Discussion

According to the plot of daily value and results for 12 trading periods, the strategy 6 (leveraged Equal Risk Contributions) achieve the highest portfolio value among all seven strategies. This is what we can expect as this strategy allows us to take long 200% position at the beginning. The portfolio value of this strategy experienced a dramatic drop during period 1 and 2, to the lowest point $1318086, and steadily increase over the 10 rest of periods. By using strategy 6, we receive approximately 35% growth of portfolio value, from $ 1962890.44 to $2655201.10, over 12 periods. However, strategy 6's growth isn't the highest: strategy 4 (Maximum Sharpe Ratio) demonstrates significant increase in portfolio values since period 10 and reach a peak at $2289772.85 portfolio value at the end of period 12, which is more than twice as much as the initial portfolio value $1000013.

Equal risk contribution strategy, has the second highest portfolio value among strategy 5, 6, and 7. It demonstrates similar trends as equally weighted strategy; While its portfolio values are slightly lower than that of equally weighted strategy since period 1, and the gaps between them becomes larger and larger over period 7 to 12. On the other hand, strategy 7 (Robust Optimization), which has the lowest portfolio value among the 3 new strategies, outperforms strategy 1 and 3. It reaches $1182125.84 at the end of period 12, which is roughly 18% increase compared to the initial portfolio value. Whereas, strategy 1 and 3 illustrate weak performance with daily portfolio value fluctuating around the initial point $1 million for 2 years.

By measuring the difference between the highest peak and the lowest trough values of each period dividing the highest peak, we get maximum drawdowns. They illustrate the volatilities of portfolio value under a specific strategy. High values indicate great fluctuations in the values of the investment and larger risks. Based on the plot of maximum drawdown, we see that Maximum Sharpe Ratio strategy has the largest maximum drawdown over 12 periods among all strategies. It is what we can expect because maximum Sharpe ratio strategy is the most aggressive as it optimizes towards assets with more returns and it has the highest portfolio value variations. For investors who wish to receive relatively stable returns would prefer the Buy and Hold strategy as it has the lowest maximum drawdowns for most of the periods.

Moreover, strategy 7 can be further investigated by plotting dynamic changes in portfolio allocations under it as shown in appendix. Based on the plot, we can conclude that the robust portfolio selection strategy reduces trading as compared with strategies 3 and 4 that have been implemented in Assignment 1. In each rebalance period under strategy 4, the Sharpe ratio of a specific stock strictly dominant the other stocks, leading to all weights are put on that stock and our portfolio consisting only a single stock. Clearly, strategy 7 is not as extreme as strategy 4, and its dynamic changes in portfolio allocations seems similar to strategy 3 (minimum variance). This is not a surprising result because the similarities shown between strategy 3 and 7 come from their same objective function in their optimization algorithm: Both of them is optimized by minimizing portfolio variance, while Robust mean-variance optimization introduce additional terms that maximize expected return and corrects for estimation error. Therefore, due to explicitly considering estimation error, Robust portfolio selection strategy slightly reduces trading compared to Minimum variance strategy. For

example, stock F's weight remains unchanged from period 1 to 2 under strategy 7, whereas its weight experiences a 0.2 decrease during that time under strategy 3.

In summary, as an investor, I would choose Maximum Sharpe Ratio strategy for managing my own portfolio. I'm not a risk-averse person, and I am willing to take up a higher risk for a higher return. Thus, according to its strong performance which doubles the portfolio value within 2 years demonstrated above, I prefer using strategy 4 regardless its high volatility.

Next, we test our trading strategies for years 2008 and 2009. According to the plot of daily values in appendix, the trends of 7 strategies demonstrate great difference compared to years 2020-2021. It shows that portfolio values sharp decline under all strategies during period 5 to 6 due to the financial crisis. The strategy 6 (leveraged Equal Risk Contributions) achieve the highest portfolio value since it allows leverage. However, strategy 4's performance is no longer as good as it is in years 2020-2021, in fact, it becomes the weakest strategy and has the lowest portfolio values over period 6 to 12. Furthermore, even though portfolio values under all strategies gradually increase after the shock, only strategy 3 and strategy 7 recover to the initial portfolio value $385097.15 in period 12.

In addition, according to the plot of Maximum Drawdown, all strategies have fairly high volatilities over period 4-7: the maximum drawdown under Maximum Sharpe Ratio strategy achieves almost 50% in period 4, whereas drawdown under Equally Weighted strategy reaches 40% in period 7. On the other hand, there're more trading under strategy 3 and 7 in 2008-2009 compared to 2020-2021: Changes become more dramatic from period to period due to the instability of the overall economy. Yet, strategy 4's dynamic change has the same pattern in 2008-2009 as that of in 2020-2021. Although robust portfolio selection strategy reduces trading as compared with the strategy 4, it seems to have similar level of trading as the strategy 3.

Overall, I would select robust portfolio selection strategy for managing my own portfolio in 2008-2009. It shows less volatilities and more stable returns over this period, which could help me to avoid great losses from the financial crisis.

Appendix

1. Results for 12 periods from 2020 to 2021:

Initial portfolio value = $ 1000013.0
Period 1: start date 01/02/2020, end date 02/28/2020
Strategy "Buy and Hold", value begin = $ 1000013.00, value end = $ 893956.82
Strategy "Equally Weighted Portfolio", value begin = $ 990810.96, value end = $ 892817.47
Strategy "Minimum Variance Portfolio", value begin = $ 992706.80, value end = $ 916193.63
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 990062.91, value end = $ 917072.88
Strategy "Equal Risk Contributions Portfolio", value begin = $ 991670.24, value end = $ 898541.74
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 1962890.44, value end = $ 1778959.60
Strategy "Robust Optimization Portfolio", value begin = $ 992417.21, value end = $ 918103.89

Period 2: start date 03/02/2020, end date 04/30/2020
Strategy "Buy and Hold", value begin = $ 945076.08, value end = $ 949228.39
Strategy "Equally Weighted Portfolio", value begin = $ 930976.58, value end = $ 861978.31
Strategy "Minimum Variance Portfolio", value begin = $ 955927.84, value end = $ 850156.78
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 947474.09, value end = $ 1001794.36
Strategy "Equal Risk Contributions Portfolio", value begin = $ 937822.63, value end = $ 852928.20
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 1832792.21, value end = $ 1664646.32
Strategy "Robust Optimization Portfolio", value begin = $ 960850.16, value end = $ 870952.43

