# SIMHEURISTIC APPROACH TO THE SINGLE-MACHINE SCHEDULING PROBLEM WITH STOCHASTIC PROCESSING TIMES AND ENERGY-EFFICIENT

Matheus Lopes Bittencourt[a], Clarissa Maria Rodrigues de Oliveira[a], Isis Didier Lins[a,b], Raphael Kramer[a]

[a] *Graduate Program in Production Engineering, Federal University of Pernambuco, Av. da Arquitetura, Cidade Universitária, 50740-550, Recife, Brazil*
[b] *Center of Studies and Testing in Risk and Environmental Modeling*

**Abstract**

This article addresses the stochastic version of the single-machine scheduling problem with environmental considerations. In this context, jobs processing times behave as random variables, and the total energy consumption depends on which jobs are processed in which periods, since each job has its own energy consumption and each period has its energy tariff due to the Time-Of-Use policy. The objective of this paper is to propose a simheuristic algorithm to minimize total energy consumption under different uncertainty scenarios. The proposed algorithm, called `SimSA`, combines the metaheuristics Simulated Annealing and Greedy Randomized Adaptive Search Procedure to perform the search in the solution space, along with Monte Carlo Simulation to generate random values. The `SimSA` results were compared with the simulation of the best solution using deterministic parameters, and `SimSA` achieved better results in the stochastic metrics Average, Value at Risk ($VaR$), and Conditional Value at Risk ($CVaR$). These results highlight the importance of incorporating uncertainties present in processes and emphasize the relevance of the proposed simheuristic.

*Corresponding author

*Email addresses:* `matheus.bittencourt@ufpe.br` (Matheus Lopes Bittencourt), `clarissa.maria@ufpe.br` (Clarissa Maria Rodrigues de Oliveira), `isis.lins@ufpe.br` (Isis Didier Lins), `raphael.kramer@ufpe.br` (Raphael Kramer)

*Keywords:* Green Scheduling, Time-Of-use (TOU), Stochastic Processing Time.

## 1. SimSA-Expected X SimExact

Table 1: Result of SimExact x `SimSA-Expected`

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 1 | 25 | 0.1 | 3.83 | 200.30 | 0.56 | 2.31 | 8.93 | 354 | 3319 | -39.74% |
| 2 | 25 | 0.1 | 6.48 | 187.00 | 0.63 | 2.48 | 2.36 | 308 | 3297 | -61.80% |
| 3 | 25 | 0.1 | 4.02 | 134.10 | 0.67 | 3.98 | 3.53 | 426 | 3847 | -0.89% |
| 4 | 25 | 0.1 | 3.86 | 374.80 | 0.83 | 3.19 | 2.86 | 437 | 3773 | -17.35% |
