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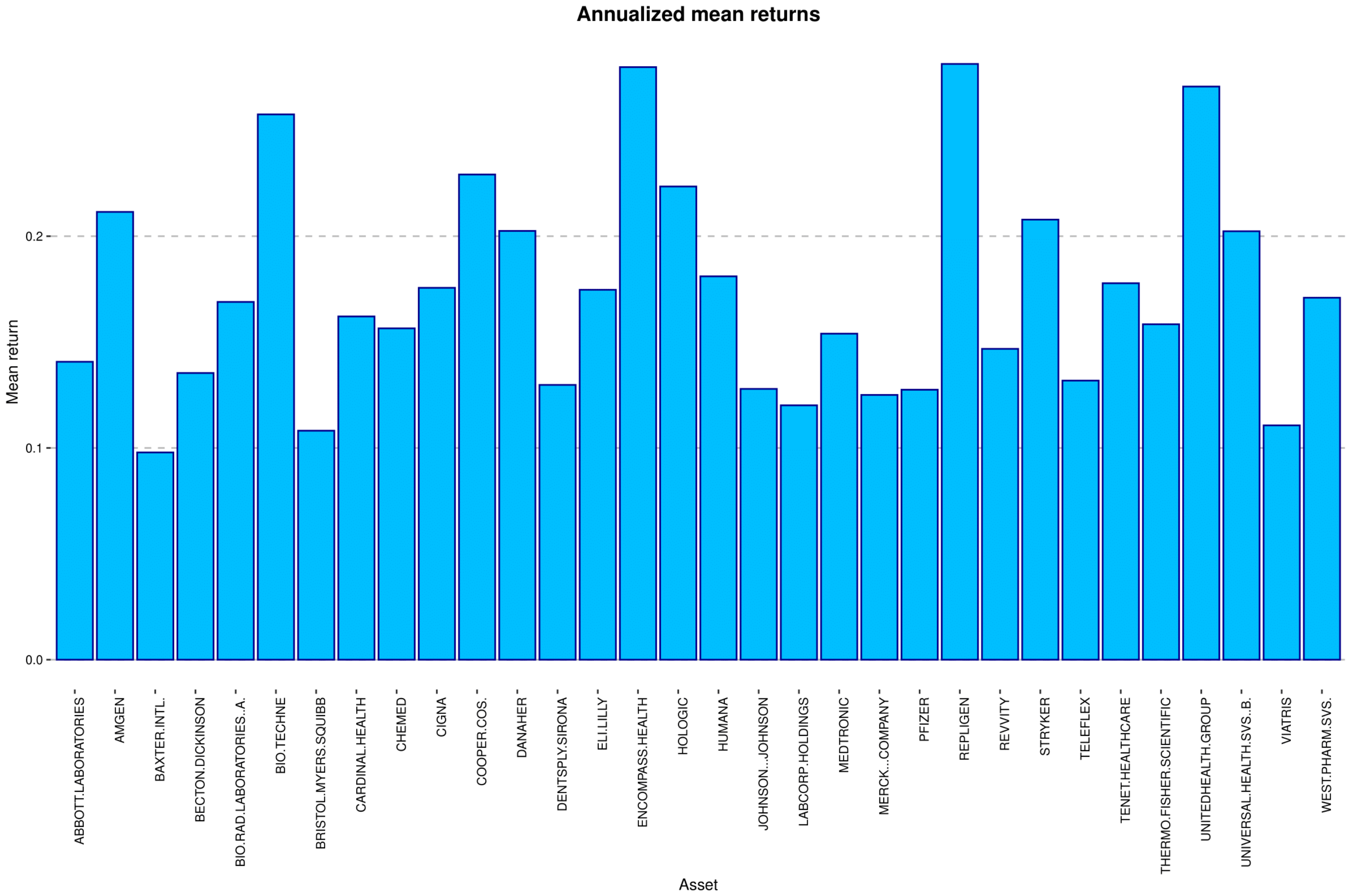
Data Project. Healthcare

Mikhail Kazakov

Data preparation

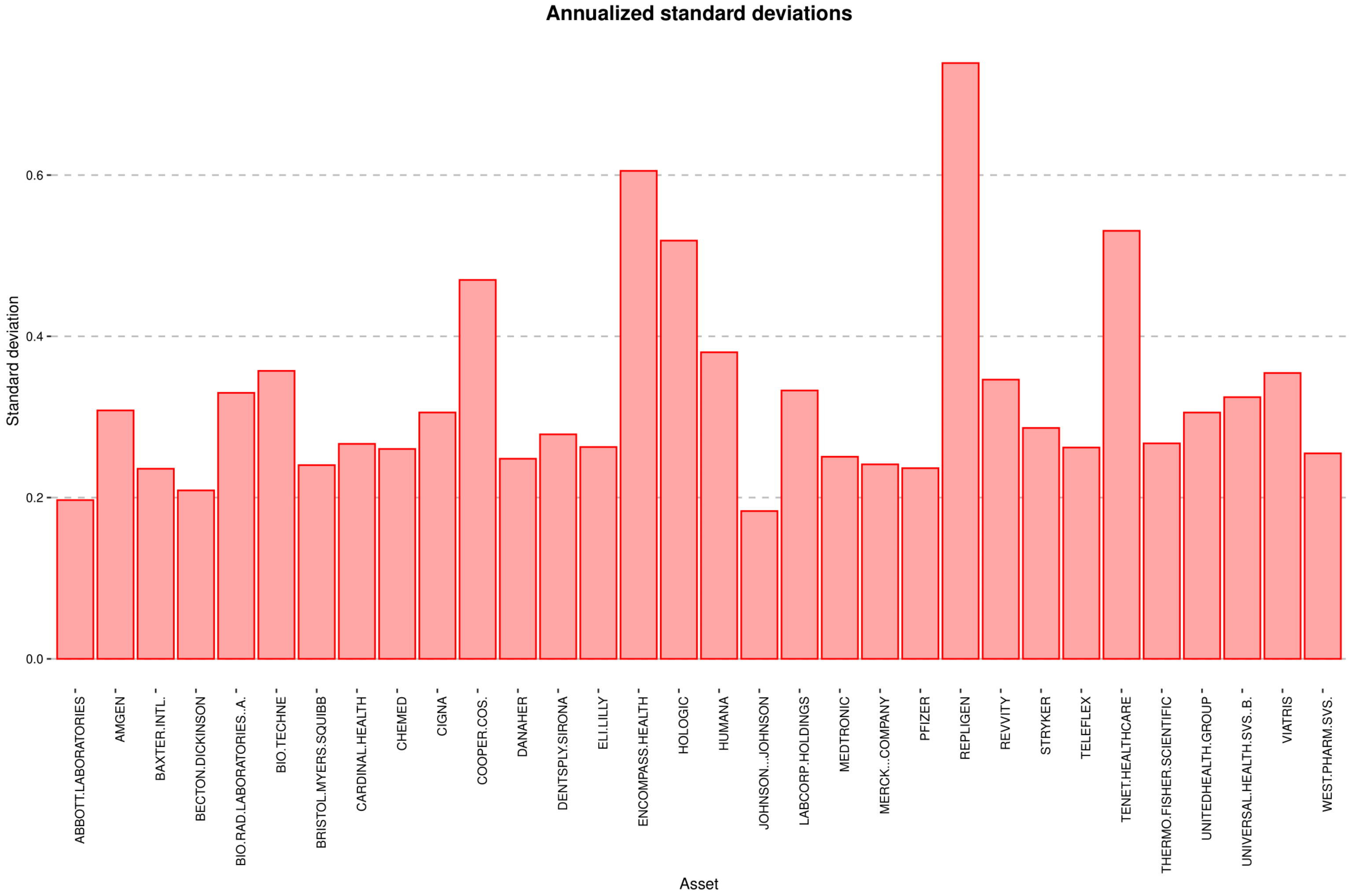
- Initial sample: 107 companies. Time period: 1973 – 2024
- Deletion criteria – missing data in 1990-2024
- Final sample: **32 companies**. Time period: **1990-2024**