Period 3: start date 05/01/2020, end date 06/30/2020
Strategy "Buy and Hold", value begin = $ 937916.75, value end = $ 913415.30
Strategy "Equally Weighted Portfolio", value begin = $ 830744.49, value end = $ 933752.95
Strategy "Minimum Variance Portfolio", value begin = $ 825743.79, value end = $ 853349.68
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 959601.71, value end =

$ 1157696.54
Strategy "Equal Risk Contributions Portfolio", value begin = $ 822672.15, value end = $ 917801.33
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 1581480.85, value end = $ 1768494.08
Strategy "Robust Optimization Portfolio", value begin = $ 844407.66, value end = $ 872624.77

Period 4: start date 07/01/2020, end date 08/31/2020
Strategy "Buy and Hold", value begin = $ 905419.70, value end = $ 994693.42
Strategy "Equally Weighted Portfolio", value begin = $ 927351.99, value end = $ 1060304.13
Strategy "Minimum Variance Portfolio", value begin = $ 855822.80, value end = $ 980963.67
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1195916.42, value end = $ 1678307.61
Strategy "Equal Risk Contributions Portfolio", value begin = $ 914088.60, value end = $ 1053820.55
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 1739005.31, value end = $ 2006644.78
Strategy "Robust Optimization Portfolio", value begin = $ 873565.94, value end = $ 1018721.27

Period 5: start date 09/01/2020, end date 10/30/2020
Strategy "Buy and Hold", value begin = $ 993194.54, value end = $ 971914.18
Strategy "Equally Weighted Portfolio", value begin = $ 1067911.63, value end = $ 998812.36
Strategy "Minimum Variance Portfolio", value begin = $ 982710.79, value end = $ 942058.55
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1717590.46, value end = $ 1402895.99
Strategy "Equal Risk Contributions Portfolio", value begin = $ 1061692.24, value end = $ 996532.91
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 1997112.60, value end = $ 1873547.90
Strategy "Robust Optimization Portfolio", value begin = $ 1021852.20, value end = $ 976737.36

Period 6: start date 11/02/2020, end date 12/31/2020
Strategy "Buy and Hold", value begin = $ 983801.02, value end = $ 1004435.74
Strategy "Equally Weighted Portfolio", value begin = $ 1007642.11, value end = $ 1193708.94
Strategy "Minimum Variance Portfolio", value begin = $ 950476.76, value end = $ 1005285.92

Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1378054.14, value end = $ 1531469.80
Strategy "Equal Risk Contributions Portfolio", value begin = $ 1004730.65, value end = $ 1180327.00
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 1864274.50, value end = $ 2194128.02
Strategy "Robust Optimization Portfolio", value begin = $ 984204.43, value end = $ 1042277.18

Period 7: start date 01/04/2021, end date 02/26/2021
Strategy "Buy and Hold", value begin = $ 1005601.39, value end = $ 956244.08
Strategy "Equally Weighted Portfolio", value begin = $ 1180184.52, value end = $ 1266566.84
Strategy "Minimum Variance Portfolio", value begin = $ 1003285.25, value end = $ 974449.93
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1493510.71, value end = $ 1649992.38
Strategy "Equal Risk Contributions Portfolio", value begin = $ 1167300.49, value end = $ 1220167.49
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 2144426.69, value end = $ 2243850.60
Strategy "Robust Optimization Portfolio", value begin = $ 1037724.53, value end = $ 1051839.97

Period 8: start date 03/01/2021, end date 04/30/2021
Strategy "Buy and Hold", value begin = $ 957791.35, value end = $ 1019731.32
Strategy "Equally Weighted Portfolio", value begin = $ 1296921.50, value end = $ 1398173.90
Strategy "Minimum Variance Portfolio", value begin = $ 974824.24, value end = $ 1087904.44
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1724323.77, value end = $ 1660996.62
Strategy "Equal Risk Contributions Portfolio", value begin = $ 1244100.92, value end = $ 1355389.40
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 2264434.61, value end = $ 2468490.87
Strategy "Robust Optimization Portfolio", value begin = $ 1068608.05, value end = $ 1185384.15

Period 9: start date 05/03/2021, end date 06/30/2021
Strategy "Buy and Hold", value begin = $ 1022204.61, value end = $ 987842.85
Strategy "Equally Weighted Portfolio", value begin = $ 1397050.27, value end = $ 1458597.95
Strategy "Minimum Variance Portfolio", value begin = $ 1087633.28, value end =

$ 1076575.38
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1657294.58, value end = $ 1564823.62
Strategy "Equal Risk Contributions Portfolio", value begin = $ 1354328.48, value end = $ 1384043.81
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 2440871.99, value end = $ 2495907.60
Strategy "Robust Optimization Portfolio", value begin = $ 1184355.77, value end = $ 1172021.52

Period 10: start date 07/01/2021, end date 08/31/2021
Strategy "Buy and Hold", value begin = $ 993283.49, value end = $ 975250.19
Strategy "Equally Weighted Portfolio", value begin = $ 1465995.49, value end = $ 1517005.67
Strategy "Minimum Variance Portfolio", value begin = $ 1076594.47, value end = $ 1086506.80
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1588812.06, value end = $ 1759912.53
Strategy "Equal Risk Contributions Portfolio", value begin = $ 1390288.03, value end = $ 1441909.38
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 2482346.67, value end = $ 2576036.01
Strategy "Robust Optimization Portfolio", value begin = $ 1172575.71, value end = $ 1198290.99