| 5 | 25 | 0.1 | 2.35 | 265.40 | 0.29 | 2.13 | 2.11 | 352 | 3090 | -9.48% |
| 6 | 25 | 0.1 | 3.97 | 228.40 | 0.27 | 3.01 | 2.23 | 381 | 3276 | -24.32% |
| 7 | 25 | 0.1 | 6.61 | 3604.91 | 0.12 | 1.89 | 2.04 | 364 | 3148 | -71.38% |
| 8 | 25 | 0.1 | 3.81 | 381.00 | 0.56 | 2.34 | 2.15 | 386 | 3246 | -38.62% |
| 9 | 25 | 0.1 | 3.83 | 346.40 | 0.50 | 2.42 | 2.42 | 349 | 3148 | -36.83% |
| 10 | 25 | 0.1 | 4.42 | 265.20 | 0.83 | 3.96 | 3.67 | 415 | 3405 | -10.30% |
| 11 | 25 | 0.1 | 8.75 | 366.60 | 0.26 | 2.28 | 2.92 | 361 | 3367 | -73.93% |
| 12 | 25 | 0.1 | 8.24 | 168.70 | 0.44 | 1.80 | 3.07 | 349 | 3074 | -78.12% |
| 13 | 25 | 0.1 | 3.95 | 285.30 | 0.01 | 2.30 | 1.44 | 348 | 2778 | -41.68% |
| 14 | 25 | 0.1 | 2.99 | 342.60 | 0.60 | 2.53 | 8.03 | 394 | 3652 | -15.23% |
| 15 | 25 | 0.1 | 2.75 | 257.20 | 0.15 | 2.41 | 2.05 | 345 | 2904 | -12.06% |
| 16 | 25 | 0.1 | 3.68 | 391.40 | 0.39 | 2.94 | 2.79 | 365 | 3275 | -20.11% |
| 17 | 25 | 0.1 | 8.36 | 243.80 | 0.37 | 2.61 | 1.99 | 311 | 3017 | -68.76% |
| 18 | 25 | 0.1 | 2.99 | 218.00 | 0.35 | 2.35 | 2.76 | 350 | 3391 | -21.44% |
| 19 | 25 | 0.1 | 14.16 | 638.00 | 0.24 | 14.02 | 2.13 | 337 | 3165 | -0.95% |
| 20 | 25 | 0.1 | 2.70 | 368.10 | 0.43 | 2.23 | 1.92 | 333 | 2995 | -17.34% |
| 21 | 25 | 0.1 | 2.67 | 3607.43 | 0.45 | 2.39 | 2.12 | 310 | 2904 | -10.56% |
| 22 | 25 | 0.1 | 19.77 | 1070.50 | 0.07 | 19.44 | 3.03 | 462 | 4138 | -1.64% |
| 23 | 25 | 0.1 | 3.28 | 318.30 | 0.38 | 1.59 | 2.25 | 327 | 2887 | -51.63% |
| 24 | 25 | 0.1 | 7.86 | 194.20 | 0.47 | 1.97 | 1.71 | 284 | 2808 | -74.89% |
| 25 | 25 | 0.1 | 3.15 | 359.70 | 0.63 | 2.22 | 2.44 | 334 | 2972 | -29.57% |
| 26 | 25 | 0.5 | 7.28 | 342.30 | 0.44 | 6.00 | 19.31 | 1527 | 14265 | -17.54% |
| 27 | 25 | 0.5 | 10.78 | 214.00 | 0.76 | 6.76 | 53.66 | 1738 | 15239 | -37.35% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 28 | 25 | 0.5 | 8.85 | 240.50 | 0.31 | 8.42 | 44.55 | 1756 | 16186 | -4.94% |
| 29 | 25 | 0.5 | 8.44 | 458.20 | 0.75 | 6.90 | 42.91 | 1729 | 14762 | -18.16% |
| 30 | 25 | 0.5 | 6.61 | 276.10 | 0.30 | 6.44 | 35.27 | 1672 | 14129 | -2.53% |
| 31 | 25 | 0.5 | 8.26 | 297.40 | 0.39 | 8.11 | 41.09 | 1762 | 15963 | -1.78% |
| 32 | 25 | 0.5 | 9.56 | 3617.21 | 0.19 | 5.92 | 34.53 | 1580 | 14319 | -38.15% |
| 33 | 25 | 0.5 | 8.29 | 460.90 | 0.72 | 6.31 | 41.01 | 1605 | 15884 | -23.93% |
| 34 | 25 | 0.5 | 8.10 | 432.30 | 0.15 | 6.64 | 35.80 | 1661 | 14819 | -17.96% |
