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

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

Distribution of the daily returns **Distribution of the daily returns**

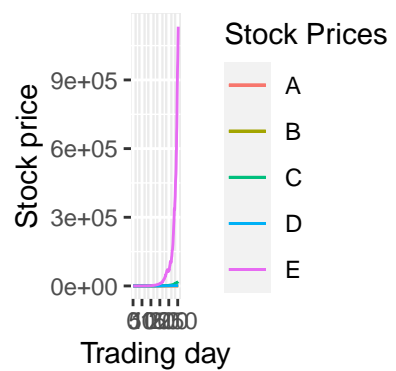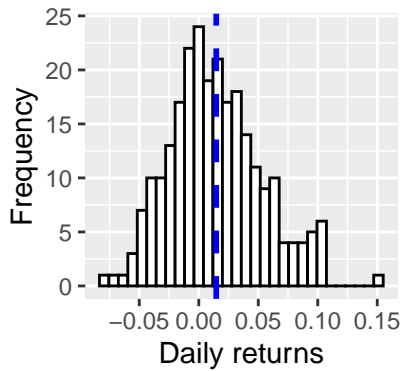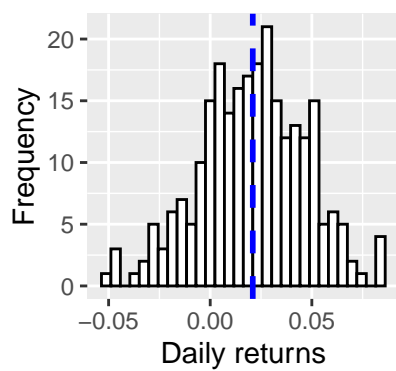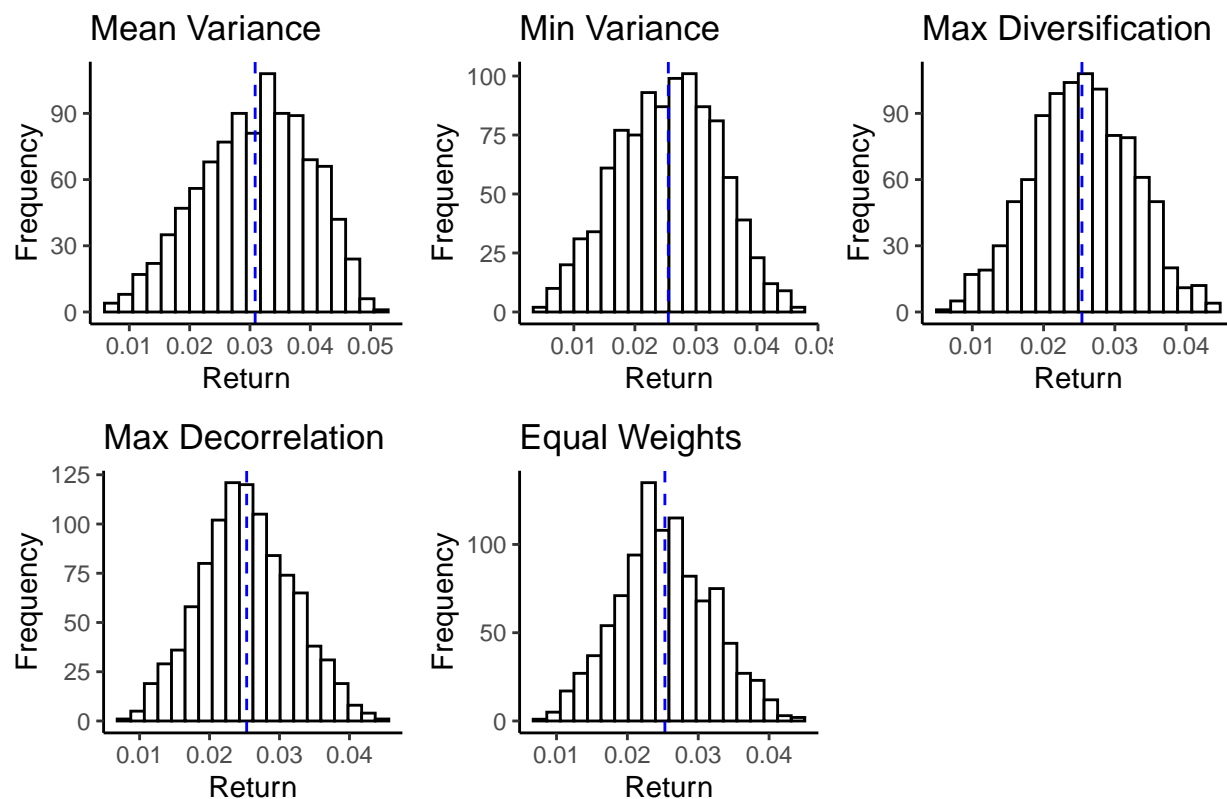**Distribution Simulated stock price over the period of 253**
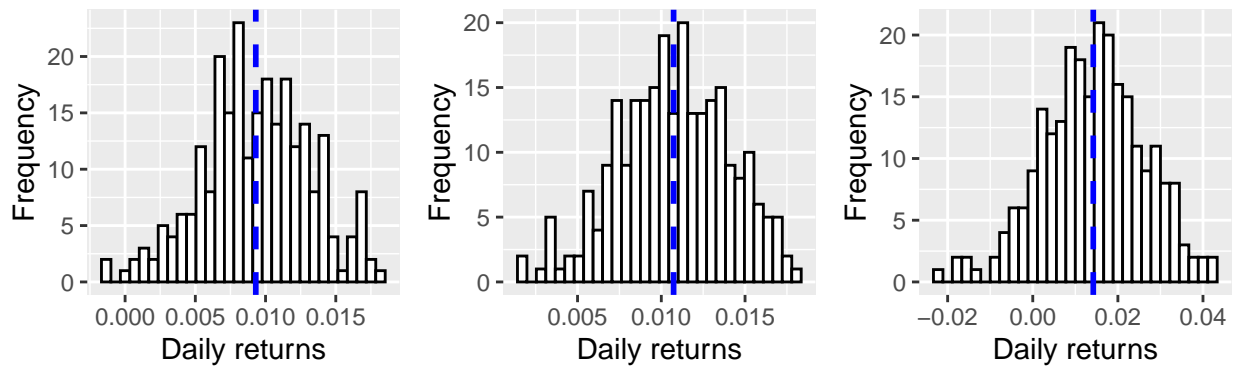
Figure 1