Period 11: start date 09/01/2021, end date 10/29/2021
Strategy "Buy and Hold", value begin = $ 974520.08, value end = $ 949068.41
Strategy "Equally Weighted Portfolio", value begin = $ 1512777.85, value end = $ 1562678.46
Strategy "Minimum Variance Portfolio", value begin = $ 1080952.15, value end = $ 1057071.44
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1746760.95, value end = $ 1909372.24
Strategy "Equal Risk Contributions Portfolio", value begin = $ 1435937.78, value end = $ 1450470.83
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 2540994.27, value end = $ 2567468.36
Strategy "Robust Optimization Portfolio", value begin = $ 1189631.14, value end = $ 1178000.38

Period 12: start date 11/01/2021, end date 12/31/2021
Strategy "Buy and Hold", value begin = $ 951350.41, value end = $ 932471.35
Strategy "Equally Weighted Portfolio", value begin = $ 1584036.53, value end = $ 1645823.52

Strategy "Minimum Variance Portfolio", value begin = $ 1054326.17, value end = $ 1048457.00

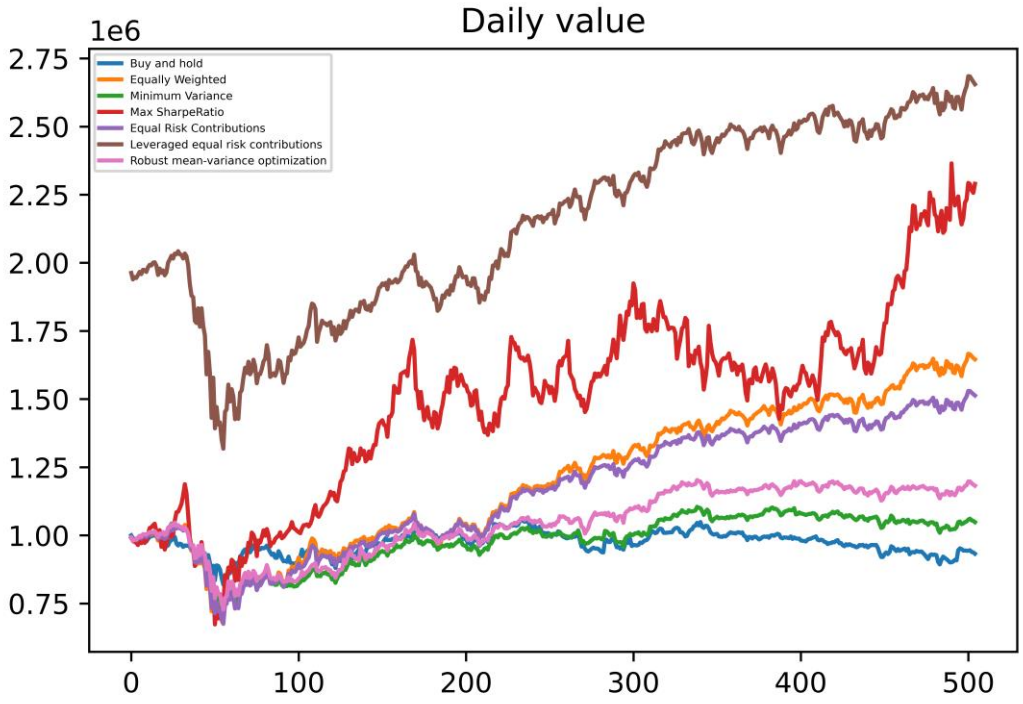
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 1968984.57, value end = $ 2289772.85

Strategy "Equal Risk Contributions Portfolio", value begin = $ 1460580.89, value end = $ 1513106.27

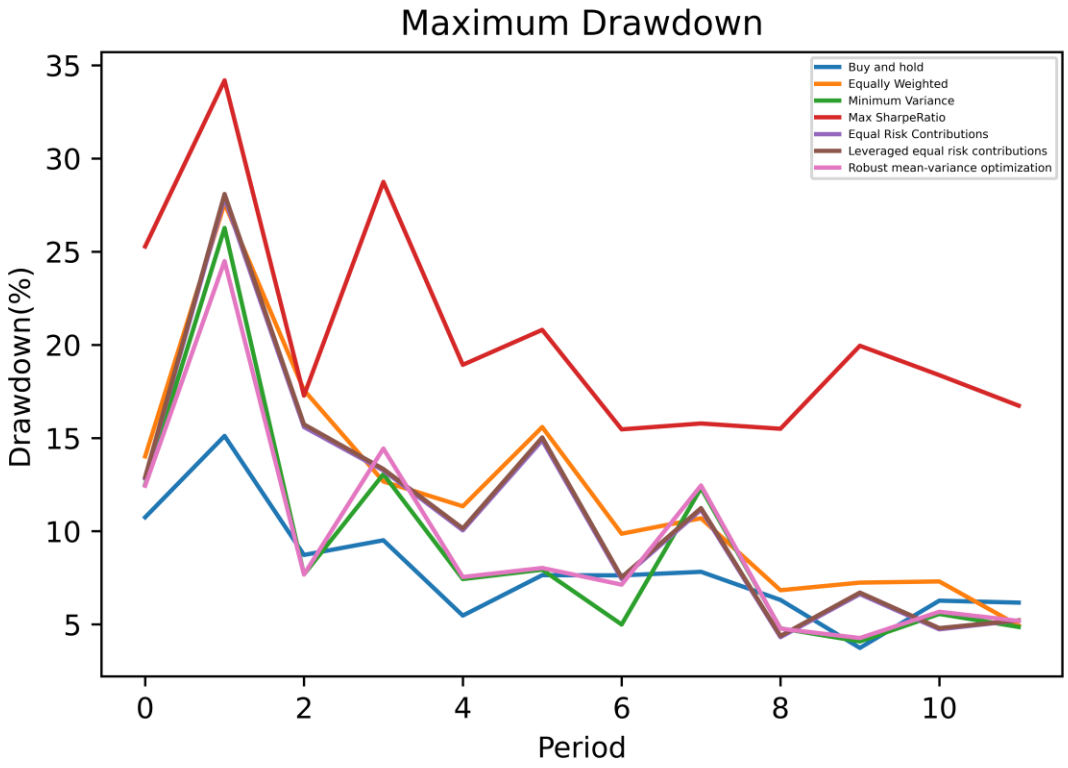
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 2561728.95, value end = $ 2655201.10