| 35 | 25 | 0.5 | 9.30 | 400.40 | 0.90 | 9.10 | 48.97 | 1719 | 15262 | -2.18% |
| 36 | 25 | 0.5 | 11.46 | 450.80 | 0.33 | 6.32 | 46.05 | 1744 | 14993 | -44.85% |
| 37 | 25 | 0.5 | 11.47 | 266.10 | 0.42 | 6.61 | 32.68 | 1700 | 14827 | -42.37% |
| 38 | 25 | 0.5 | 8.47 | 291.30 | 1.25 | 7.29 | 44.55 | 1635 | 15311 | -13.88% |
| 39 | 25 | 0.5 | 9.45 | 432.00 | 1.22 | 8.45 | 204.10 | 2130 | 19637 | -10.54% |
| 40 | 25 | 0.5 | 6.84 | 325.90 | 0.01 | 6.68 | 30.17 | 1576 | 14480 | -2.35% |
| 41 | 25 | 0.5 | 8.72 | 467.20 | 0.32 | 7.95 | 50.21 | 1675 | 16068 | -8.76% |
| 42 | 25 | 0.5 | 11.80 | 309.70 | 0.49 | 7.20 | 36.49 | 1572 | 14691 | -38.93% |
| 43 | 25 | 0.5 | 7.43 | 252.40 | 0.33 | 7.34 | 36.27 | 1709 | 15654 | -1.16% |
| 44 | 25 | 0.5 | 2.78 | 243.20 | 0.22 | 2.69 | 37.64 | 1640 | 15466 | -3.25% |
| 45 | 25 | 0.5 | 6.16 | 380.20 | 0.21 | 5.98 | 34.94 | 1562 | 14131 | -2.97% |
| 46 | 25 | 0.5 | 7.02 | 3626.84 | 0.02 | 6.91 | 28.14 | 1559 | 13709 | -1.55% |
| 47 | 25 | 0.5 | 4.22 | 307.60 | 0.06 | 3.33 | 71.26 | 2265 | 20638 | -21.21% |
| 48 | 25 | 0.5 | 7.28 | 415.30 | 0.31 | 6.00 | 38.47 | 1624 | 14930 | -17.54% |
| 49 | 25 | 0.5 | 11.52 | 222.50 | 0.47 | 6.71 | 34.39 | 1693 | 14363 | -41.78% |
| 50 | 25 | 0.5 | 7.20 | 367.70 | 0.64 | 6.64 | 30.15 | 1605 | 14245 | -7.75% |
| 51 | 25 | 2.0 | 13.07 | 915.20 | 0.44 | 12.35 | 303.83 | 5326 | 47260 | -5.52% |
| 52 | 25 | 2.0 | 16.51 | 791.40 | 0.76 | 14.16 | 588.97 | 5890 | 52549 | -14.23% |
| 53 | 25 | 2.0 | 14.75 | 441.10 | 0.87 | 14.01 | 597.31 | 5749 | 50486 | -4.98% |
| 54 | 25 | 2.0 | 14.73 | 828.80 | 0.91 | 12.93 | 486.02 | 5303 | 48564 | -12.22% |
| 55 | 25 | 2.0 | 12.96 | 850.70 | 0.29 | 12.28 | 406.07 | 5402 | 47615 | -5.30% |
| 56 | 25 | 2.0 | 14.39 | 974.90 | 1.05 | 13.90 | 558.28 | 5418 | 51102 | -3.45% |
| 57 | 25 | 2.0 | 14.45 | 3770.04 | 0.31 | 11.37 | 360.71 | 4917 | 44620 | -21.36% |
| 58 | 25 | 2.0 | 13.93 | 1099.90 | 0.90 | 12.84 | 488.31 | 5612 | 50543 | -7.78% |
| 59 | 25 | 2.0 | 13.30 | 777.40 | 0.26 | 12.36 | 429.53 | 5405 | 48186 | -7.06% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 60 | 25 | 2.0 | 14.92 | 751.20 | 0.86 | 14.23 | 539.26 | 5397 | 47578 | -4.59% |
| 61 | 25 | 2.0 | 15.48 | 630.90 | 0.35 | 12.28 | 488.30 | 5202 | 48575 | -20.65% |
| 62 | 25 | 2.0 | 15.50 | 904.60 | 0.60 | 12.80 | 521.06 | 5446 | 49819 | -17.41% |
