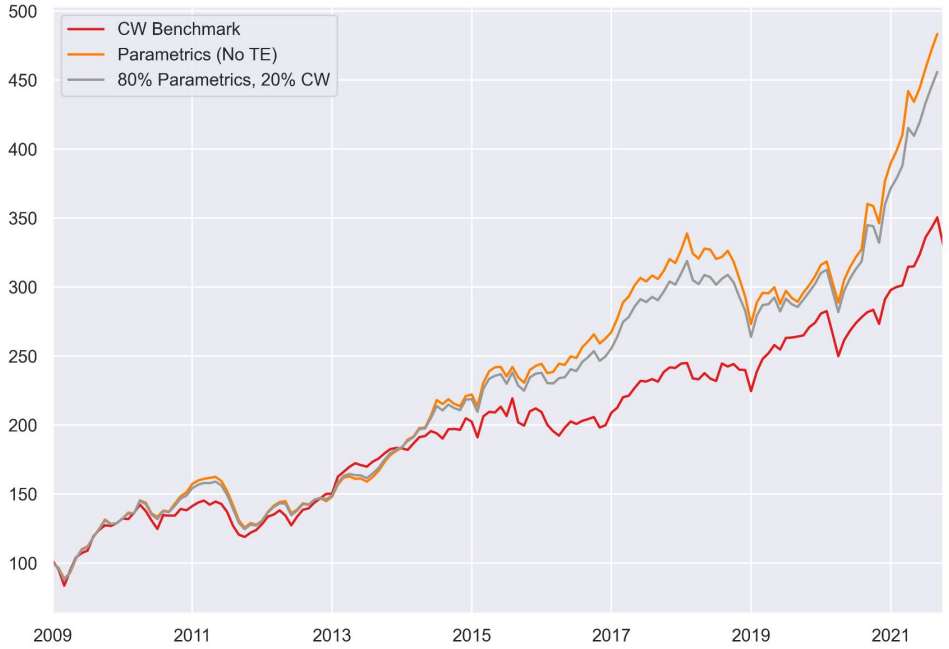


Defensive Portfolio

	CW	Ridge (No TE)	Ridge (6% TE Target)	80% Ridge, 20% CW
Ann. Return (%)	10.086	11.352	8.614	11.099
Ann. STD (%)	12.051	10.602	11.438	10.511
SR	0.869	1.107	0.787	1.092
Max DD (%)	-18.161	-21.496	-24.616	-20.751
Hit Ratio (%)	66.234	66.883	64.935	66.234
TE Ex-Post (%)	0.000	7.308	6.194	5.846
Info. Ratio	0.000	0.173	-0.238	0.173
VaR (%)	3.671	3.041	3.606	3.076
ES (%)	4.885	3.997	4.660	4.107

- Outperformance of the defensive portfolio
- TE reduction in optimization not optimal, better performances when simply combining it with the benchmark
- Low risk and decent returns
- Lowest information ratio as most defensive portfolio