Descriptive statistics. Mean



Metrics	Value
Min	9.8%
Q1	13.1%
Median	16.5%
Q3	20.3%
Max	28.1%
Market mean	12.0%

Descriptive statistics. SD



Metrics	Value
Min	18.3%
Q1	25.0%
Median	28.2%
Q3	34.8%
Max	74.0%
Market SD	15.5%

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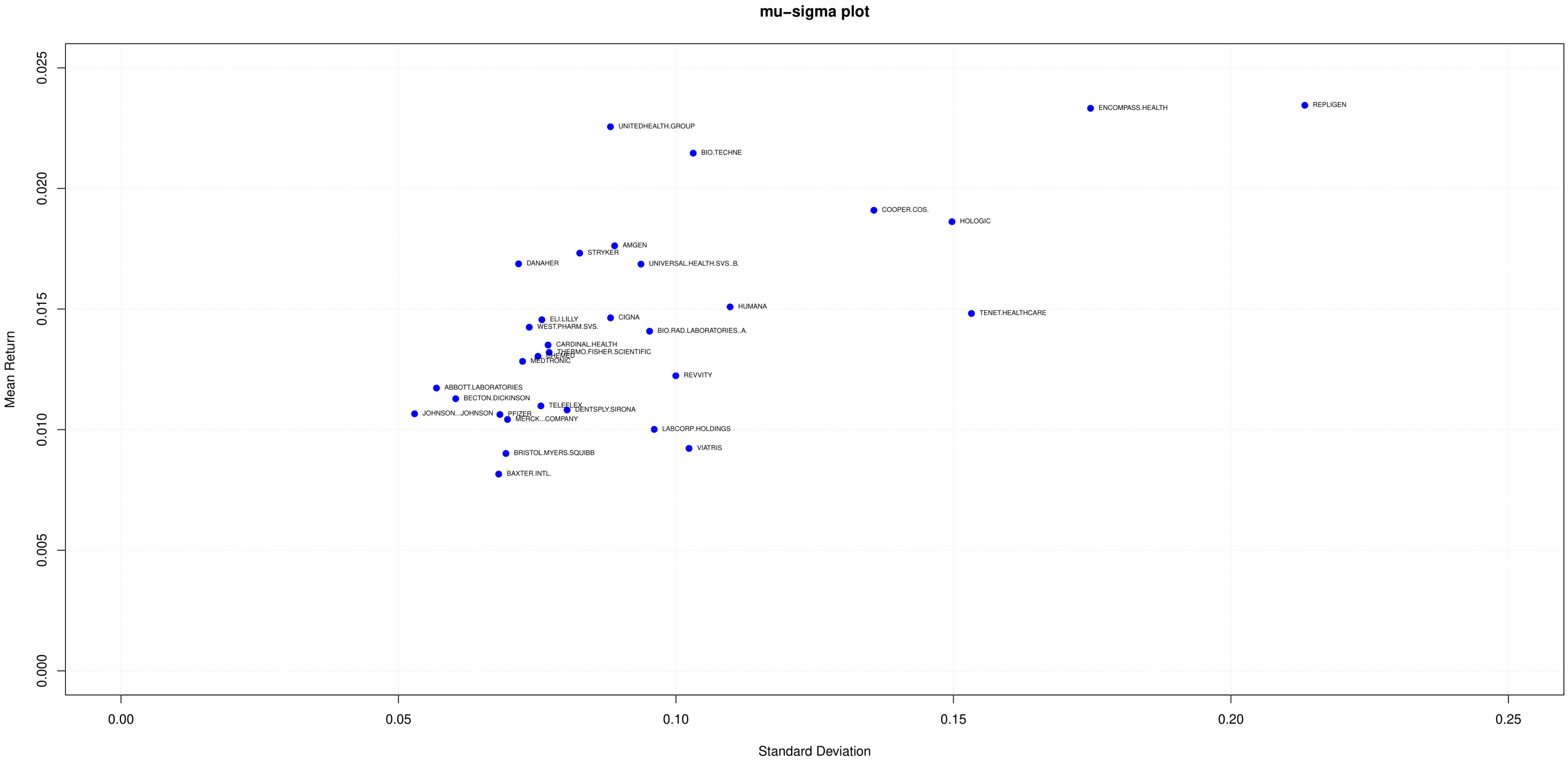
Descriptive statistics. μ-σ plot



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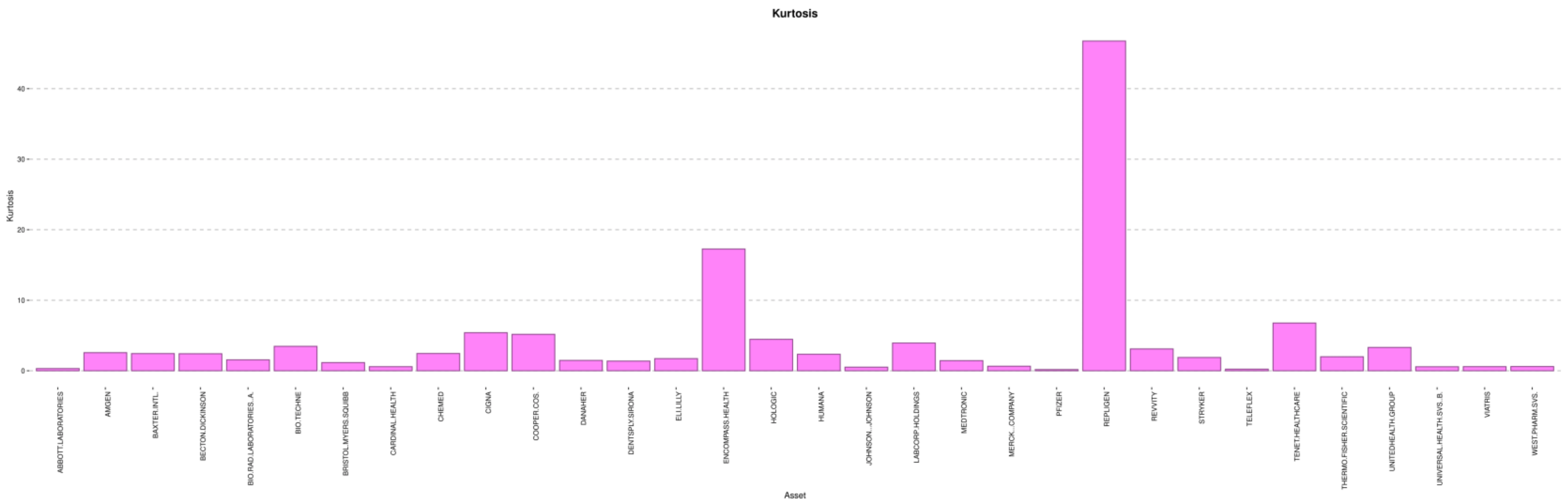
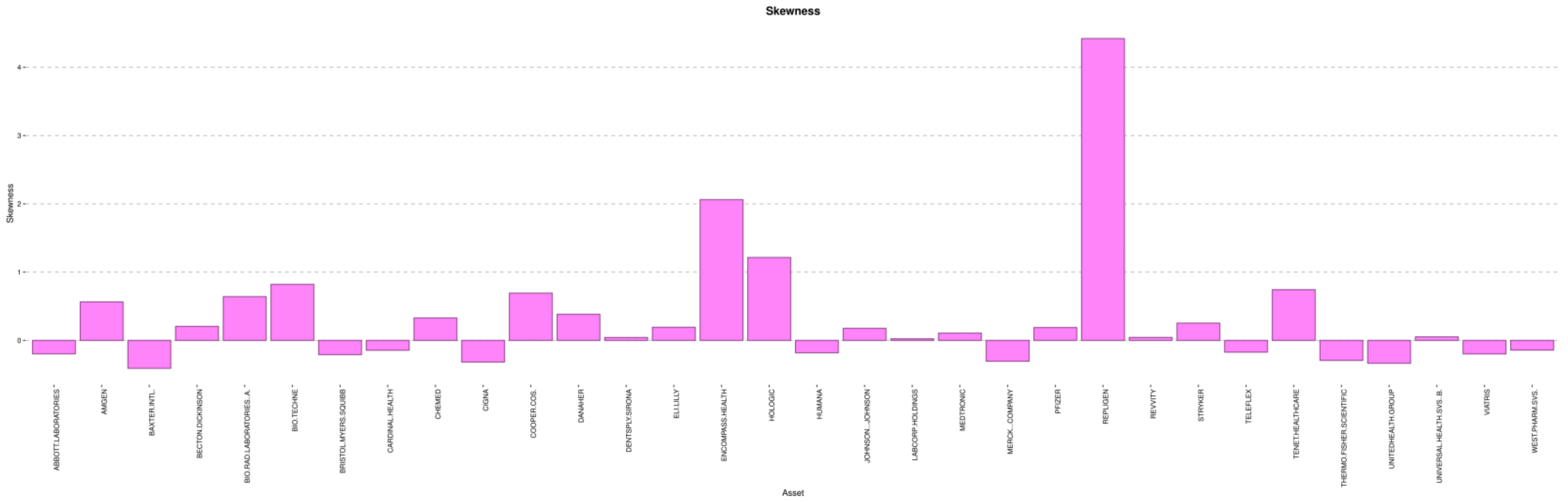
Descriptive statistics. Kurtosis and skewness