| 63 | 25 | 2.0 | 14.26 | 584.70 | 1.52 | 13.37 | 946.72 | 5839 | 50658 | -6.22% |
| 64 | 25 | 2.0 | 20.16 | 616.70 | 1.22 | 18.16 | 3898.11 | 8269 | 72209 | -9.92% |
| 65 | 25 | 2.0 | 14.48 | 640.90 | 1.45 | 13.39 | 578.84 | 5835 | 51753 | -7.51% |
| 66 | 25 | 2.0 | 16.85 | 607.20 | 0.32 | 16.16 | 611.14 | 6366 | 56216 | -4.09% |
| 67 | 25 | 2.0 | 16.38 | 710.20 | 0.82 | 13.10 | 425.87 | 5430 | 48372 | -20.00% |
| 68 | 25 | 2.0 | 14.46 | 813.00 | 0.30 | 14.11 | 523.76 | 5512 | 50979 | -2.38% |
| 69 | 25 | 2.0 | 7.54 | 359.20 | 0.24 | 7.41 | 458.64 | 5398 | 50068 | -1.65% |
| 70 | 25 | 2.0 | 12.16 | 879.60 | 0.29 | 11.51 | 358.55 | 4871 | 45564 | -5.39% |
| 71 | 25 | 2.0 | 12.68 | 3844.08 | 1.82 | 12.07 | 447.32 | 5012 | 46057 | -4.82% |
| 72 | 25 | 2.0 | 10.59 | 405.10 | 0.07 | 9.72 | 899.41 | 7592 | 69111 | -8.19% |
| 73 | 25 | 2.0 | 12.72 | 882.40 | 0.38 | 11.80 | 446.76 | 5321 | 48942 | -7.20% |
| 74 | 25 | 2.0 | 16.52 | 937.60 | 0.46 | 12.90 | 390.05 | 5275 | 48162 | -21.91% |
| 75 | 25 | 2.0 | 12.38 | 765.90 | 0.64 | 12.23 | 331.00 | 5175 | 46287 | -1.27% |
| 76 | 50 | 0.1 | 13.31 | 4289.80 | 0.24 | 12.88 | 3.48 | 340 | 3073 | -3.24% |
| 77 | 50 | 0.1 | 2.54 | 3611.12 | 0.11 | 2.39 | 3.90 | 362 | 3210 | -5.95% |
| 78 | 50 | 0.1 | 3.12 | 3610.67 | 0.02 | 2.33 | 3.31 | 381 | 3282 | -25.16% |
| 79 | 50 | 0.1 | 4.75 | 3617.11 | 0.01 | 2.25 | 2.78 | 289 | 2902 | -52.62% |
| 80 | 50 | 0.1 | 1.91 | 3636.41 | 0.09 | 1.84 | 3.68 | 363 | 2885 | -3.40% |
| 81 | 50 | 0.1 | 4.99 | 3621.79 | 0.15 | 2.28 | 3.67 | 371 | 3218 | -54.24% |
| 82 | 50 | 0.1 | 2.60 | 3611.40 | 0.02 | 2.30 | 2.83 | 314 | 3006 | -11.44% |
| 83 | 50 | 0.1 | 2.43 | 3623.80 | 0.14 | 1.91 | 3.11 | 321 | 3077 | -21.40% |
| 84 | 50 | 0.1 | 2.30 | 3623.38 | 0.26 | 2.22 | 3.30 | 355 | 3198 | -3.50% |
| 85 | 50 | 0.1 | 3.42 | 3624.27 | 0.20 | 2.42 | 3.19 | 293 | 3111 | -29.22% |
| 86 | 50 | 0.1 | 12.32 | 3999.92 | 0.17 | 12.19 | 3.01 | 318 | 2869 | -1.06% |
| 87 | 50 | 0.1 | 12.41 | 3989.07 | 0.14 | 12.15 | 2.33 | 322 | 3112 | -2.10% |
| 88 | 50 | 0.1 | 2.54 | 3623.76 | 0.27 | 2.47 | 4.09 | 356 | 3149 | -2.42% |
| 89 | 50 | 0.1 | 5.30 | 3619.14 | 0.09 | 2.40 | 3.39 | 362 | 3152 | -54.66% |
| 90 | 50 | 0.1 | 4.08 | 3622.31 | 0.05 | 2.33 | 3.40 | 339 | 3135 | -42.79% |
| 91 | 50 | 0.1 | 2.87 | 3623.80 | 0.22 | 2.82 | 2.79 | 306 | 2917 | -1.80% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 92 | 50 | 0.1 | 2.65 | 3623.15 | 0.01 | 2.65 | 3.09 | 323 | 3035 | -0.19% |