Strategy "Robust Optimization Portfolio", value begin = $ 1170179.97, value end = $ 1182125.84

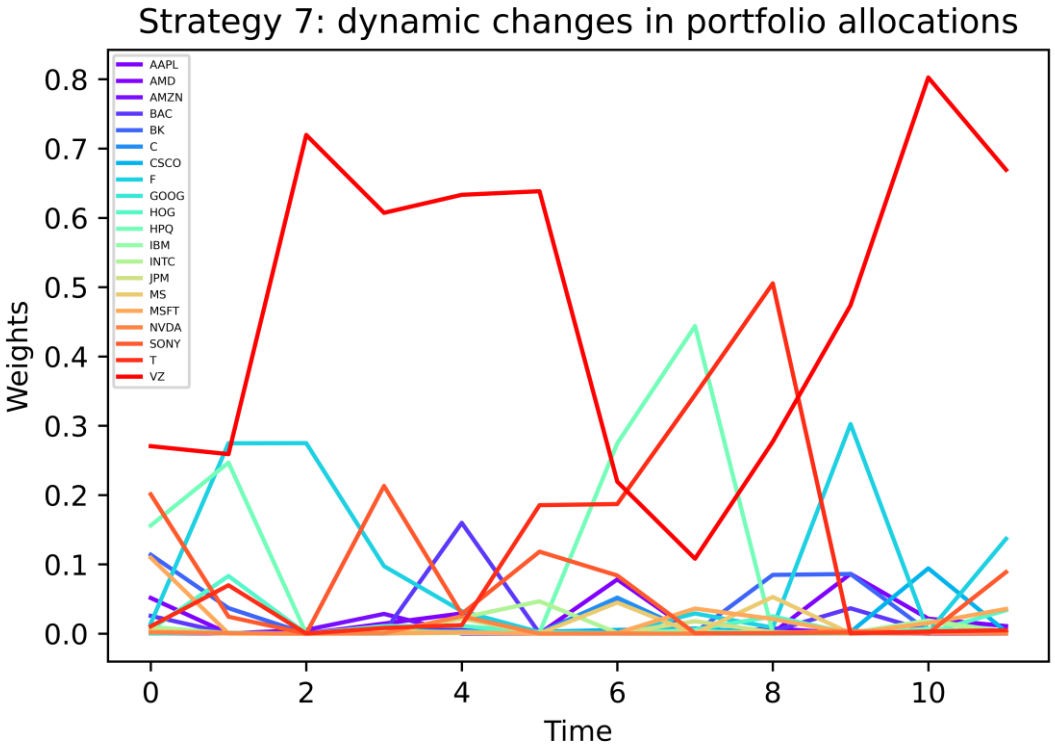
2. **Daily value of portfolio (for each trading strategy) over the years 2020-2021:**