Portfolio of All Normal Stocks

Scenario 2: All Normally Distributed Stock Returns with low volatility

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

ution of the daily returns Distribution of the daily returns Distribution of the daily returns
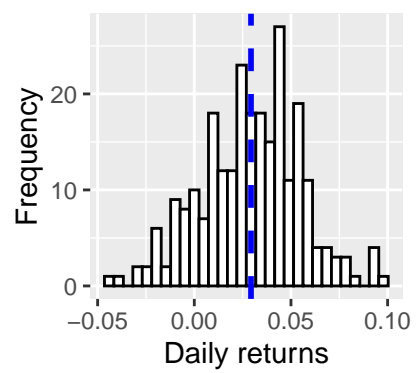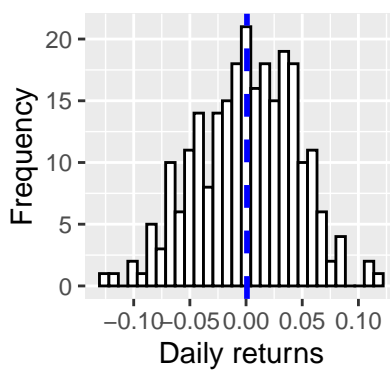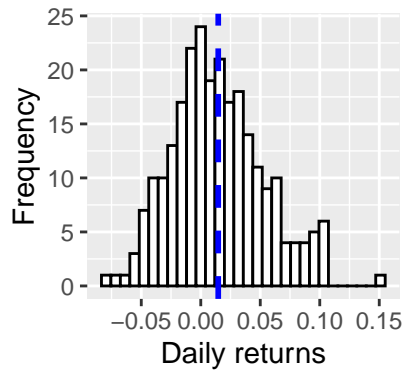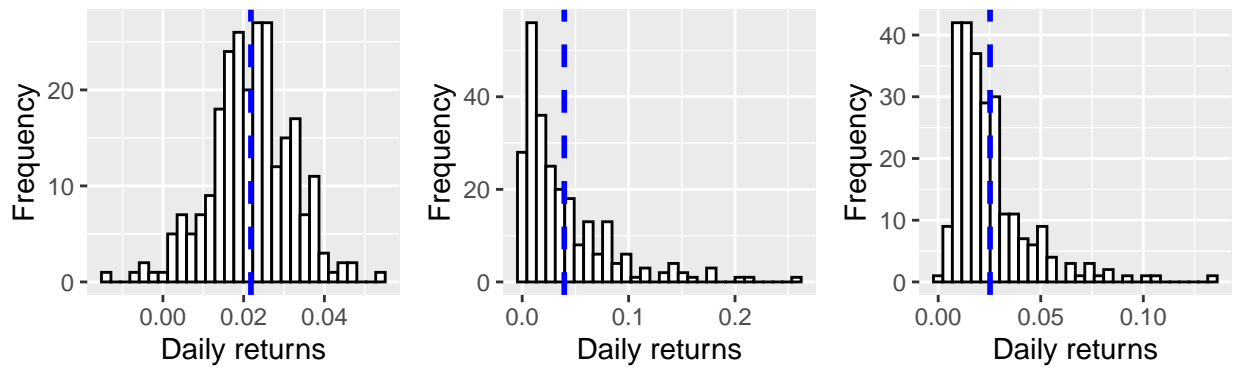
ution of the daily returns Distribution of the daily returns Simulated stock price over the period of 253 t