Balanced Portfolio

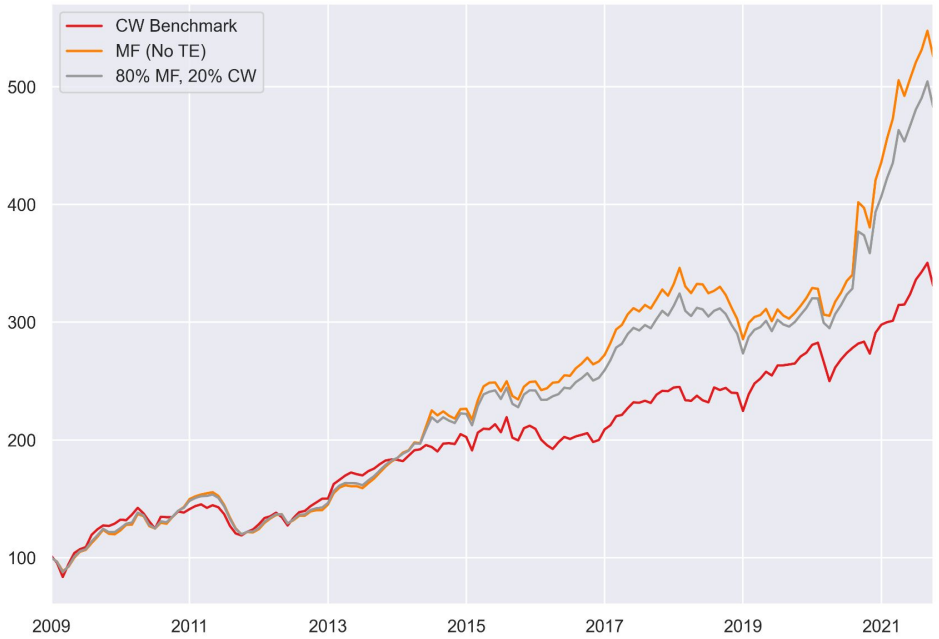


Balanced Portfolio

	CW	Parametrics (No TE)	80% Parametrics, 20% CW
Ann. Return (%)	10.086	13.075	12.578
Ann. STD (%)	12.051	11.462	11.148
SR	0.869	1.174	1.163
Max DD (%)	-18.161	-22.644	-21.678
Hit Ratio (%)	66.234	66.667	65.584
TE Ex-Post (%)	0.000	7.698	6.158
Info. Ratio	0.000	0.323	0.323
VaR (%)	3.671	3.353	3.318
ES (%)	4.885	4.291	4.330

- Outperformance of the balanced portfolio
- Optimal trade-off between TE and performances
- Combination with benchmark can reduce substantially the TE, while keeping a similar SR
- High information ratio (approximately the double of the defensive portfolio)

Dynamic Portfolio



Dynamic Portfolio

	CW	MF (No TE)	80% MF, 20% CW
Ann. Return (%)	10.086	13.738	13.007
Ann. STD (%)	12.051	12.219	11.662
SR	0.869	1.156	1.148
Max DD (%)	-18.161	-23.006	-21.974
Hit Ratio (%)	66.234	67.532	66.883
TE Ex-Post (%)	0.000	8.860	7.088
Info. Ratio	0.000	0.412	0.412
VaR (%)	3.671	3.331	3.297
ES (%)	4.885	4.550	4.587

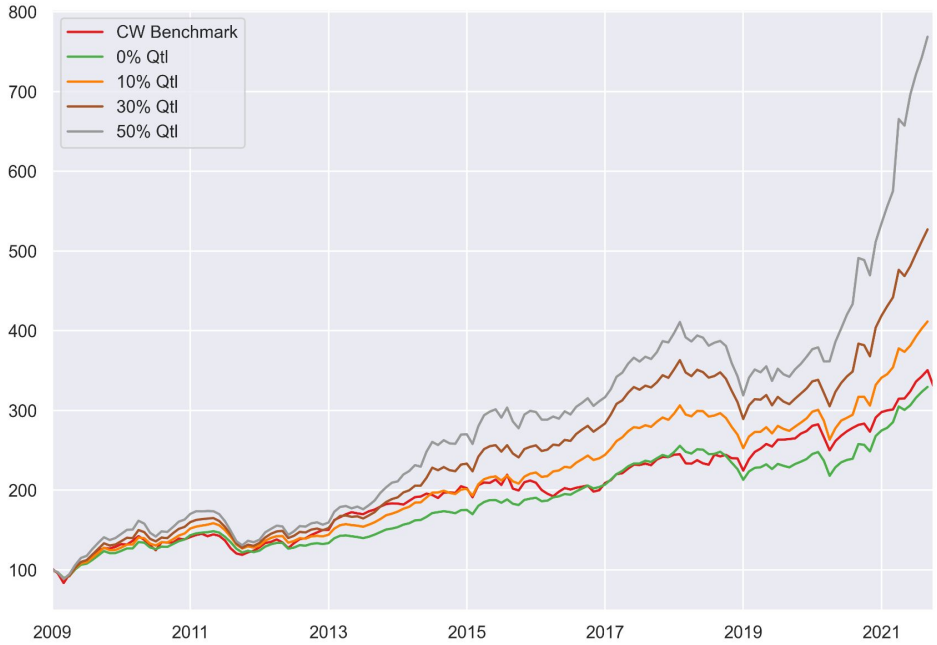
- Outperformance of the dynamic portfolio
- Highest annualized returns, but with higher risk (lower SR than balanced portfolio)
- Highest information ratio but with similar maximum drawdown as the other portfolio
- Highest tracking-error of all strategies: optimal to combine with the benchmark