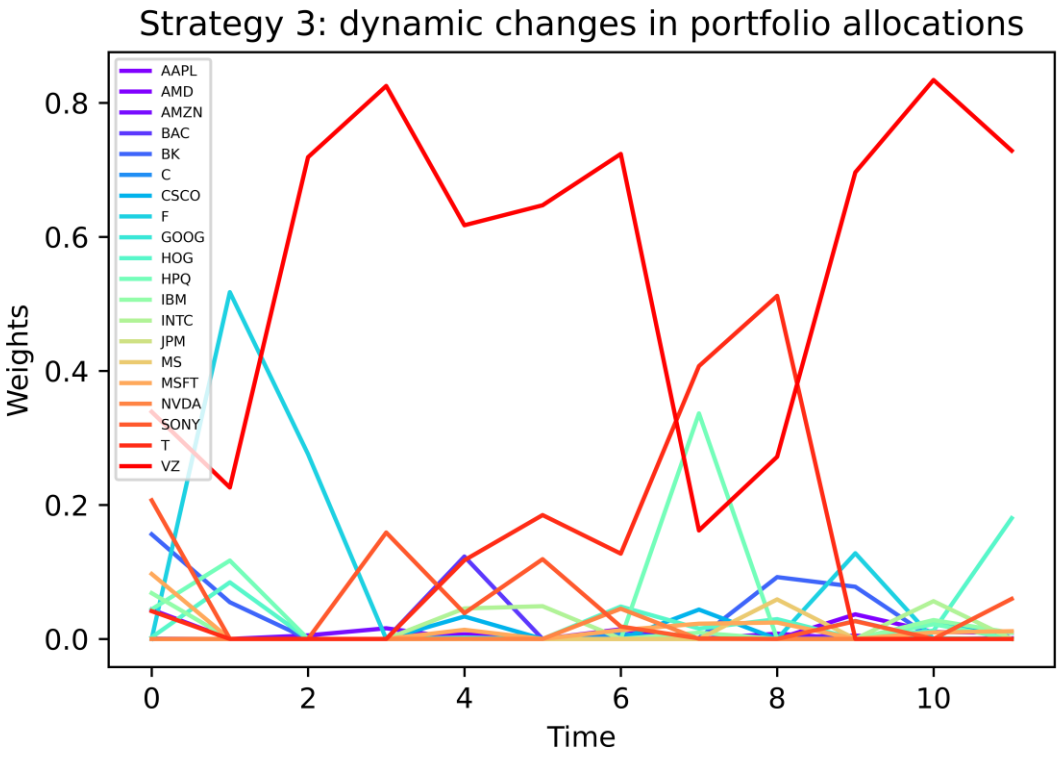


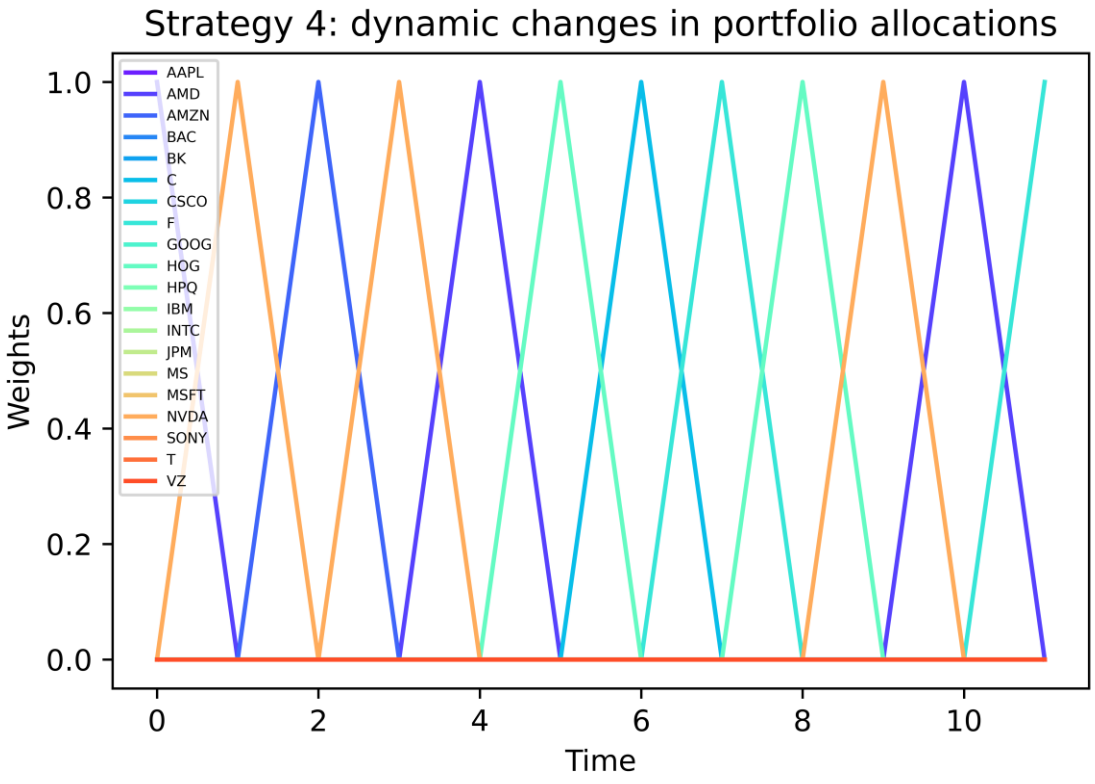
3. **Maximum drawdown of your portfolio (for each trading strategy) over the years 2020-2021:**



4. **Dynamic changes in portfolio allocations over the years 2020-2021:**







5. Results for 12 periods from 2008 to 2009:

Initial portfolio value = $ 385097.15

Period 1: start date 01/02/2008, end date 02/29/2008

Strategy "Buy and Hold", value begin = $ 385097.15, value end = $ 325918.34
Strategy "Equally Weighted Portfolio", value begin = $ 381617.90, value end = $ 326739.79
Strategy "Minimum Variance Portfolio", value begin = $ 383251.20, value end = $ 327071.03
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 381265.54, value end = $ 332652.59
Strategy "Equal Risk Contributions Portfolio", value begin = $ 381818.29, value end = $ 329118.72
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 747853.37, value end = $ 644825.01
Strategy "Robust Optimization Portfolio", value begin = $ 383268.03, value end = $ 327099.82

Period 2: start date 03/03/2008, end date 04/30/2008
Strategy "Buy and Hold", value begin = $ 325807.08, value end = $ 349997.20
Strategy "Equally Weighted Portfolio", value begin = $ 321816.11, value end = $ 354498.75
Strategy "Minimum Variance Portfolio", value begin = $ 322596.74, value end = $ 365780.84
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 325785.77, value end = $ 344234.61
Strategy "Equal Risk Contributions Portfolio", value begin = $ 324254.38, value end = $ 361195.10
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 620432.53, value end = $ 691625.78
Strategy "Robust Optimization Portfolio", value begin = $ 322724.06, value end = $ 365480.01

Period 3: start date 05/01/2008, end date 06/30/2008
Strategy "Buy and Hold", value begin = $ 357929.49, value end = $ 322881.56
Strategy "Equally Weighted Portfolio", value begin = $ 366089.19, value end = $ 308714.53
Strategy "Minimum Variance Portfolio", value begin = $ 373188.59, value end = $ 351697.89
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 349024.99, value end = $ 324672.35
Strategy "Equal Risk Contributions Portfolio", value begin = $ 371995.65, value end = $ 322549.59
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 696342.03, value end = $ 603265.44
Strategy "Robust Optimization Portfolio", value begin = $ 373329.13, value end = $ 344731.89

Period 4: start date 07/01/2008, end date 08/29/2008
Strategy "Buy and Hold", value begin = $ 324349.75, value end = $ 326489.53
Strategy "Equally Weighted Portfolio", value begin = $ 309166.32, value end = $ 315633.02
Strategy "Minimum Variance Portfolio", value begin = $ 352054.56, value end = $ 356534.49
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 335340.11, value end = $ 343588.41
Strategy "Equal Risk Contributions Portfolio", value begin = $ 322194.05, value end = $ 326310.90
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 587926.50, value end = $ 595614.28
Strategy "Robust Optimization Portfolio", value begin = $ 346392.32, value end = $ 350647.42

Period 5: start date 09/02/2008, end date 10/31/2008
Strategy "Buy and Hold", value begin = $ 333252.73, value end = $ 274022.75
Strategy "Equally Weighted Portfolio", value begin = $ 316410.12, value end = $ 231207.29
Strategy "Minimum Variance Portfolio", value begin = $ 348594.58, value end = $ 269094.59
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 330893.73, value end = $ 250012.99
Strategy "Equal Risk Contributions Portfolio", value begin = $ 326067.37, value end = $ 241905.47
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 579891.46, value end = $ 428711.94
Strategy "Robust Optimization Portfolio", value begin = $ 343172.61, value end = $ 274703.45

Period 6: start date 11/03/2008, end date 12/31/2008
Strategy "Buy and Hold", value begin = $ 282342.11, value end = $ 305967.56
Strategy "Equally Weighted Portfolio", value begin = $ 229798.51, value end = $ 198694.75
Strategy "Minimum Variance Portfolio", value begin = $ 269427.35, value end = $ 247951.51
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 241791.19, value end = $ 187182.92
Strategy "Equal Risk Contributions Portfolio", value begin = $ 241059.16, value end = $ 212048.25
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 413995.96, value end = $ 361195.77
Strategy "Robust Optimization Portfolio", value begin = $ 274880.05, value end = $ 252943.13