Stock Prices
- A
- B
- C
- D
- E

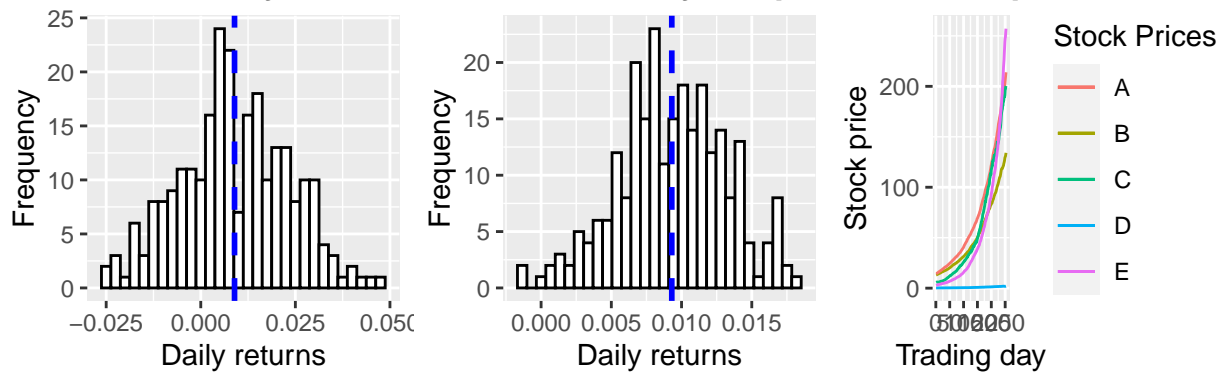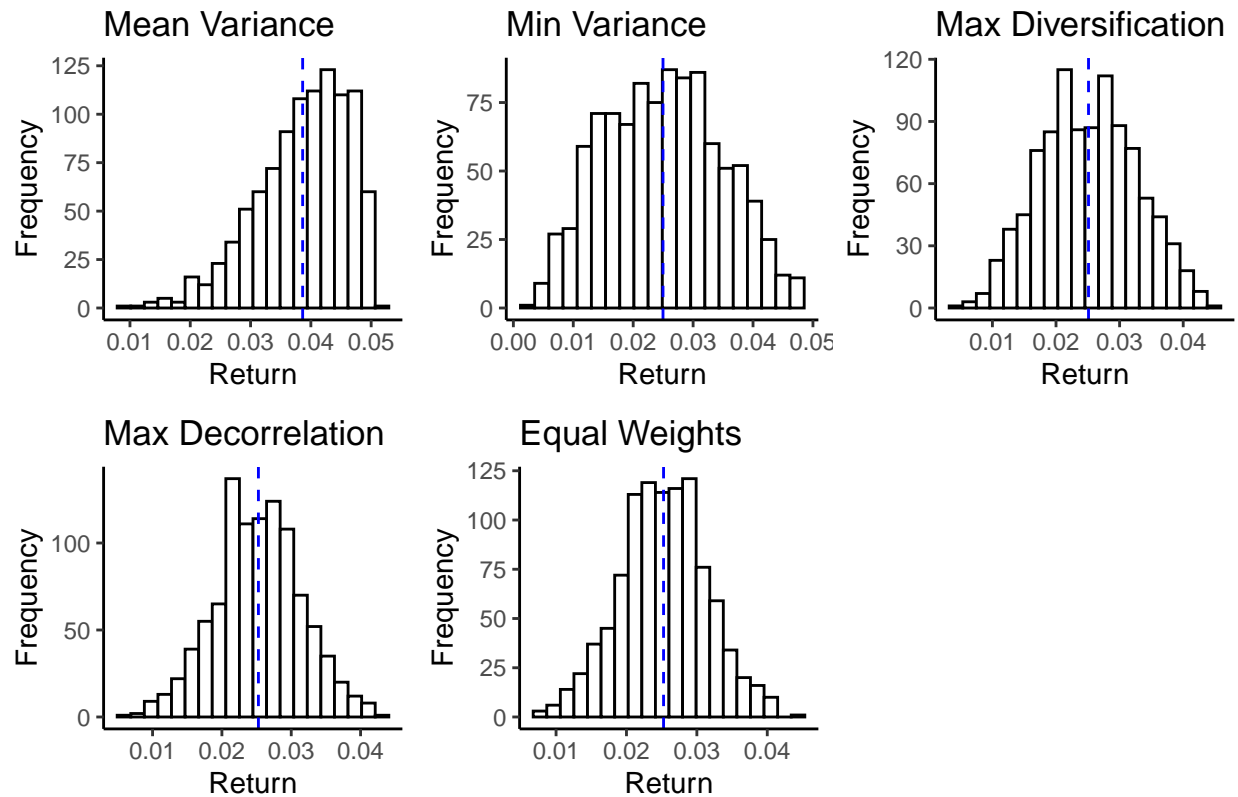Frequency / Daily returns / Stock price / Trading day
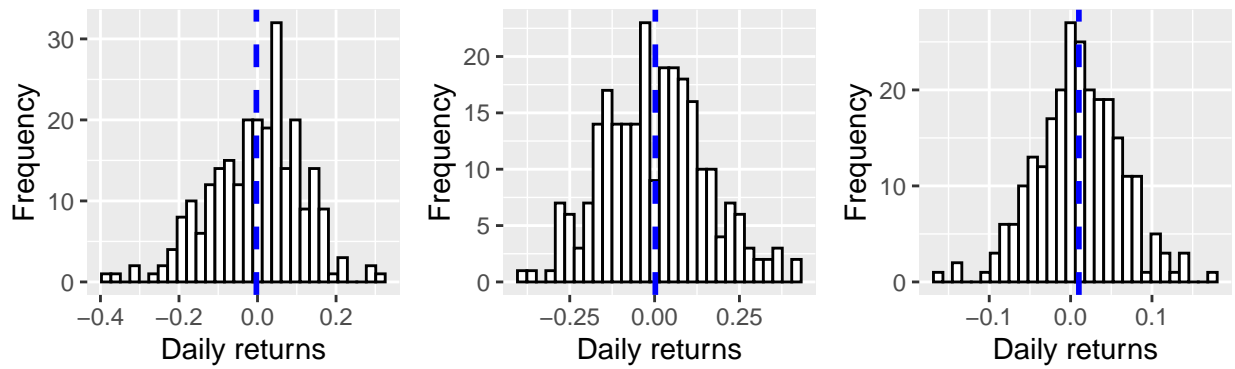
Figure 3