Sensitivity & Robustness

Variables to Monitor

- Liquidity constraint
- Factor construction
- Combination with the benchmark to reduce the tracking-error
- Focus on the balanced portfolio (parametric weights with VIX)

Liquidity Constraints



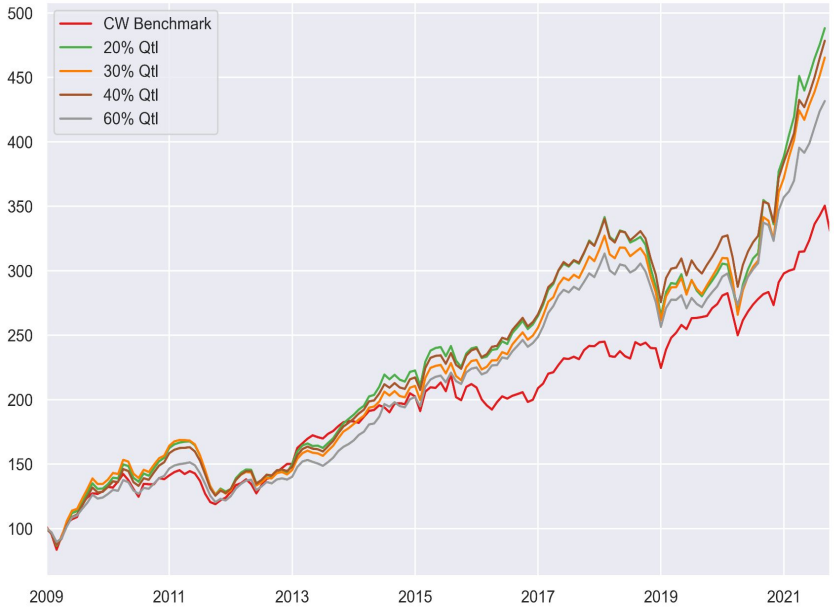
- Interestingly, adding liquidity constraint increases performance
- No liquidity premium

Liquidity Constraints

	0% Qtl		10% Qtl		30% Qtl		50% Qtl	
	No TE	20% CW	No TE	20% CW	No TE	20% CW	No TE	20% CW
Ann. Return (%)	9.842	9.992	11.702	11.479	13.809	13.165	17.067	15.772
Ann. STD (%)	9.534	9.621	10.550	10.467	11.890	11.501	13.992	13.152
SR	1.072	1.078	1.145	1.133	1.194	1.178	1.247	1.228
Max DD (%)	-17.987	-17.930	-20.028	-19.569	-22.594	-21.637	-24.766	-23.299
Hit Ratio (%)	68.627	66.883	69.281	68.182	66.667	66.883	64.706	63.636
TE Ex-Post (%)	7.415	5.932	7.122	5.698	7.699	6.159	8.767	7.013
Info. Ratio	-0.101	-0.101	0.156	0.156	0.418	0.418	0.739	0.739
VaR (%)	2.846	2.938	3.152	3.184	3.486	3.429	3.908	3.743
ES (%)	3.833	3.967	4.249	4.293	4.461	4.480	5.049	4.930

- Expected return & volatility increase as quantile increases
- Risk-adjusted performance (Sharpe ratio & IR) also increases
- Drawdowns become also more frequent
- TE becomes also higher when quantile increases