Period 7: start date 01/02/2009, end date 02/27/2009
Strategy "Buy and Hold", value begin = $ 313366.90, value end = $ 258275.19
Strategy "Equally Weighted Portfolio", value begin = $ 207171.39, value end = $ 169778.42
Strategy "Minimum Variance Portfolio", value begin = $ 256011.28, value end = $ 244043.86
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 186510.22, value end = $ 151636.33
Strategy "Equal Risk Contributions Portfolio", value begin = $ 220932.28, value end = $ 188643.81
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 362522.62, value end = $ 309759.20
Strategy "Robust Optimization Portfolio", value begin = $ 261166.00, value end = $ 248932.97

Period 8: start date 03/02/2009, end date 04/30/2009
Strategy "Buy and Hold", value begin = $ 248688.22, value end = $ 286368.72
Strategy "Equally Weighted Portfolio", value begin = $ 161563.65, value end = $ 259844.00
Strategy "Minimum Variance Portfolio", value begin = $ 234415.66, value end = $ 320345.33
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 141120.57, value end = $ 186438.91
Strategy "Equal Risk Contributions Portfolio", value begin = $ 180755.31, value end = $ 271167.36
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 285516.74, value end = $ 432663.37
Strategy "Robust Optimization Portfolio", value begin = $ 239126.58, value end = $ 326645.92

Period 9: start date 05/01/2009, end date 06/30/2009
Strategy "Buy and Hold", value begin = $ 287805.37, value end = $ 285824.08
Strategy "Equally Weighted Portfolio", value begin = $ 259409.32, value end = $ 273076.22
Strategy "Minimum Variance Portfolio", value begin = $ 317761.17, value end = $ 321192.13
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 201604.66, value end = $ 215067.92
Strategy "Equal Risk Contributions Portfolio", value begin = $ 270681.98, value end = $ 281206.32
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 418854.73, value end = $ 435583.07
Strategy "Robust Optimization Portfolio", value begin = $ 324270.30, value end =

$ 334039.11

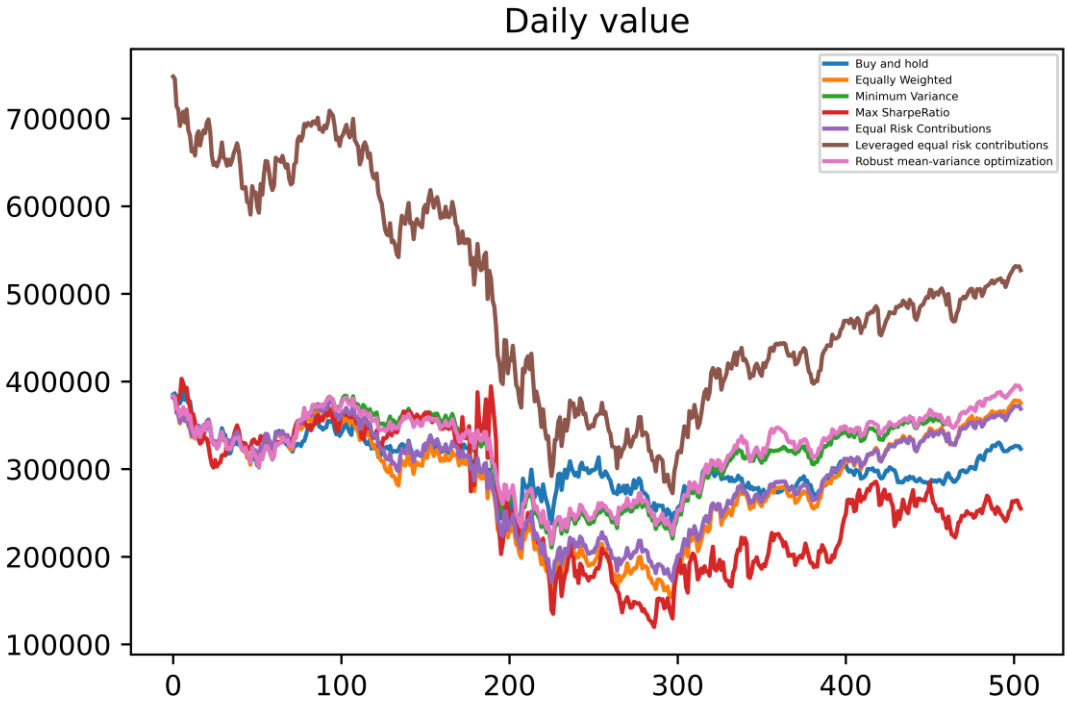
Period 10: start date 07/01/2009, end date 08/31/2009
Strategy "Buy and Hold", value begin = $ 286766.63, value end = $ 298338.27
Strategy "Equally Weighted Portfolio", value begin = $ 272761.62, value end = $ 321508.72
Strategy "Minimum Variance Portfolio", value begin = $ 320881.69, value end = $ 342283.99
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 207315.76, value end = $ 279432.77
Strategy "Equal Risk Contributions Portfolio", value begin = $ 281206.52, value end = $ 319917.02
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 422627.30, value end = $ 482283.47
Strategy "Robust Optimization Portfolio", value begin = $ 329901.43, value end = $ 350031.26

Period 11: start date 09/01/2009, end date 10/30/2009
Strategy "Buy and Hold", value begin = $ 291703.36, value end = $ 290193.57
Strategy "Equally Weighted Portfolio", value begin = $ 309943.72, value end = $ 328056.79
Strategy "Minimum Variance Portfolio", value begin = $ 334104.16, value end = $ 350960.50
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 258881.36, value end = $ 233223.95
Strategy "Equal Risk Contributions Portfolio", value begin = $ 310185.59, value end = $ 328999.58
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 454383.40, value end = $ 482863.79
Strategy "Robust Optimization Portfolio", value begin = $ 340401.53, value end = $ 350080.65