Portfolio of Low Volatility Stocks

Scenario 3: All Normally Distributed Stock Returns with high volatility

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```
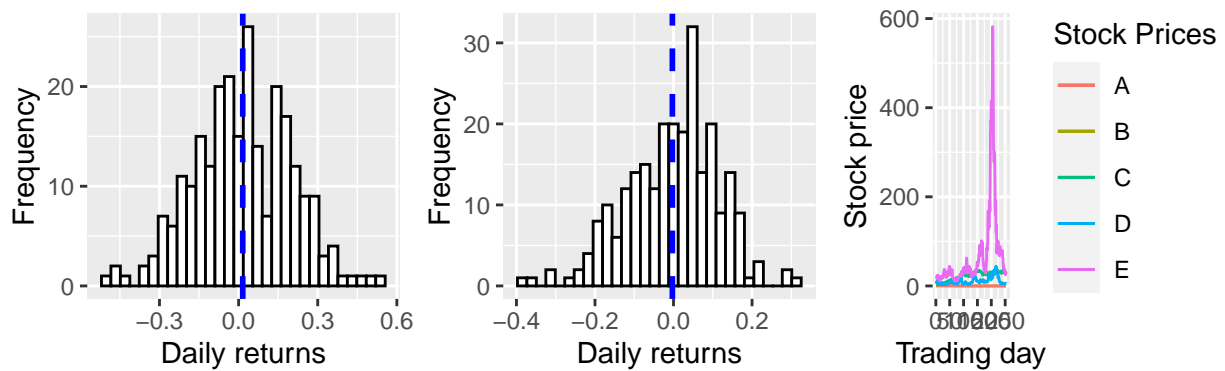
Figure 4

Portfolio of High Volatility Stocks

Scenario 4: Mixed distributed Stock Returns

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```

Table 1: Table 1: Portfolio of All Normal Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	3.0856	0.4791	0.488348	3.0298	3.1413
Min Variance	2.5476	0.3929	0.438405	2.4962	2.5990
Max Diversification	2.5384	0.5099	0.375760	2.4944	2.5824
Max Decorrelation	2.5307	0.6569	0.326366	2.4899	2.5715
Equal Weights	2.5295	0.6615	0.325238	2.4890	2.5701

Table 2: Table 2: Portfolio of Mixed Distribution Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	2.7538	0.4580	0.443108	2.6989	2.8087
Min Variance	2.2474	0.3632	0.398683	2.1961	2.2986
Max Diversification	2.1939	0.4449	0.349721	2.1538	2.2340
Max Decorrelation	2.0746	0.6119	0.307296	2.0422	2.1071
Equal Weights	2.0778	0.6152	0.306001	2.0455	2.1101

