Monte Carlo Simulation of Portfolio Returns for Different Optimization Strategies

Context

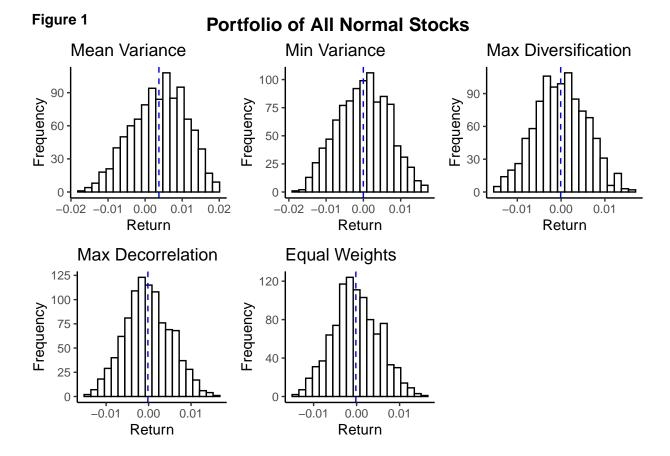
The main goal of investors when creating an asset portfolio is to obtain the most value from their constructed portfolio. A major decision in portfolio management lies in defining how to allocate funds when constructing a portfolio. Portfolio optimization is a phenomenon widely studied in finance. It consists of determining the optimal proportions of total capital invested to assign to each particular asset in the portfolio. Such a problem poses a challenge to financial investors as portfolio managers seek to define the best way to distribute capital in order to yield the most favorable portfolio returns depending on the level of risk the investor is willing to take. Many different strategies exist to define optimal weights in a portfolio however, it remains hard for portfolio managers to decide which optimization strategy is best suited for a given set of risky assets.

Scenario 1: All Normally Distributed Stock Returns

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## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
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Figure 1 Portfolio of Stocks allnormal Stock C Stock B Stock A 25 -20 -Freduency 10 -25 -Frequency 10 - 01 Frequency 15**-**10 -0 **- DIII** -0.10-0.05 0.00 0.05 0.10 Daily returns 0.1 -0.04 0.00 0.04 Daily returns 0.0 0.08 -0.1 Daily returns Stock D Stock E **Prices over time** 25 -20 -750 -20 -Stock price 250 -Frequency 15 - 25 Frequency 15 **-**10 -5 о- П 0 --0.04 0.00 0 Daily returns -0.1 0.1 0 50 100 150 200 250 Trading day 0.04 0.0 0.1

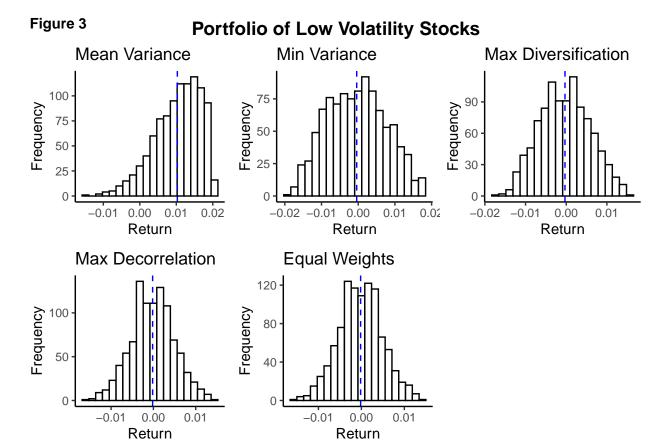
Daily returns -0.08 -0.04



Scenario 2: All Normally Distributed Stock Returns with low volatility

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Figure 3 Portfolio of Stocks low volatility Stock C Stock B Stock A 20 -20 -20 -Frequency 10-Frequency 10 - 01 Frequency 15 -10 --0.020 -0.015 -0.010 -0.005 Daily returns -0.025-0.020-0.015-0.010-0.005 Daily returns -0.025 0.000 Daily returns -0.025 Stock D Stock E **Prices over time** 20 **-**20 -Frequency 10-Stock price Frequency 10 15 -10 -5 0 -0 50 100 150 200 250 Trading day -0.01 0.00 Daily returns 0.025 0.01 -0.050 Daily returns