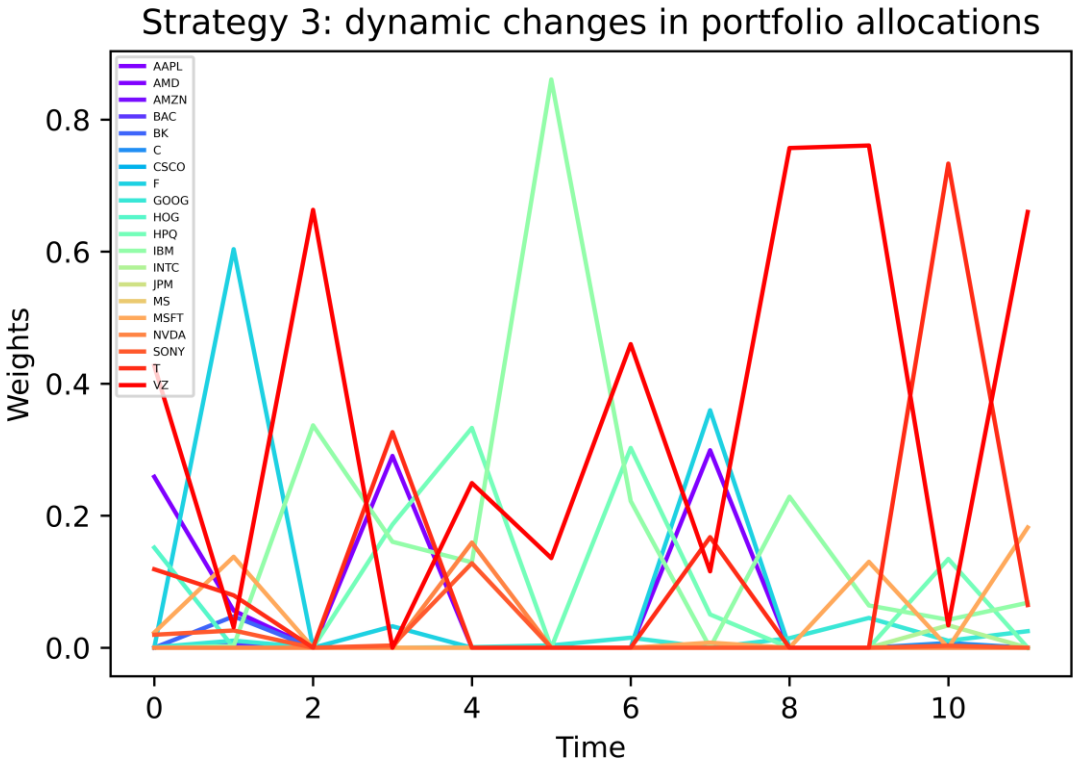
Period 12: start date 11/02/2009, end date 12/31/2009
Strategy "Buy and Hold", value begin = $ 288596.05, value end = $ 323101.02
Strategy "Equally Weighted Portfolio", value begin = $ 329407.43, value end = $ 375443.74
Strategy "Minimum Variance Portfolio", value begin = $ 348373.09, value end = $ 391211.43
Strategy "Maximum Sharpe Ratio Portfolio", value begin = $ 225258.80, value end = $ 254972.42
Strategy "Equal Risk Contributions Portfolio", value begin = $ 329643.66, value end = $ 368862.19
Strategy "Leveraged Equal Risk Contributions Portfolio", value begin = $ 470933.48, value end = $ 526851.38

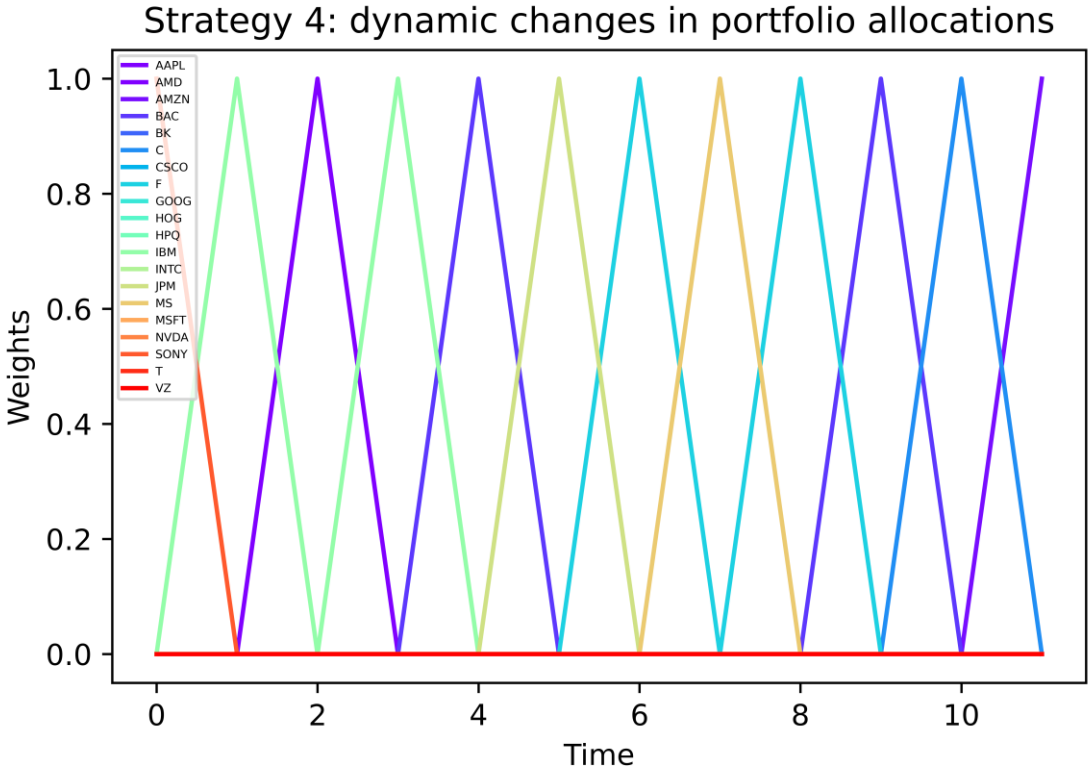
Strategy "Robust Optimization Portfolio", value begin = $ 348430.57, value end = $ 391061.35