Factor Construction



- Increasing the quantile generally decreases performance

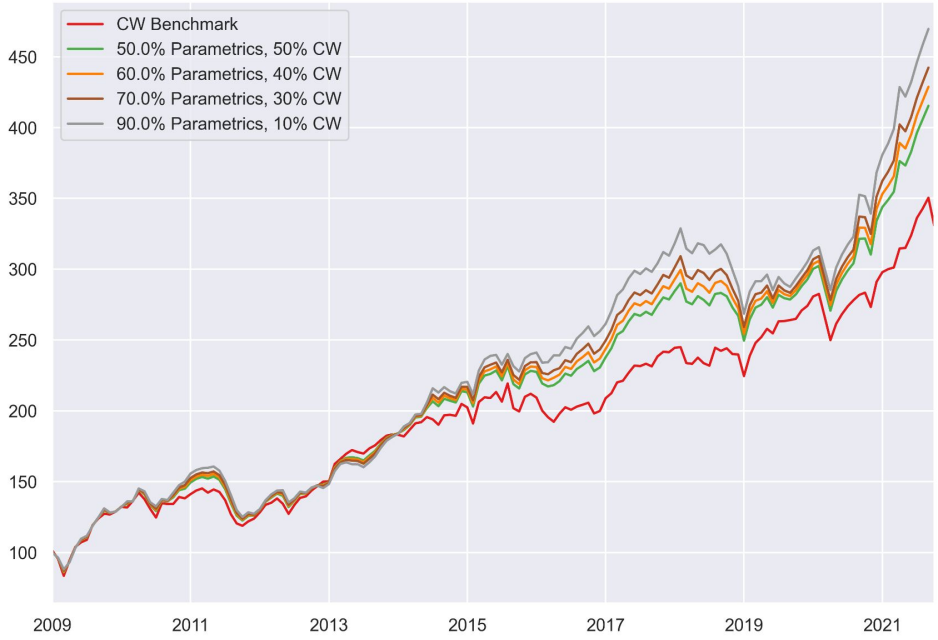
- Still outperforms CW benchmark in terms of absolute performance (seems quite robust).

Factor Construction

	20% Qtl		30% Qtl		40% Qtl		60% Qtl	
	No TE	20% CW	No TE	20% CW	No TE	20% CW	No TE	20% CW
Ann. Return (%)	13.385	12.826	12.969	12.493	13.050	12.558	12.079	11.781
Ann. STD (%)	13.362	12.690	13.056	12.478	11.929	11.601	10.554	10.431
SR	1.030	1.041	1.023	1.032	1.126	1.115	1.181	1.166
Max DD (%)	-24.594	-23.255	-25.207	-23.825	-23.088	-22.037	-20.360	-19.836
Hit Ratio (%)	66.667	65.584	64.706	66.883	66.667	66.234	67.320	66.883
TE Ex-Post (%)	8.081	6.465	7.632	6.106	7.027	5.621	7.474	5.979
Info. Ratio	0.346	0.346	0.312	0.312	0.350	0.350	0.199	0.199
VaR (%)	3.984	3.826	3.980	3.824	3.627	3.550	3.068	3.112
ES (%)	5.069	4.924	5.237	5.073	4.755	4.697	3.976	4.081

- Expected return and volatility are decreasing when quantile increases
- Slight improvement in the Sharpe ratio, however the IR is smaller.
- Portfolio becomes clearly less risky (lower volatility, drawdowns)
- TE is decreasing as quantile increases

Combination with Benchmark



- Parametric portfolio (using VIX) outperforms CW benchmark
- The more we allocate to the parametric portfolio the more (absolute) performance we get.
- The idea is to reduce TE