Kurtosis

Metrics	Value
Min	0.17
Q1	0.63
Median	1.94
Q3	3.35
Max	46.76
Market kurtosis	1.92

Skewness

Metrics	Value
Min	-0.41
Q1	-0.19
Median	0.08
Q3	0.43
Max	4.42
Market skewness	-0.43

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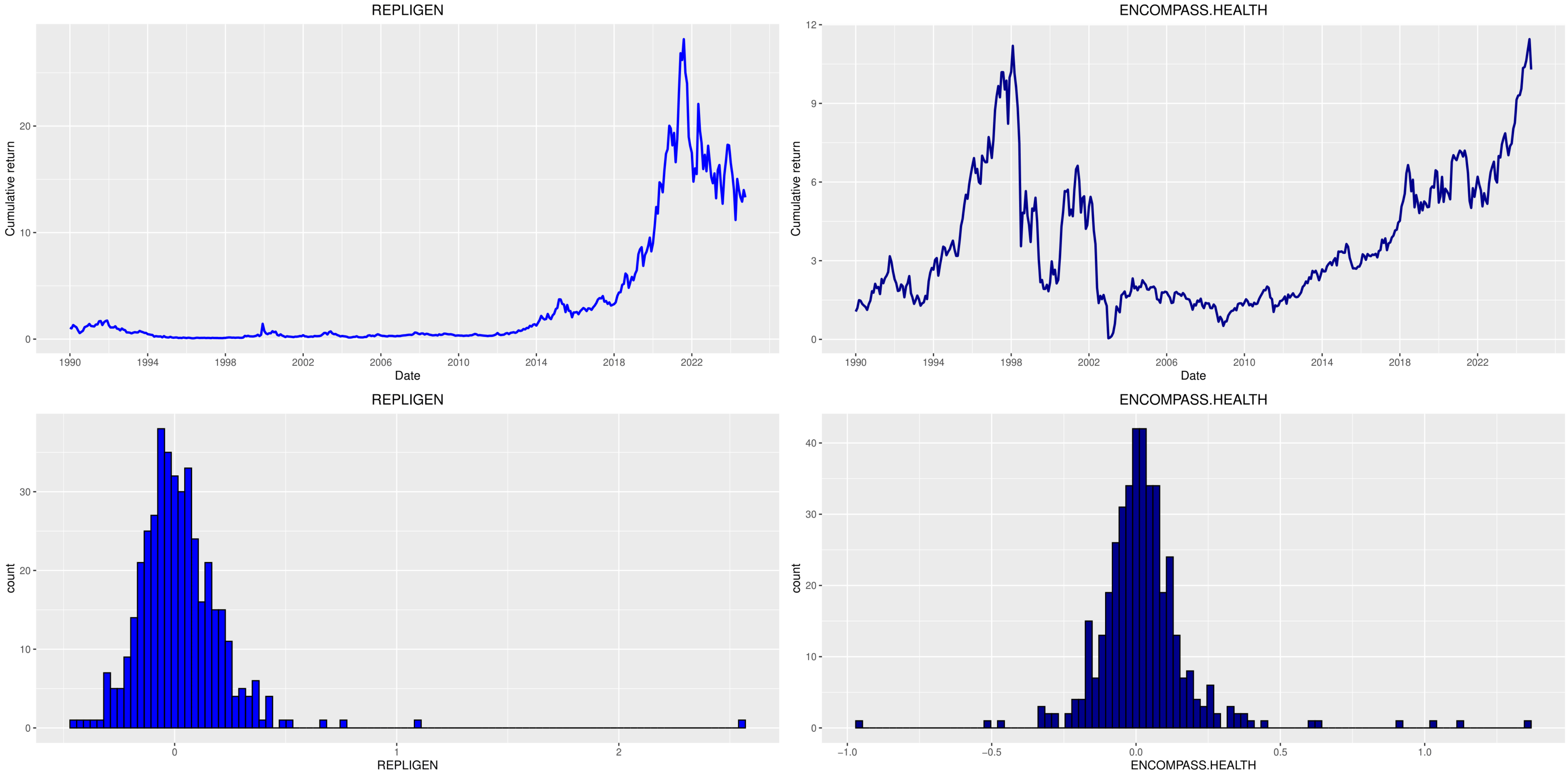
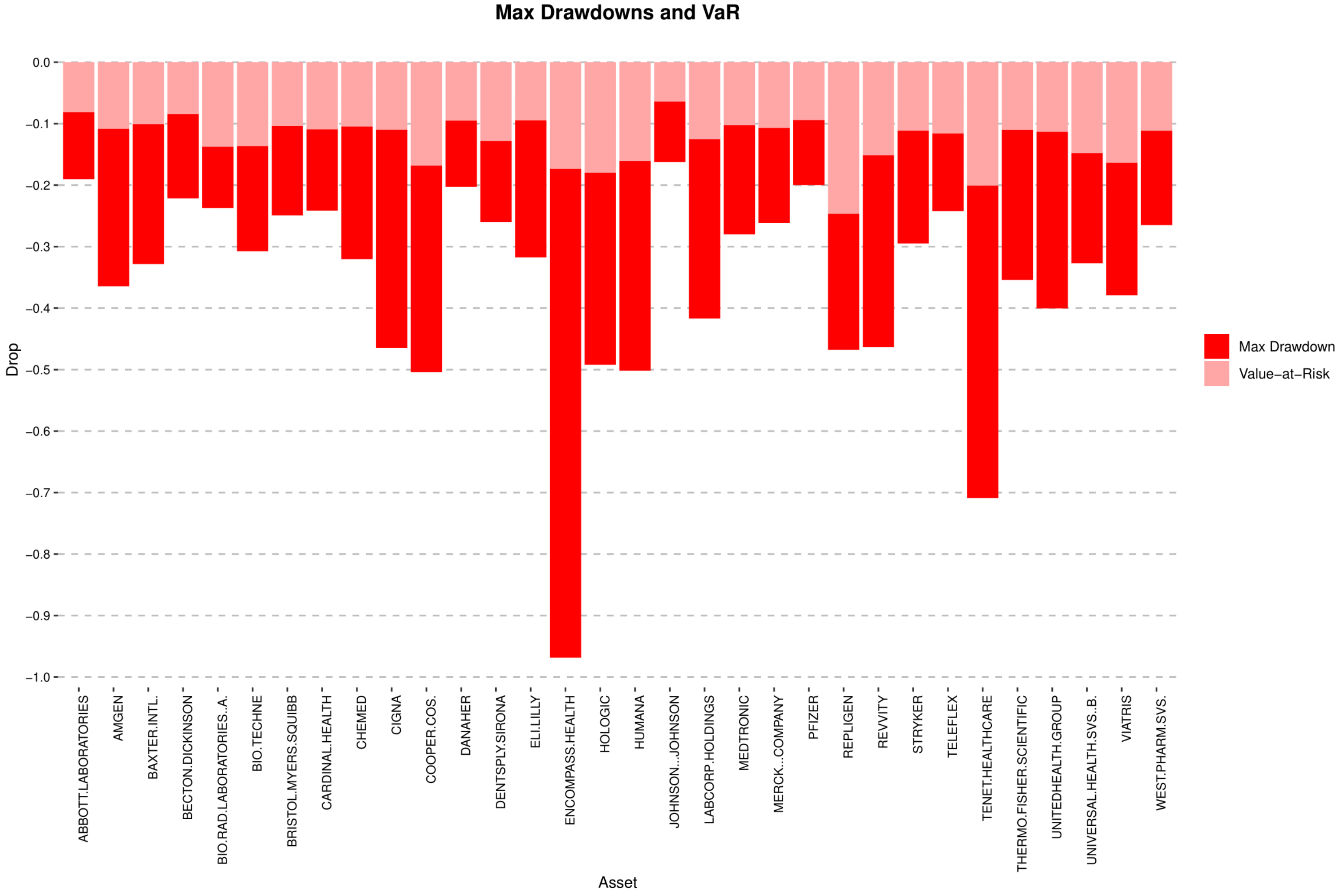
Repligen and Encompass Health