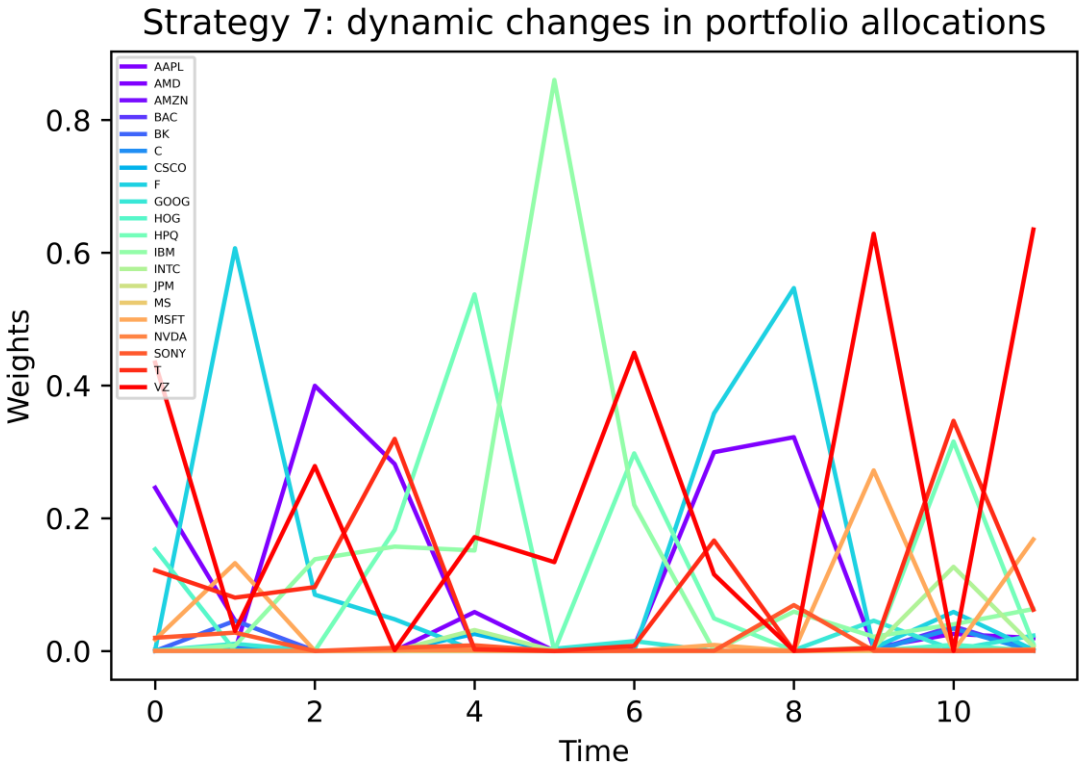
6. **Daily value of portfolio (for each trading strategy) over the years 2008-2009:**



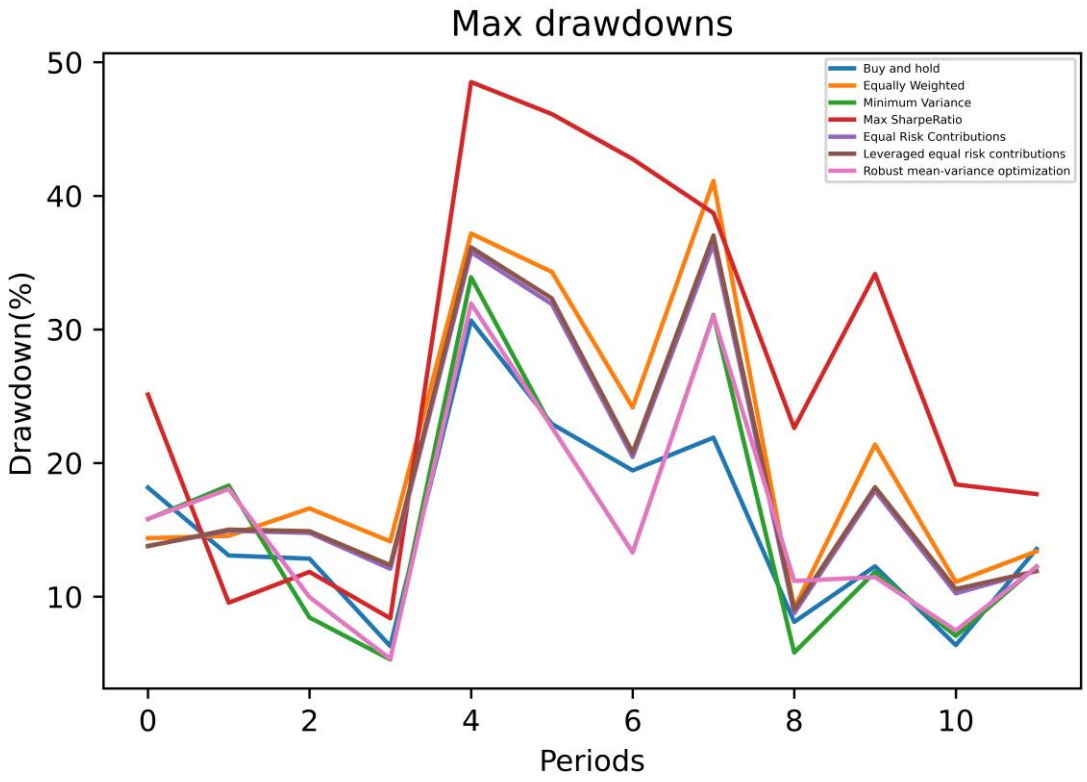
7. **Dynamic changes in portfolio allocations over the year 2008-2009:**







8. Maximum drawdown of your portfolio (for each trading strategy) over the years 2008-2009:


Max drawdowns
Buy and hold
Equally Weighted
Minimum Variance
Max SharpeRatio
Equal Risk Contributions
Leveraged equal risk contributions
Robust mean-variance optimization
Drawdown(%)
50
40
30
20
10
0
2
4
6
8
10
Periods