The 'Smart' Construction of an Ideal Portfolio

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SmartPortfolio

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Data Overview

Markowiz
Mean-
Variance
Model
Maximize the
Sharpe Ratio
Minimize the
Variance

Risk Parity

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Overview

Data Overview

How to choose 5 out of 10?
How to balance the return and risk?
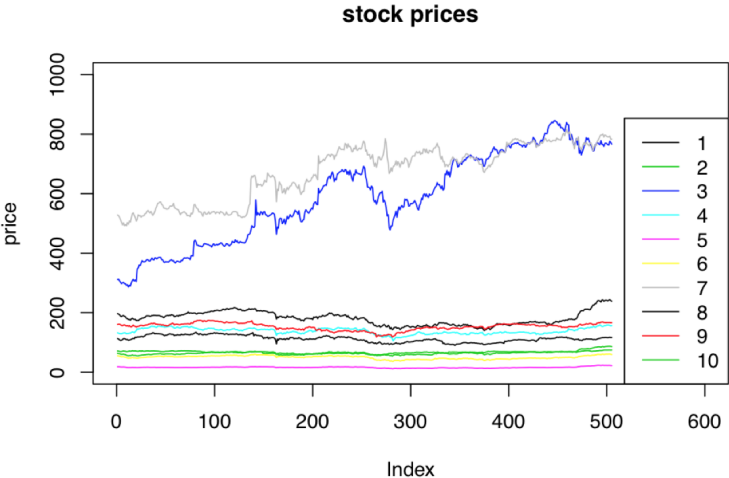
Data Overview

| Num	Asset	Mean Daily Return	SD
1	Apple	0.024%	$188\%^2$
2	Allstate Corp.	0.015%	$\mathbf{108.2}\%^2$
3	Amazon	$\mathbf{0.201}\%$	$211\%^2$
4	Boeing	0.043%	$140.9\%^2$
5	Bank of America	0.054%	$183.2\%^2$
6	Citi Group	0.031%	$178.1\%^2$
7	Google	0.091%	$168.6\%^2$
8	GoldmanScah	0.048%	$146\%^2$
9	IBM	0.015%	$124.5\%^2$
10	JP Morgan	0.071%	$142.9\%^2$
11	Risk Free Asset	0.089%	$3.7\%^2$
12	Market	0.019%	$83.7\%^2$

Markowiz Mean-Variance Model

Maximize the Sharpe Ratio
- maximize the sharpe ratio with 10 stocks
- pick the 5 stocks with the highest weights
- use these 5 stocks to construct a max-sharpe-ratio portfolio, along with the risk-free asset.

Minimize the Variance
- minimize the variance with 10 stocks
- pick the 5 stocks with the highest weights
- use these 5 stocks to construct a min-variance portfolio, along with the risk-free asset.

Markowiz Mean-Variance Model
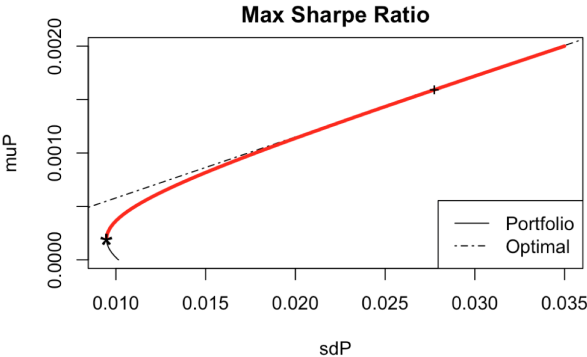
Min Variance	2	9	8	4	10
Max Sharpe Ratio	10	3	5	4	7

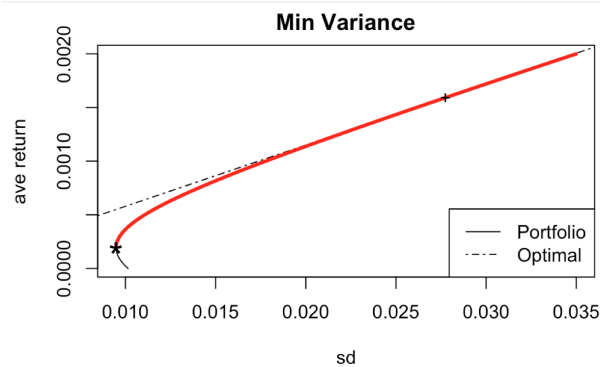Table: Indices of the largest 5 weights, according to the criteria.