Figure 2

Portfolio of Mixed Distribution Stocks
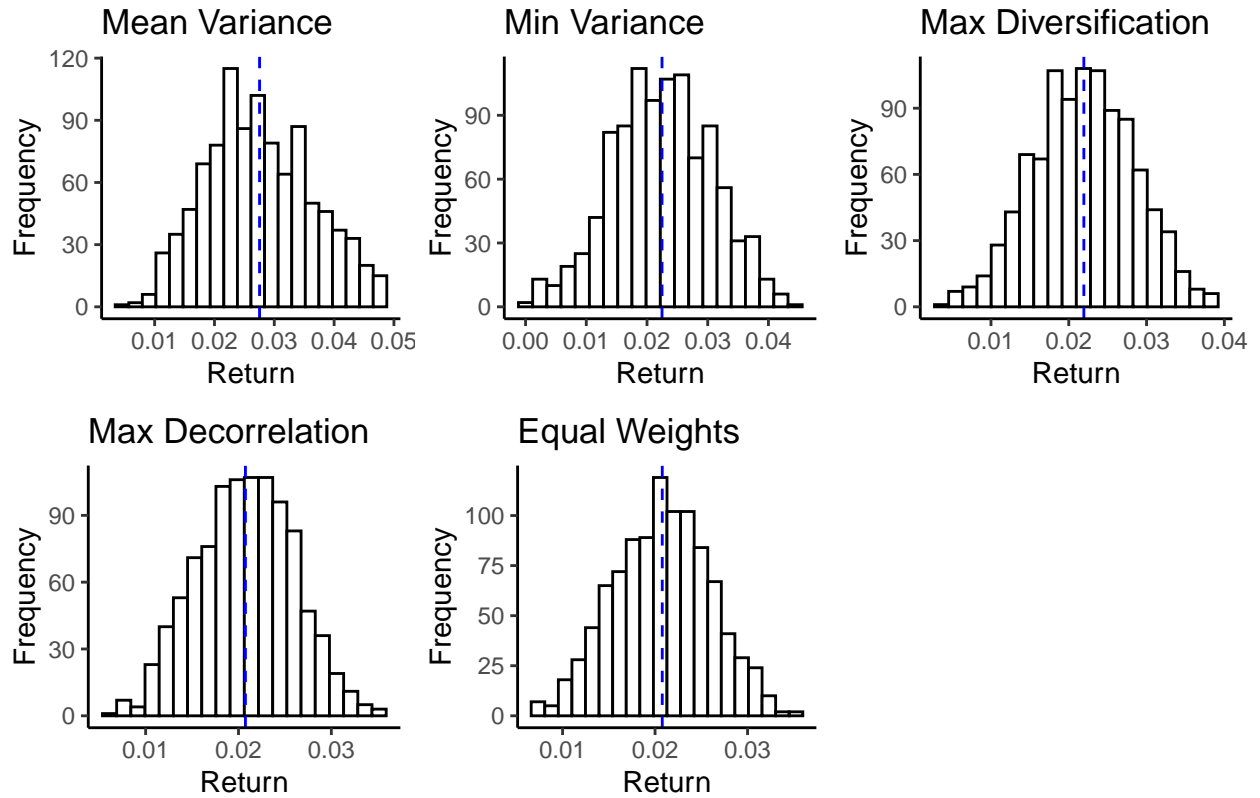
Comparison of Portfolio Strategies

Table 3: Table 3: Portfolio of Low Volatility Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	3.8637	0.0858	2.349934	3.8167	3.9108
Min Variance	2.4974	0.0324	2.011273	2.4366	2.5583
Max Diversification	2.5112	0.0528	1.299529	2.4641	2.5583
Max Decorrelation	2.5265	0.0885	0.930967	2.4881	2.5649
Equal Weights	2.5269	0.0892	0.927315	2.4886	2.5651

Table 4: Table 4: Portfolio of High Volatility Stocks

	Return (%)	Variance (%)	Sharpe	Lower CI	Upper CI
Mean Variance	2.5911	10.1786	0.088967	2.5364	2.6457
Min Variance	2.5596	10.0374	0.088486	2.5050	2.6143
Max Diversification	2.5641	13.0029	0.076596	2.5155	2.6126
Max Decorrelation	2.5673	16.6608	0.067317	2.5184	2.6162
Equal Weights	2.5687	16.8211	0.066906	2.5200	2.6174