Descriptive statistics. VaR and Max Drawdowns



VaR (0.05)

Metrics	Value
Min	-24.7%
Q1	-14.9%
Median	-11.1%
Q3	-10.3%
Max	-6.4%
Market VaR	-6.8%

Max drawdown

Metrics	Value
Min	-96.8%
Q1	-42.8%
Median	-31.9%
Q3	-24.7%
Max	-16.2%
Market max drop	-19.0%

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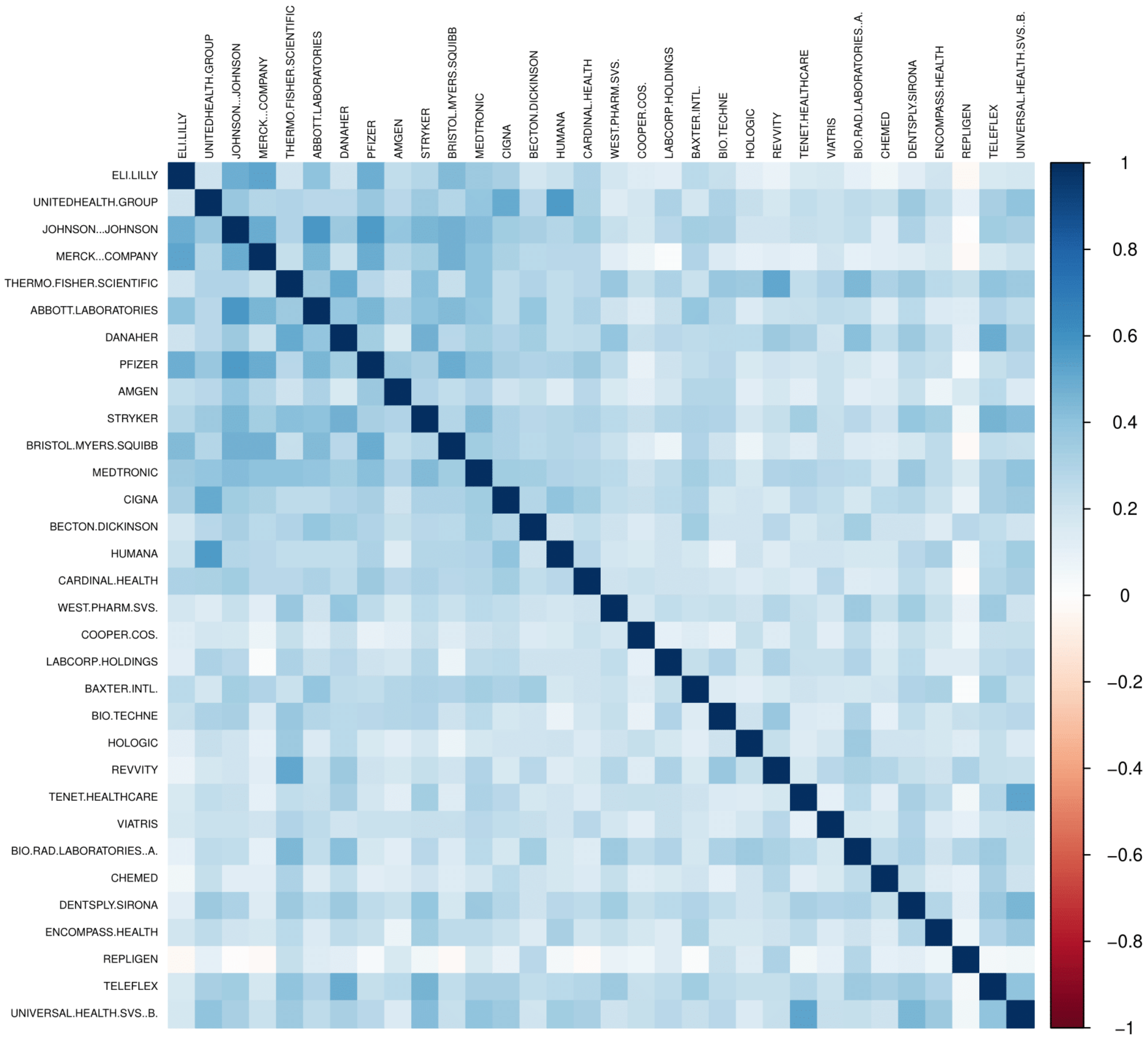
Descriptive statistics. Correlations