| 93 | 50 | 0.1 | 2.33 | 3623.84 | 0.06 | 2.26 | 2.86 | 313 | 2902 | -3.15% |
| 94 | 50 | 0.1 | 14.36 | 4053.18 | 0.12 | 13.64 | 2.77 | 307 | 2850 | -5.03% |
| 95 | 50 | 0.1 | 2.05 | 3624.75 | 0.24 | 1.88 | 3.20 | 350 | 3090 | -8.18% |
| 96 | 50 | 0.1 | 5.00 | 3617.77 | 0.15 | 2.78 | 3.68 | 370 | 3416 | -44.41% |
| 97 | 50 | 0.1 | 2.41 | 3629.96 | 0.19 | 2.07 | 3.13 | 344 | 2970 | -13.74% |
| 98 | 50 | 0.1 | 3.18 | 3621.90 | 0.15 | 2.80 | 3.53 | 342 | 3092 | -12.00% |
| 99 | 50 | 0.1 | 2.50 | 3616.26 | 0.21 | 1.93 | 3.25 | 323 | 3088 | -22.98% |
| 100 | 50 | 0.1 | 4.32 | 3609.72 | 0.28 | 2.18 | 3.07 | 303 | 3152 | -49.50% |
| 101 | 50 | 0.5 | 2.46 | 3605.90 | 0.13 | 2.43 | 37.22 | 1699 | 14407 | -1.23% |
| 102 | 50 | 0.5 | 7.46 | 3621.85 | 0.14 | 7.39 | 45.69 | 1662 | 15390 | -0.91% |
| 103 | 50 | 0.5 | 7.78 | 3620.20 | 0.11 | 6.87 | 41.93 | 1696 | 15168 | -11.67% |
| 104 | 50 | 0.5 | 9.06 | 3627.14 | 0.19 | 7.30 | 45.92 | 1584 | 15245 | -19.43% |
| 105 | 50 | 0.5 | 6.53 | 3669.47 | 0.12 | 6.05 | 41.04 | 1612 | 13863 | -7.37% |
| 106 | 50 | 0.5 | 8.88 | 3642.91 | 0.14 | 6.81 | 43.04 | 1528 | 14901 | -23.27% |
| 107 | 50 | 0.5 | 7.14 | 3668.60 | 0.04 | 6.81 | 42.92 | 1605 | 14992 | -4.64% |
| 108 | 50 | 0.5 | 13.74 | 4052.75 | 0.32 | 13.57 | 49.93 | 1619 | 15235 | -1.25% |
| 109 | 50 | 0.5 | 6.66 | 3645.66 | 0.30 | 6.51 | 37.78 | 1590 | 14725 | -2.32% |
| 110 | 50 | 0.5 | 8.62 | 3650.40 | 0.17 | 7.87 | 47.33 | 1795 | 15831 | -8.69% |
| 111 | 50 | 0.5 | 2.47 | 3623.50 | 0.17 | 2.41 | 40.73 | 1623 | 14710 | -2.56% |
| 112 | 50 | 0.5 | 2.94 | 3619.58 | 0.22 | 2.39 | 42.25 | 1661 | 14322 | -18.66% |
| 113 | 50 | 0.5 | 7.56 | 3644.29 | 0.14 | 6.81 | 44.76 | 1700 | 15100 | -9.89% |
| 114 | 50 | 0.5 | 9.19 | 3643.95 | 0.06 | 6.98 | 36.68 | 1640 | 14675 | -23.98% |
| 115 | 50 | 0.5 | 8.52 | 3643.58 | 0.05 | 7.43 | 52.08 | 1819 | 15630 | -12.80% |
| 116 | 50 | 0.5 | 7.61 | 3648.49 | 0.28 | 6.85 | 41.90 | 1489 | 14732 | -10.08% |
| 117 | 50 | 0.5 | 8.49 | 3647.74 | 0.17 | 7.00 | 51.41 | 1654 | 15229 | -17.59% |
| 118 | 50 | 0.5 | 13.24 | 4029.41 | 0.13 | 12.97 | 36.34 | 1487 | 14757 | -2.04% |
| 119 | 50 | 0.5 | 2.84 | 3624.77 | 0.04 | 2.18 | 38.20 | 1625 | 14737 | -23.23% |
| 120 | 50 | 0.5 | 6.45 | 3644.03 | 0.24 | 6.20 | 41.55 | 1601 | 15021 | -3.84% |
| 121 | 50 | 0.5 | 9.30 | 3627.63 | 0.23 | 7.12 | 55.87 | 1725 | 15370 | -23.37% |