Combination with Benchmark

	50% Ptf, 50% CW	60% Ptf, 40% CW	70% Ptf, 30% CW	90% Ptf, 10% CW
Ann. Return (%)	11.832	12.081	12.329	12.826
Ann. STD (%)	11.065	11.040	11.067	11.280
SR	1.104	1.129	1.149	1.171
Max DD (%)	-20.216	-20.705	-21.192	-22.161
Hit Ratio (%)	68.182	65.584	65.584	66.234
TE Ex-Post (%)	3.849	4.619	5.388	6.928
Info. Ratio	0.323	0.323	0.323	0.323
VaR (%)	3.388	3.350	3.320	3.326
ES (%)	4.495	4.423	4.365	4.302

- Expected return decreases a bit when allocating more to the CW benchmark, while volatility remains almost the same
- Sharpe ratio decreases a little bit
- TE is substantially smaller when CW shares increases

Conclusion

Conclusion

Each portfolio has its strengths & weaknesses

- ERC (not presented) : less risky than CW but underperforms in terms of absolute return
- Ridge regression (defensive) : less return than CW, lowest risk-adjusted performance & lowest risk
- Momentum of factors (dynamic): outperforms CW, best risk-adjusted performance but most risky
- Parametric VIX (balanced): outperforms CW, good risk-adjusted performance & low TE

Optimal choice depends on risk preferences but Parametric VIX seems to be the best for an institutional investor

Thank You

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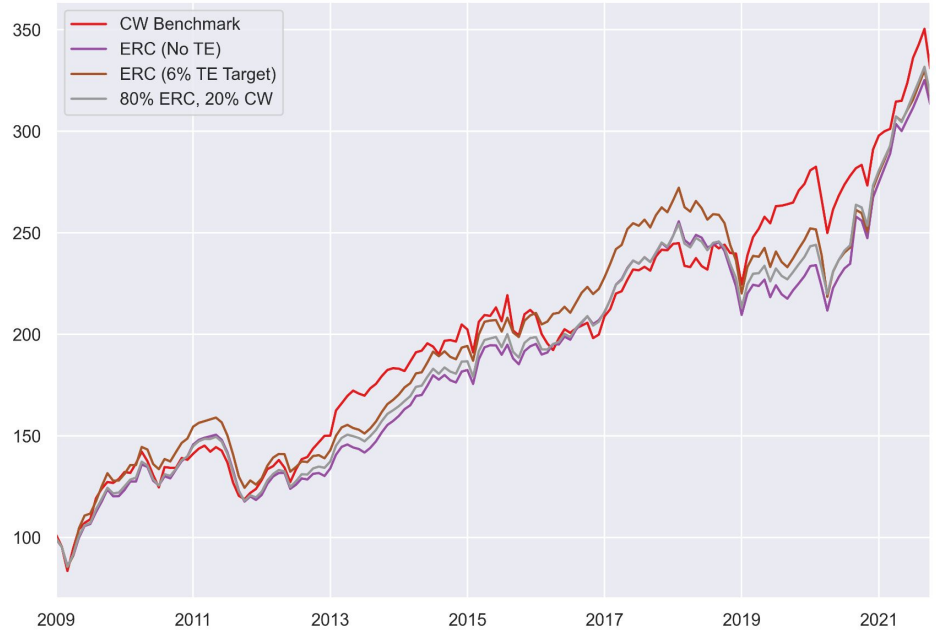
Appendix

Laggard: Equal-Risk Contribution



Laggard: Equal-Risk Contribution

	CW	ERC (No TE)	ERC (6% TE Target)	80% ERC, 20% CW
Ann. Return (%)	10.086	9.500	9.698	9.617
Ann. STD (%)	12.051	10.653	11.466	10.577
SR	0.869	0.928	0.879	0.945
Max DD (%)	-18.161	-21.859	-21.743	-21.043
Hit Ratio (%)	66.234	65.584	64.935	65.584
TE Ex-Post (%)	0.000	7.077	6.766	5.662
Info. Ratio	0.000	-0.083	-0.057	-0.083
VaR (%)	3.671	3.216	3.449	3.228
ES (%)	4.885	4.146	4.525	4.232