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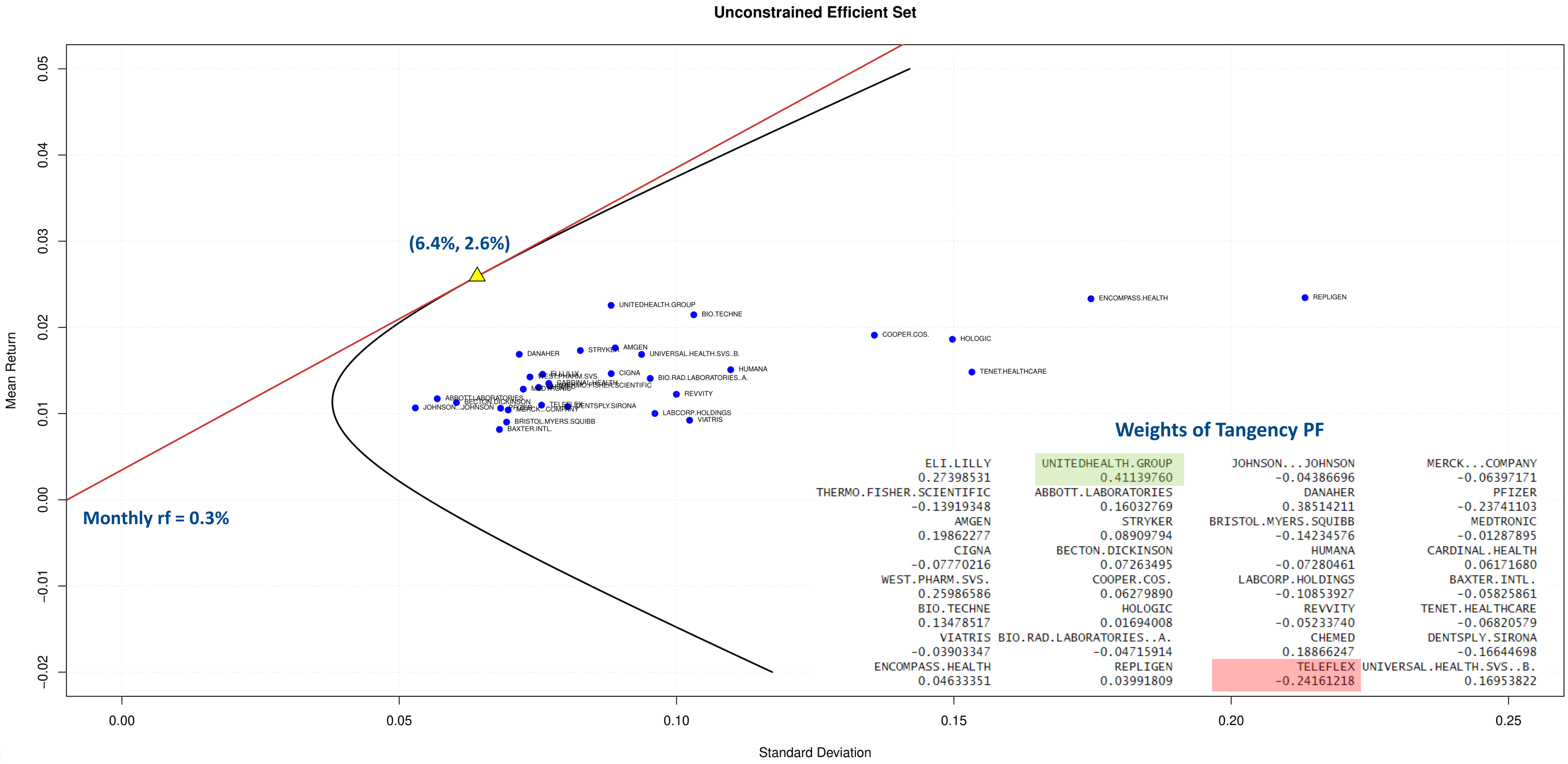
Efficient frontiers. Unconstrained



Weights of Tangency PF

ELI.LILLY	UNITEDHEALTH.GROUP	JOHNSON...JOHNSON	MERCK...COMPANY
0.27398531	0.41139760	-0.04386696	-0.06397171
THERMO.FISHER.SCIENTIFIC	ABBOTT.LABORATORIES	DANAHER	PFIZER
-0.13919348	0.16032769	0.38514211	-0.23741103
AMGEN	STRYKER	BRISTOL.MYERS.SQUIBB	MEDTRONIC
0.19862277	0.08909794	-0.14234576	-0.01287895
CIGNA	BECTON.DICKINSON	HUMANA	CARDINAL.HEALTH
-0.07770216	0.07263495	-0.07280461	0.06171680
WEST.PHARM.SVS.	COOPER.COS.	LABCORP.HOLDINGS	BAXTER.INTL.
0.25986586	0.06279890	-0.10853927	-0.05825861
BIO.TECHNE	HOLOGIC	REVVITY	TENET.HEALTHCARE
0.13478517	0.01694008	-0.05233740	-0.06820579
VIATRIS	BIO.RAD.LABORATORIES..A.	CHEMED	DENTSPLY.SIRONA
-0.03903347	-0.04715914	0.18866247	-0.16644698
ENCOMPASS.HEALTH	REPLIGEN	TELEFLEX	UNIVERSAL.HEALTH.SVS..B.
0.04633351	0.03991809	-0.24161218	0.16953822

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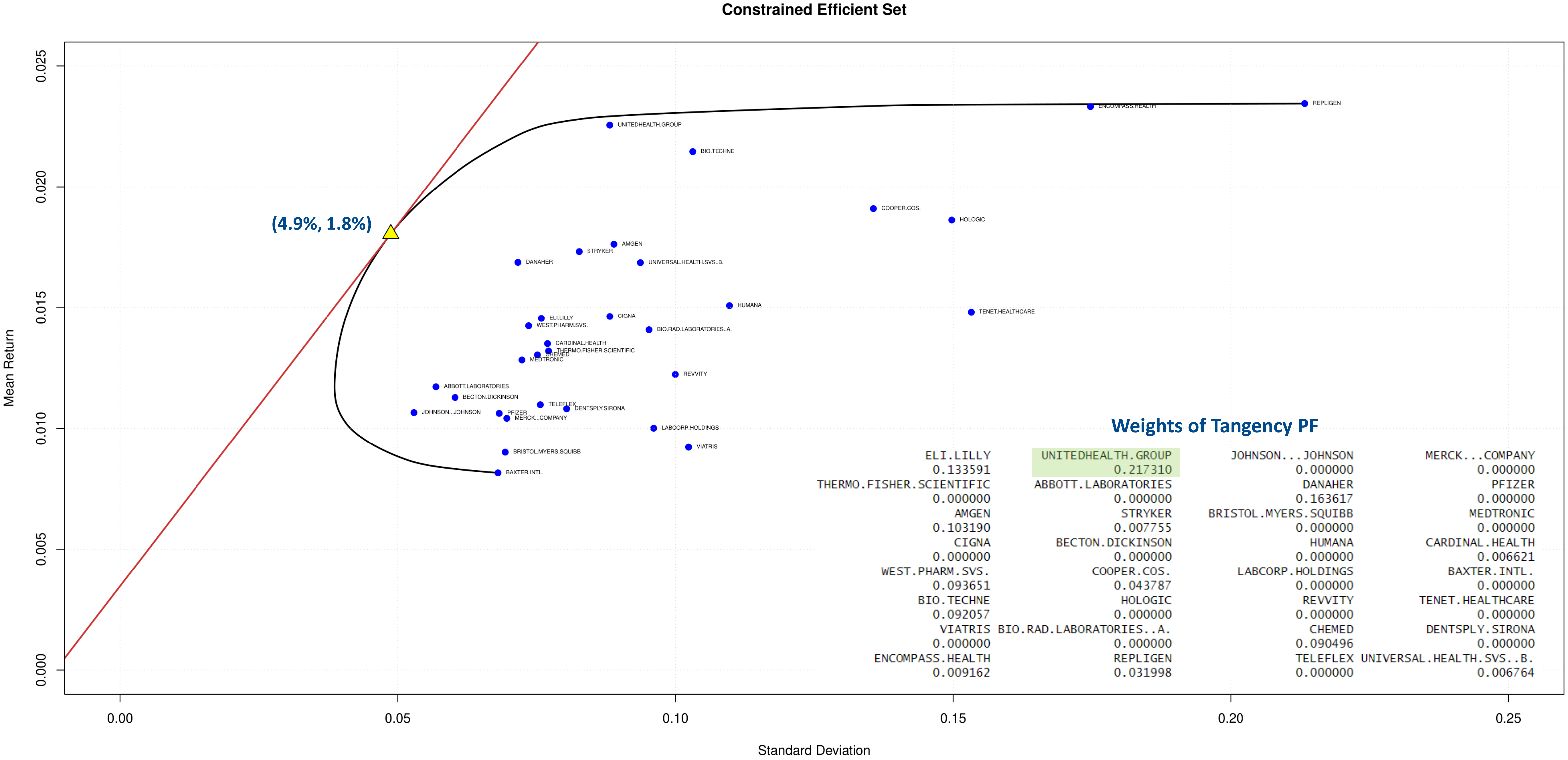
Efficient frontiers. Constrained