| 122 | 50 | 0.5 | 7.09 | 3646.86 | 0.29 | 6.33 | 41.53 | 1540 | 14317 | -10.62% |
| 123 | 50 | 0.5 | 7.81 | 3638.27 | 0.21 | 7.63 | 51.80 | 1756 | 15785 | -2.34% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 124 | 50 | 0.5 | 7.17 | 3626.09 | 0.28 | 6.48 | 42.39 | 1647 | 14537 | -9.56% |
| 125 | 50 | 0.5 | 8.27 | 3619.02 | 0.51 | 6.71 | 44.86 | 1507 | 14612 | -18.81% |
| 126 | 50 | 2.0 | 7.10 | 3660.80 | 0.15 | 6.65 | 438.96 | 5407 | 49006 | -6.28% |
| 127 | 50 | 2.0 | 13.80 | 3742.81 | 0.11 | 13.58 | 493.45 | 5519 | 51196 | -1.60% |
| 128 | 50 | 2.0 | 13.42 | 3720.23 | 0.12 | 12.83 | 429.89 | 5221 | 48831 | -4.39% |
| 129 | 50 | 2.0 | 15.08 | 3806.36 | 0.34 | 14.03 | 586.23 | 5529 | 50753 | -6.93% |
| 130 | 50 | 2.0 | 12.15 | 4124.58 | 0.04 | 11.57 | 424.40 | 5041 | 46431 | -4.82% |
| 131 | 50 | 2.0 | 13.96 | 3846.18 | 0.47 | 11.90 | 511.17 | 5226 | 48019 | -14.76% |
| 132 | 50 | 2.0 | 13.52 | 3797.90 | 0.05 | 13.03 | 481.43 | 5514 | 49190 | -3.60% |
| 133 | 50 | 2.0 | 7.08 | 3650.09 | 0.19 | 6.92 | 545.30 | 5684 | 50653 | -2.28% |
| 134 | 50 | 2.0 | 11.84 | 4005.65 | 0.41 | 11.58 | 511.82 | 5139 | 47087 | -2.25% |
| 135 | 50 | 2.0 | 14.95 | 4096.08 | 0.20 | 14.56 | 584.28 | 5794 | 52566 | -2.60% |
| 136 | 50 | 2.0 | 6.70 | 3645.09 | 0.18 | 6.28 | 397.98 | 4900 | 46795 | -6.20% |
| 137 | 50 | 2.0 | 7.18 | 3648.72 | 0.24 | 7.06 | 435.43 | 5370 | 47135 | -1.63% |
| 138 | 50 | 2.0 | 13.71 | 4044.07 | 0.15 | 13.53 | 555.56 | 5424 | 50299 | -1.35% |
| 139 | 50 | 2.0 | 14.16 | 3948.95 | 0.23 | 12.82 | 445.08 | 5238 | 48004 | -9.45% |
| 140 | 50 | 2.0 | 14.47 | 4036.42 | 0.08 | 13.35 | 549.98 | 5664 | 50458 | -7.75% |
| 141 | 50 | 2.0 | 13.54 | 4012.63 | 0.79 | 13.29 | 563.07 | 5531 | 49726 | -1.88% |
| 142 | 50 | 2.0 | 14.09 | 4056.53 | 0.06 | 13.81 | 487.72 | 5416 | 49483 | -1.95% |
| 143 | 50 | 2.0 | 6.92 | 3652.33 | 0.33 | 6.85 | 457.84 | 5432 | 49718 | -1.04% |
| 144 | 50 | 2.0 | 7.06 | 3645.63 | 0.11 | 6.91 | 528.58 | 5683 | 51919 | -2.15% |
| 145 | 50 | 2.0 | 11.93 | 3980.05 | 0.24 | 11.60 | 410.90 | 5279 | 45479 | -2.77% |
| 146 | 50 | 2.0 | 15.39 | 3784.06 | 0.23 | 13.82 | 515.28 | 5711 | 51348 | -10.20% |
| 147 | 50 | 2.0 | 13.24 | 3818.03 | 0.27 | 12.81 | 468.59 | 5573 | 48445 | -3.20% |
| 148 | 50 | 2.0 | 14.55 | 3947.41 | 0.11 | 14.45 | 548.18 | 5847 | 53777 | -0.65% |
| 149 | 50 | 2.0 | 12.87 | 3772.46 | 0.35 | 12.75 | 483.47 | 5256 | 49034 | -0.92% |