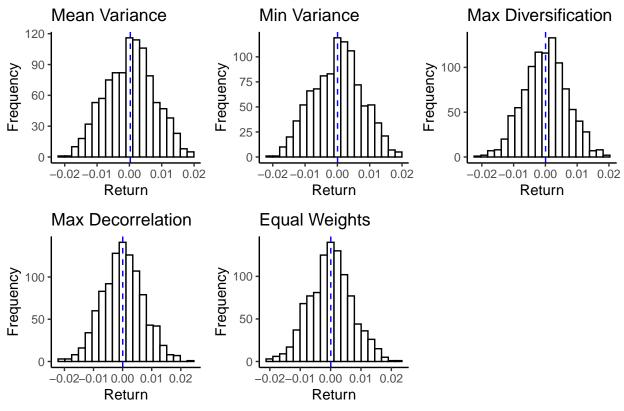


Scenario 3: All Normally Distributed Stock Returns with high volatility

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Figure 4 Portfolio of Stocks high volatility Stock C Stock B Stock A 30 -20 -Frequency 10 -Frequency 10-Frequency 20 -0 - **m** -0.4 -0.2 0.0 Daily returns 0.2 -0.25 .25 0.00 0.2 Daily returns 0.25 0.1 -0.2 -0.1 0.0 Daily returns Stock D Stock E **Prices over time** 20 -20 -Frequency 10 -Stock price Frequency 15 -10 -_0.6 0 -50 100 150 200 250 Trading day 0.3 0 b.3 0.0 0.3 Daily returns 0.0 -0.3 0.3 Daily returns





Scenario 4: Mixed distributed Stock Returns

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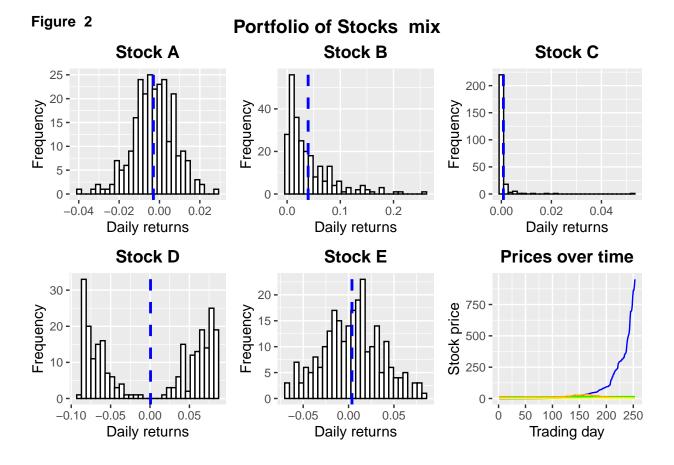


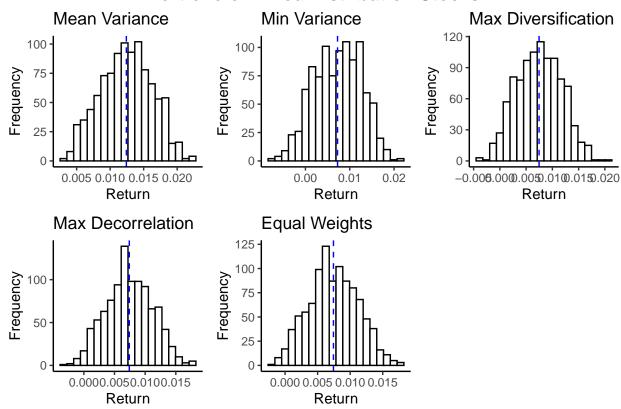
Table 1: Table 1: Portfolio of All Normal Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	0.3722	3.5379	0.021669	0.3271	0.4173
Min Variance	-0.0021	3.1273	-0.000161	-0.0442	0.0399
Max Diversification	-0.0100	3.5649	-0.000444	-0.0460	0.0260
Max Decorrelation	-0.0167	5.2390	-0.000645	-0.0502	0.0168
Equal Weights	-0.0176	5.2716	-0.000659	-0.0509	0.0156

Table 2: Table 2: Portfolio of Mixed Distribution Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	1.2419	3.4223	0.070969	1.2183	1.2656
Min Variance	0.7243	2.8523	0.043751	0.6912	0.7574
Max Diversification	0.7465	3.3907	0.042225	0.7202	0.7728
Max Decorrelation	0.7411	6.6956	0.030637	0.7176	0.7645
Equal Weights	0.7430	6.7090	0.030576	0.7199	0.7662

Figure 2 Portfolio of Mixed Distribution Stocks



Comparison of Portfolio Strategies

Table 3: Table 3: Portfolio of Low Volatility Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	1.0282	0.8871	0.162021	0.9889	1.0674
Min Variance	-0.0411	0.2566	-0.008728	-0.0908	0.0085
Max Diversification	-0.0301	0.3207	-0.005916	-0.0686	0.0083
Max Decorrelation	-0.0181	0.6935	-0.003146	-0.0495	0.0132
Equal Weights	-0.0179	0.6983	-0.003130	-0.0492	0.0134

Table 4: Table 4: Portfolio of High Volatility Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	0.0282	77.8455	0.000344	-0.0183	0.0747
Min Variance	0.0047	77.8187	0.000030	-0.0417	0.0512
Max Diversification	0.0055	88.5490	0.000038	-0.0365	0.0475
Max Decorrelation	0.0046	129.4078	0.000013	-0.0389	0.0482
Equal Weights	0.0058	130.3586	0.000017	-0.0376	0.0491