Weights of Tangency PF

ELI.LILLY	UNITEDHEALTH.GROUP	JOHNSON...JOHNSON	MERCK...COMPANY
0.133591	0.217310	0.000000	0.000000
THERMO.FISHER.SCIENTIFIC	ABBOTT.LABORATORIES	DANAHER	PFIZER
0.000000	0.000000	0.163617	0.000000
AMGEN	STRYKER	BRISTOL.MYERS.SQUIBB	MEDTRONIC
0.103190	0.007755	0.000000	0.000000
CIGNA	BECTON.DICKINSON	HUMANA	CARDINAL.HEALTH
0.000000	0.000000	0.000000	0.006621
WEST.PHARM.SVS.	COOPER.COS.	LABCORP.HOLDINGS	BAXTER.INTL.
0.093651	0.043787	0.000000	0.000000
BIO.TECHNE	HOLOGIC	REVVITY	TENET.HEALTHCARE
0.092057	0.000000	0.000000	0.000000
VIATRIS	BIO.RAD.LABORATORIES..A.	CHEMED	DENTSPLY.SIRONA
0.000000	0.000000	0.090496	0.000000
ENCOMPASS.HEALTH	REPLIGEN	TELEFLEX	UNIVERSAL.HEALTH.SVS..B.
0.009162	0.031998	0.000000	0.006764

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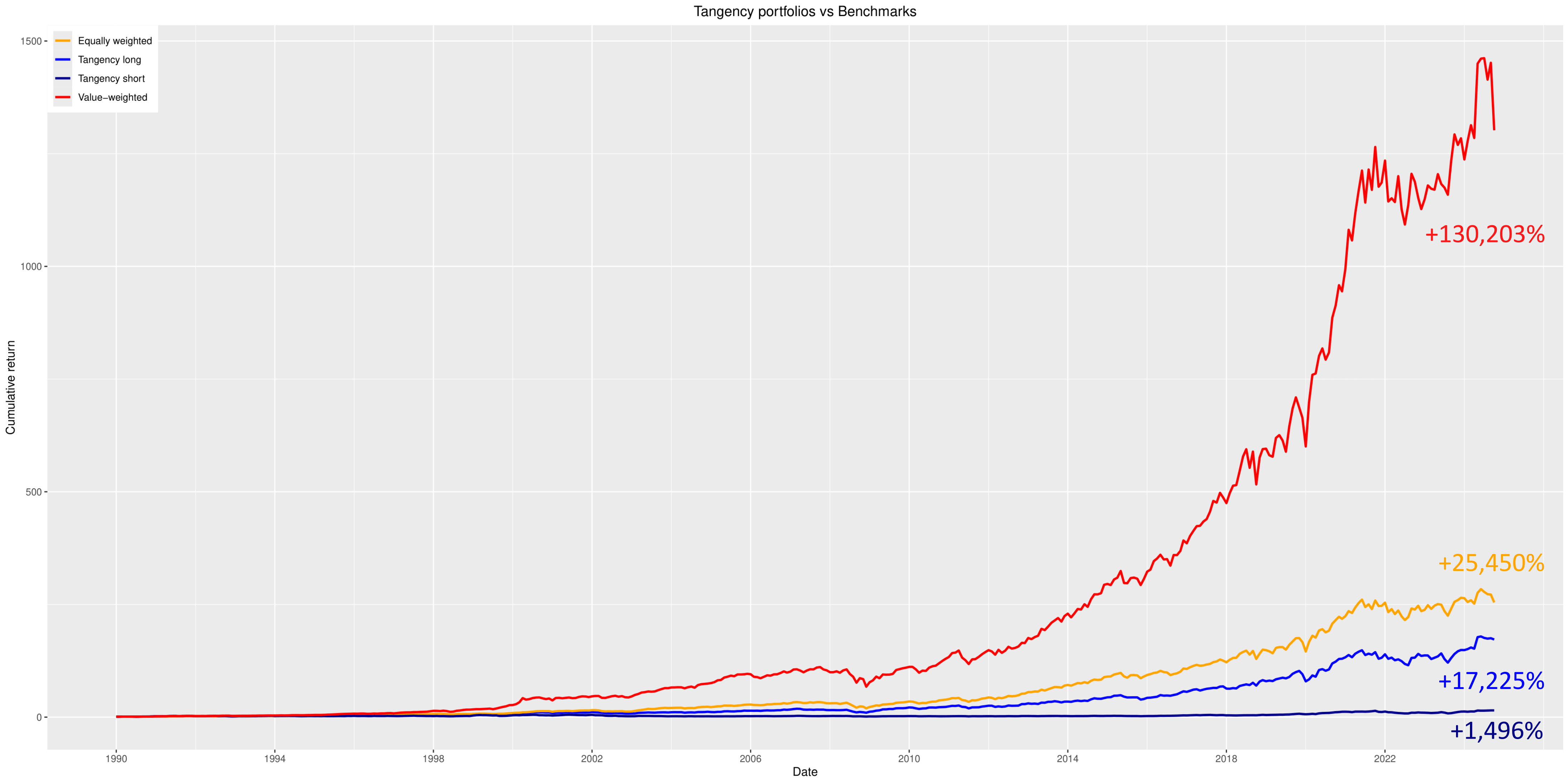
Performance of tangency portfolios