| 150 | 50 | 2.0 | 14.10 | 3707.72 | 0.15 | 11.42 | 434.35 | 5343 | 46459 | -19.05% |
| 151 | 75 | 0.1 | 2.41 | 3606.90 | 0.07 | 2.27 | 3.61 | 324 | 2923 | -5.61% |
| 152 | 75 | 0.1 | 13.76 | 4018.50 | 0.15 | 13.74 | 4.19 | 336 | 3112 | -0.17% |
| 153 | 75 | 0.1 | 3.03 | 3606.20 | 0.11 | 2.43 | 4.46 | 332 | 3251 | -19.96% |
| 154 | 75 | 0.1 | 3.00 | 3615.41 | 0.10 | 2.27 | 3.63 | 346 | 3014 | -24.53% |
| 155 | 75 | 0.1 | 6.91 | 3712.40 | 0.15 | 6.90 | 4.25 | 372 | 3144 | -0.18% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **$GAP_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 156 | 75 | 0.1 | 2.55 | 3615.45 | 0.19 | 2.15 | 3.86 | 344 | 3054 | -15.67% |
| 157 | 75 | 0.1 | 13.28 | 3732.92 | 0.23 | 13.01 | 4.35 | 337 | 3057 | -2.06% |
| 158 | 75 | 0.1 | 2.31 | 3615.57 | 0.15 | 2.10 | 3.94 | 311 | 2886 | -8.99% |
| 159 | 75 | 0.1 | 2.44 | 3616.11 | 0.23 | 2.33 | 4.34 | 363 | 3182 | -4.51% |
| 160 | 75 | 0.1 | 2.73 | 3613.54 | 0.15 | 2.05 | 3.98 | 310 | 2894 | -24.84% |
| 161 | 75 | 0.1 | 2.62 | 3616.25 | 0.10 | 2.41 | 5.26 | 381 | 3012 | -8.13% |
| 162 | 75 | 0.1 | 2.54 | 3610.60 | 0.08 | 2.28 | 3.82 | 289 | 2866 | -10.17% |
| 163 | 75 | 0.1 | 2.20 | 3605.80 | 0.09 | 2.16 | 3.67 | 321 | 2957 | -1.76% |
| 164 | 75 | 0.1 | 13.06 | 3978.80 | 0.13 | 12.88 | 3.70 | 321 | 2802 | -1.35% |
| 165 | 75 | 0.1 | 13.17 | 3723.88 | 0.20 | 12.94 | 4.25 | 366 | 2979 | -1.75% |
| 166 | 75 | 0.1 | 2.80 | 3615.68 | 0.04 | 2.40 | 4.03 | 347 | 3094 | -14.14% |
| 167 | 75 | 0.1 | 2.65 | 3614.89 | 0.23 | 2.62 | 4.51 | 326 | 3113 | -0.96% |
| 168 | 75 | 0.1 | 2.37 | 3615.71 | 0.06 | 1.91 | 4.01 | 326 | 2973 | -19.41% |
| 169 | 75 | 0.1 | 13.05 | 3754.21 | 0.12 | 12.97 | 3.28 | 316 | 3056 | -0.66% |
| 170 | 75 | 0.1 | 2.53 | 3615.36 | 0.17 | 2.50 | 4.50 | 341 | 3220 | -1.43% |
| 171 | 75 | 0.1 | 13.51 | 3738.69 | 0.05 | 11.97 | 4.03 | 364 | 2914 | -11.36% |
| 172 | 75 | 0.1 | 2.68 | 3615.15 | 0.09 | 2.57 | 3.69 | 317 | 2953 | -4.26% |
| 173 | 75 | 0.1 | 2.54 | 3614.02 | 0.05 | 2.36 | 3.85 | 304 | 3178 | -7.25% |
| 174 | 75 | 0.1 | 2.34 | 3616.30 | 0.12 | 2.28 | 4.55 | 384 | 3245 | -2.55% |
| 175 | 75 | 0.1 | 3.05 | 3623.43 | 0.11 | 2.73 | 4.84 | 377 | 3148 | -10.61% |
| 176 | 75 | 0.5 | 6.92 | 3665.10 | 0.21 | 6.82 | 50.87 | 1592 | 14775 | -1.37% |
| 177 | 75 | 0.5 | 2.42 | 3605.70 | 0.14 | 2.15 | 54.72 | 1793 | 15788 | -11.43% |