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Maximize the Sharpe Ratio

Num	10	3	5	4	7
Weight	0.77	0.85	-0.43	-0.14	-0.05

Table: Weights of assets that maximize the sharpe ratio.

Minimize the Variance

Num	2	9	8	4	10
Weight	0.53	0.28	0.083	0.16	-0.049

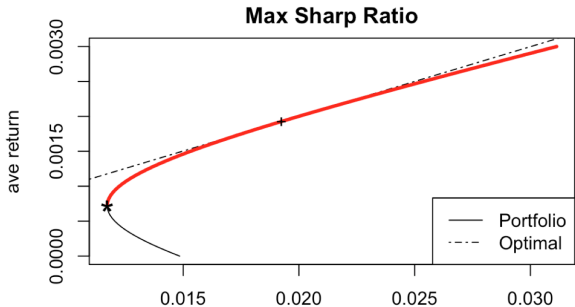Table: Weights of assets that minimize the variance.

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Risk Parity

Adjusting allocations of assets (leveraged or deleveraged) to the same risk level to achieve a higher Sharpe ratio and can be more resistant to market downturns.
Consider a portfolio of N assets where the weight of asset i is w_i. Denote the covariance matrix of the assets by Σ. The volatility of the portfolio is

$$\sigma_P = \sqrt{w'\Sigma w}$$

The marginal risk contribution of asset i is computed as

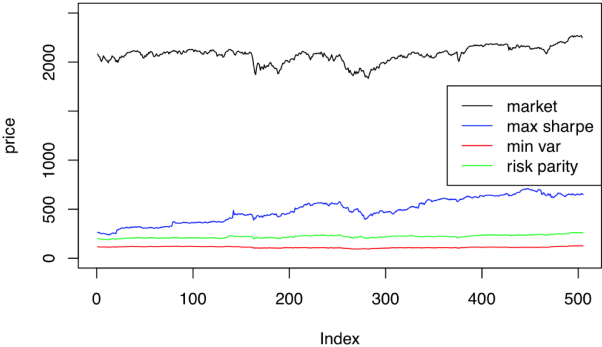$$\sigma_i(w) = w_i \times \partial_{w_i}\sigma(w) = \frac{w_i(\Sigma w)_i}{\sqrt{w'\Sigma w}}$$

Risk Parity

To equal risk contribution $\sigma_i(w) = \sigma_j(w)$ for all i, j, is equal to the minimization problem.

$$\min \sum_{i=1}^{N} \sum_{j=1}^{N} [w_i(\Sigma_i w_i) - w_j(\Sigma_j w_j)]^2$$

Num	2	9	4	7	8
Weight	0.26	0.21	0.19	0.17	0.17

Table: Weights of risk parity assets.

Evaluations

Time Series of Portfolios

Portfolio	Mean	SD	Sharpe Ratio	beta
Max Sharpe Ratio	0.19%	$192.4\%^2$	0.100	0.175
Min Variance	0.019%	$94.8\%^2$	0.020	0.479
Risk Parity	0.040%	$98.8\%^2$	0.040	0.525
Market	0.019%	$83.7\%^2$	0.021	1

Conclusion

The most efficient portfolio

The tangency portfolio gives the most efficient portfolio.
However, the investor must face the high risk.

The safe portfolios

Risk parity and minimizing variance can controls risk. However,
risk parity out performs the latter with higher return.

The End