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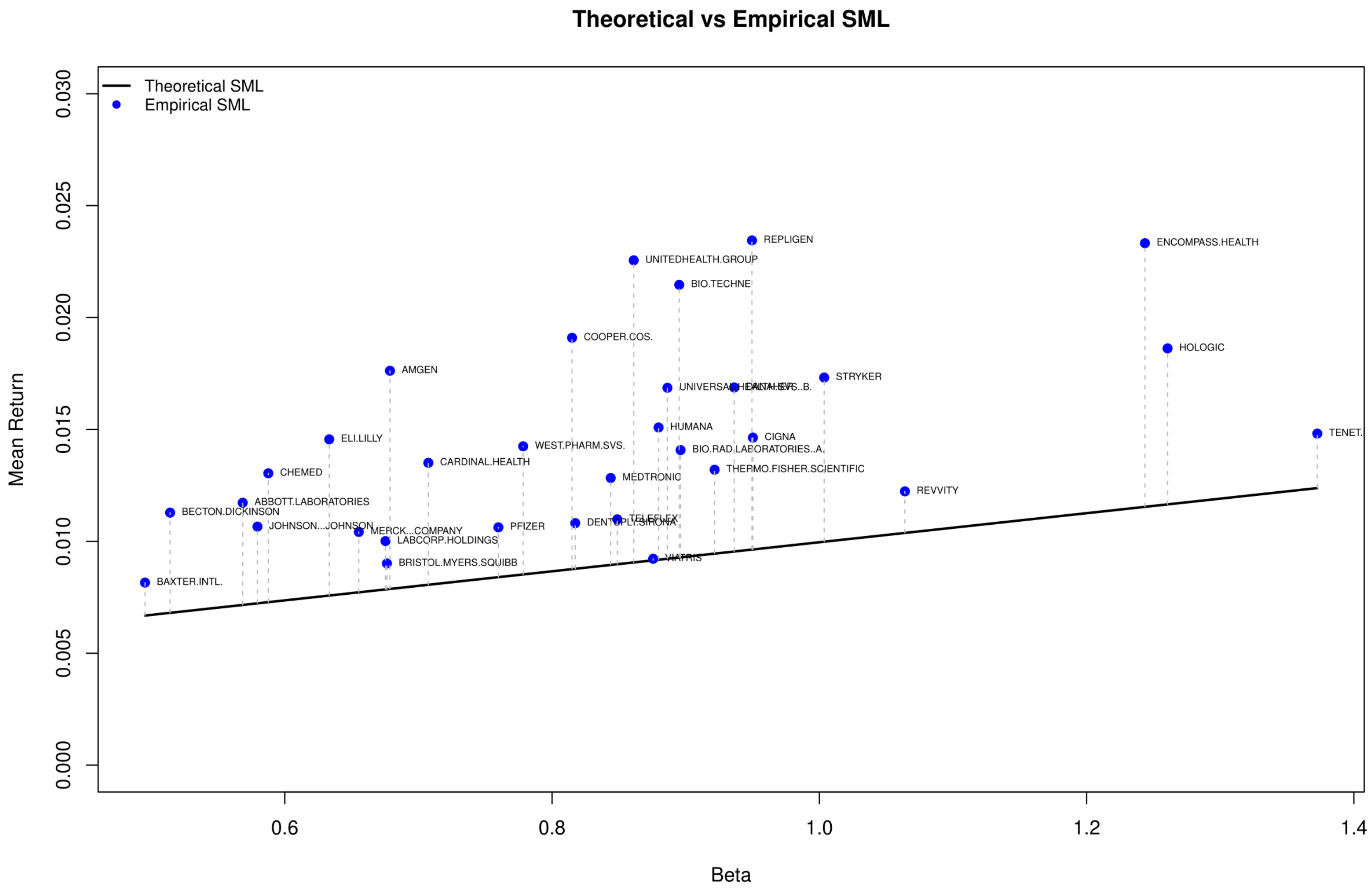
SML



Empirical betas

Metrics	Value
Min	0.50
Q1	0.68
Median	0.85
Q3	0.93
Max	1.37

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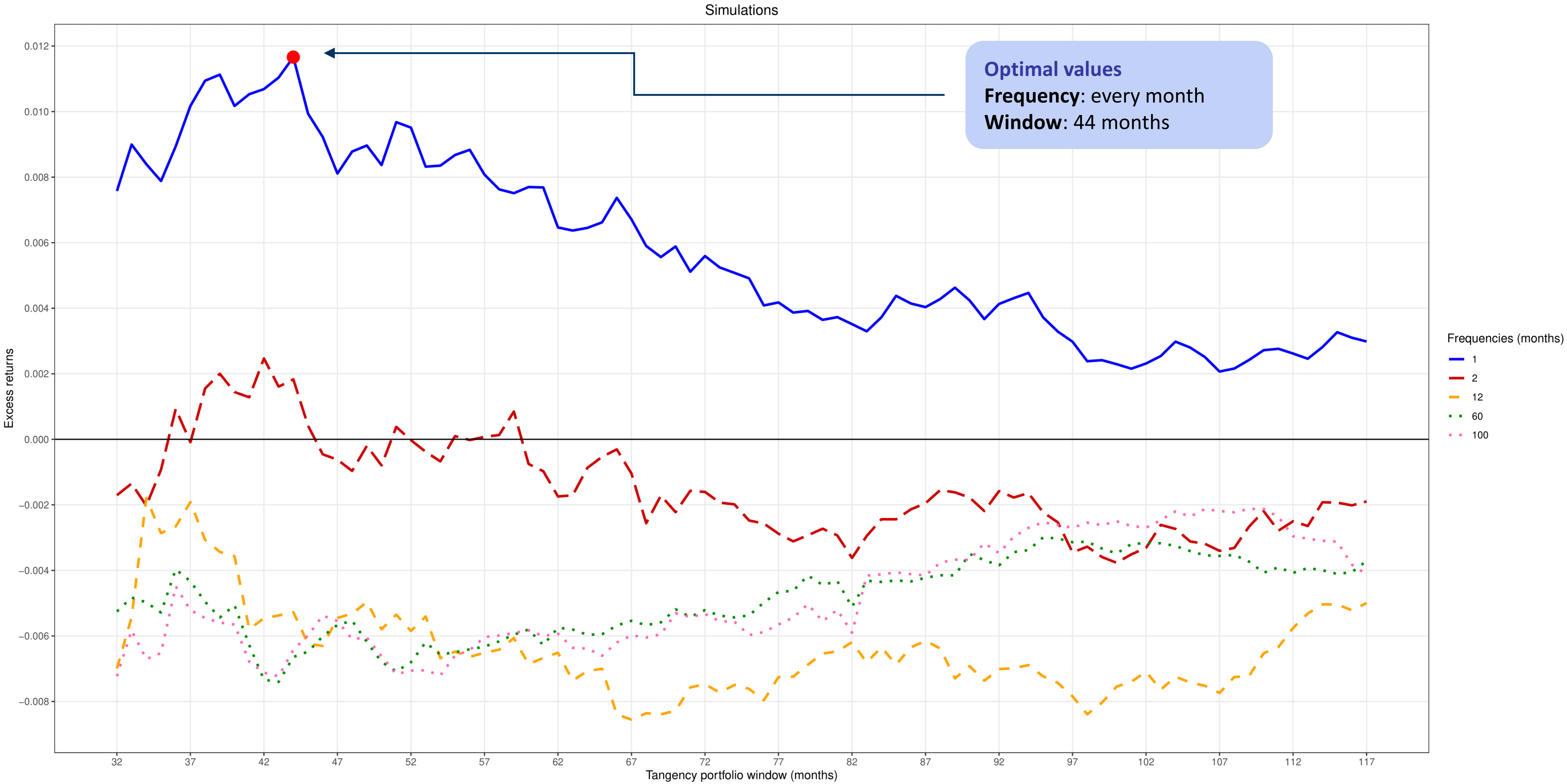
Portfolio optimization

- **Strategy:** rolling tangency portfolio (without short-selling)
- **Idea for optimitazion:** finding optimal frequency of changing the weights and tangency portfolio window, which **maximize average excess return** over EW-portfolio over the testing period
- **In-sample period:** 2020-2012 (max window ≈ 117 months, since the whole sample starts at March 1990)
- **Out-of-sample period:** 2013-2024

Simulations for different frequencies and windows



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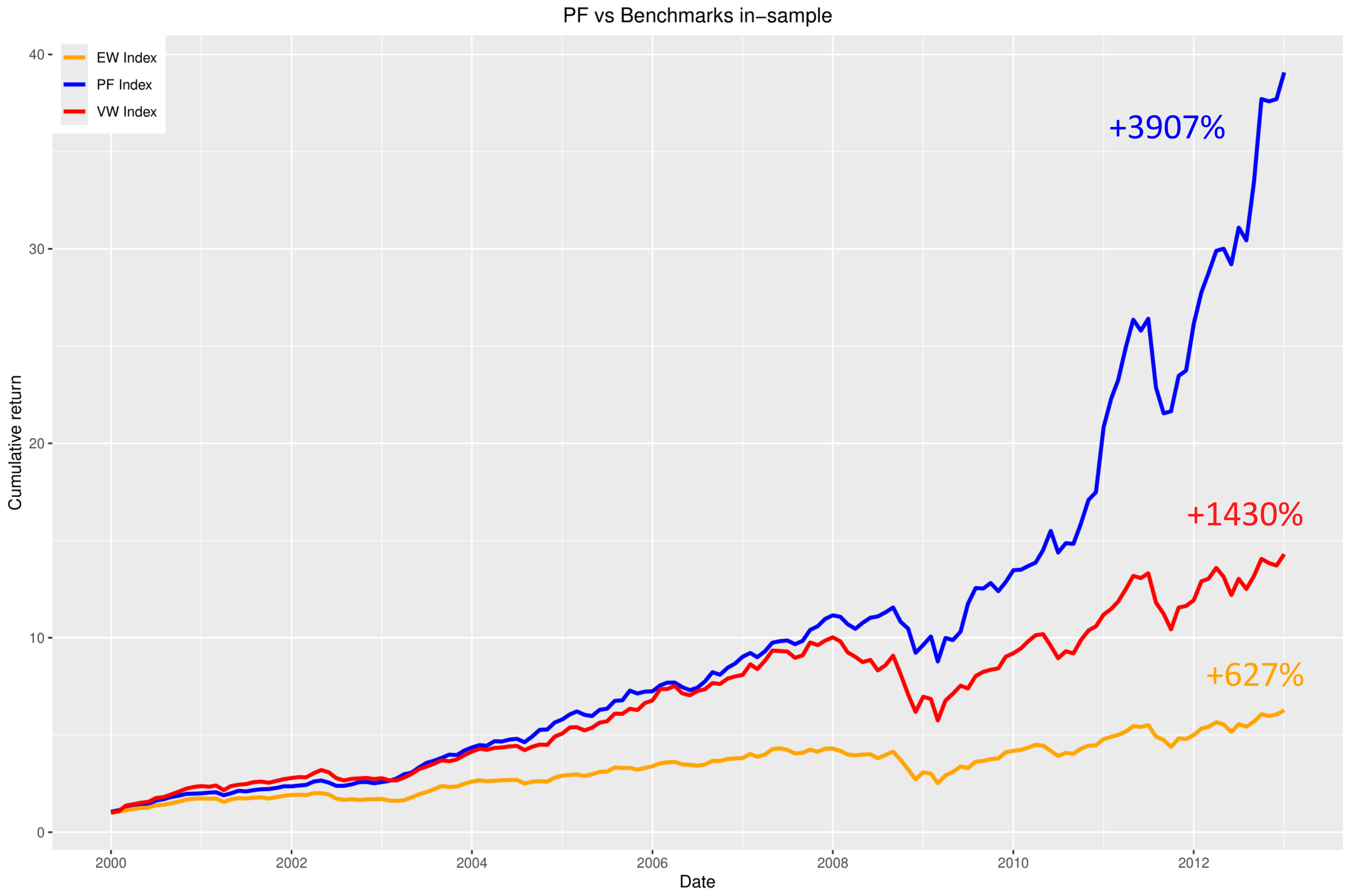
In-sample results (2000-2012)



Optimal values
Frequency: every month
Window: 44 months

Annualized

Metrics	PF	VW	EW
Mean	29.6%	22.2%	15.6%
SD	16.1%	18.8%	17.3%
Sharpe ratio	1.58	0.96	0.66

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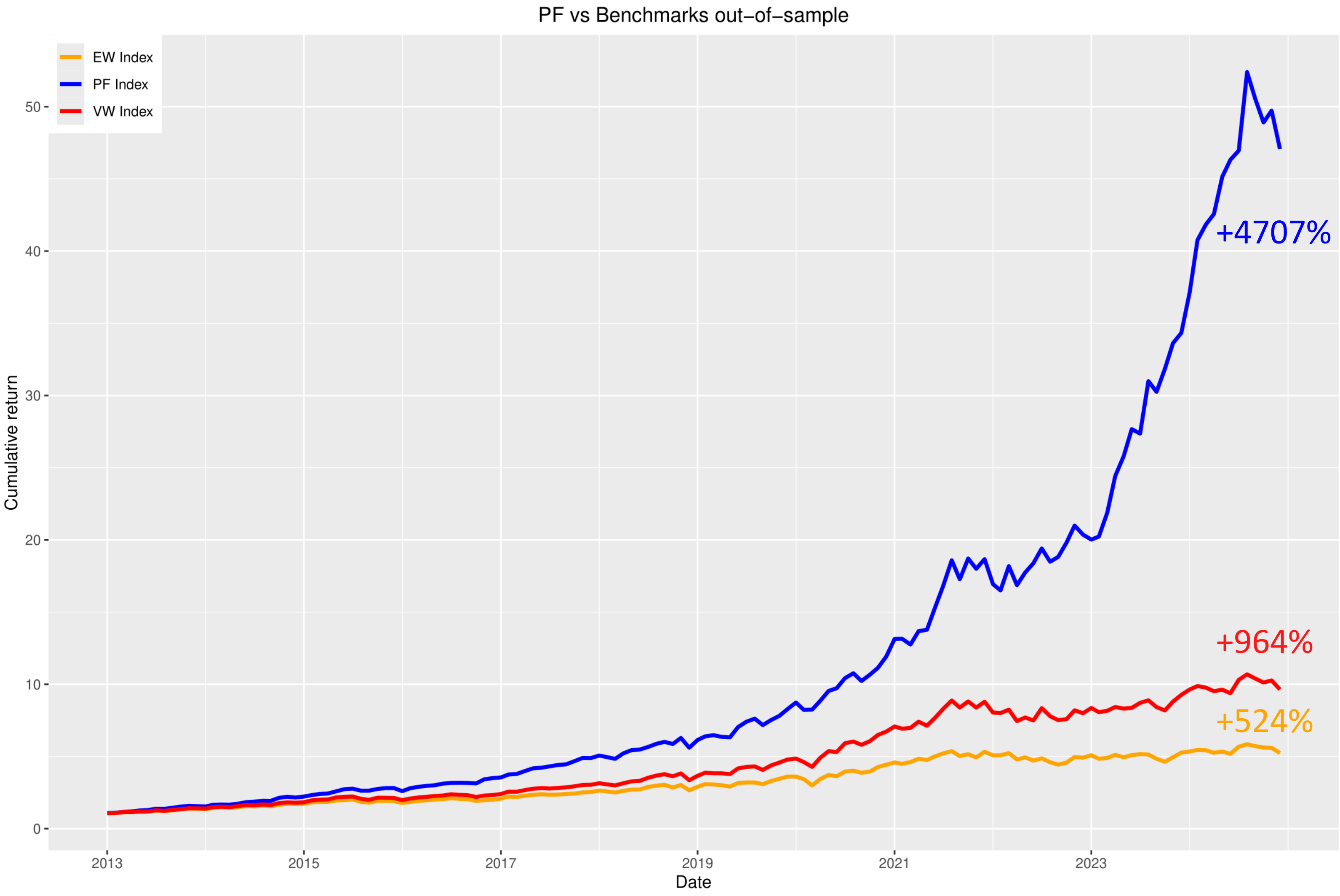
Out-of-sample results (2013-2024)



Optimal values
Frequency: every month
Window: 44 months

Annualized

Metrics	PF	VW	EW
Mean	33.8%	20.3%	15.1%
SD	15.9%	16.0%	15.3%
Sharpe ratio	1.86	1.00	0.70

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