| 178 | 75 | 0.5 | 8.04 | 3670.30 | 0.07 | 7.36 | 49.91 | 1751 | 15692 | -8.42% |
| 179 | 75 | 0.5 | 7.20 | 3625.83 | 0.11 | 7.08 | 43.44 | 1599 | 14957 | -1.68% |
| 180 | 75 | 0.5 | 2.60 | 3607.30 | 0.15 | 2.41 | 53.02 | 1700 | 14613 | -7.41% |
| 181 | 75 | 0.5 | 7.39 | 3626.65 | 0.16 | 7.17 | 45.02 | 1701 | 15252 | -2.94% |
| 182 | 75 | 0.5 | 2.44 | 3614.02 | 0.21 | 2.35 | 49.70 | 1587 | 14798 | -3.72% |
| 183 | 75 | 0.5 | 6.86 | 3626.84 | 0.14 | 6.56 | 49.40 | 1596 | 14297 | -4.42% |
| 184 | 75 | 0.5 | 7.01 | 3626.06 | 0.22 | 6.52 | 49.56 | 1662 | 14730 | -6.99% |
| 185 | 75 | 0.5 | 7.31 | 3624.66 | 0.11 | 6.97 | 49.24 | 1673 | 15145 | -4.63% |
| 186 | 75 | 0.5 | 7.53 | 3626.13 | 0.08 | 7.44 | 52.63 | 1770 | 15526 | -1.09% |
| 187 | 75 | 0.5 | 7.57 | 3631.30 | 0.03 | 7.19 | 45.03 | 1740 | 15286 | -5.10% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 188 | 75 | 0.5 | 6.52 | 3620.10 | 0.16 | 6.38 | 52.23 | 1627 | 14820 | -2.25% |
| 189 | 75 | 0.5 | 2.71 | 3609.70 | 0.13 | 2.54 | 45.43 | 1532 | 14438 | -6.22% |
| 190 | 75 | 0.5 | 2.52 | 3615.09 | 0.13 | 2.52 | 47.84 | 1615 | 14965 | -0.36% |
| 191 | 75 | 0.5 | 7.39 | 3625.98 | 0.15 | 7.05 | 50.27 | 1579 | 15233 | -4.62% |
| 192 | 75 | 0.5 | 13.07 | 3729.23 | 0.23 | 13.05 | 57.94 | 1736 | 15594 | -0.17% |
| 193 | 75 | 0.5 | 7.35 | 3625.73 | 0.13 | 6.65 | 49.93 | 1656 | 14652 | -9.47% |
| 194 | 75 | 0.5 | 2.28 | 3616.54 | 0.26 | 2.27 | 50.67 | 1485 | 15244 | -0.80% |
| 195 | 75 | 0.5 | 7.56 | 3626.31 | 0.22 | 7.11 | 55.38 | 1661 | 15499 | -6.01% |
| 196 | 75 | 0.5 | 2.65 | 3615.08 | 0.17 | 2.28 | 46.11 | 1694 | 14922 | -14.08% |
| 197 | 75 | 0.5 | 6.99 | 3624.52 | 0.11 | 6.93 | 47.10 | 1788 | 15107 | -0.97% |
| 198 | 75 | 0.5 | 7.35 | 3624.74 | 0.08 | 7.30 | 55.48 | 1784 | 15973 | -0.78% |
| 199 | 75 | 0.5 | 11.91 | 3721.12 | 0.14 | 11.55 | 47.16 | 1621 | 14353 | -2.99% |
| 200 | 75 | 0.5 | 8.10 | 3633.66 | 0.09 | 7.73 | 55.49 | 1751 | 15832 | -4.58% |
| 201 | 75 | 2.0 | 12.74 | 3809.00 | 0.11 | 12.46 | 432.28 | 5375 | 48659 | -2.16% |
| 202 | 75 | 2.0 | 7.63 | 3645.50 | 0.17 | 7.04 | 618.55 | 5977 | 53451 | -7.78% |
| 203 | 75 | 2.0 | 13.87 | 4060.70 | 0.18 | 13.16 | 585.97 | 5715 | 50252 | -5.12% |
| 204 | 75 | 2.0 | 13.18 | 3728.00 | 0.23 | 13.07 | 502.49 | 5224 | 48638 | -0.87% |
| 205 | 75 | 2.0 | 12.65 | 4086.60 | 0.07 | 12.28 | 432.23 | 5135 | 47594 | -2.88% |
| 206 | 75 | 2.0 | 13.34 | 3728.05 | 0.31 | 13.32 | 529.50 | 5366 | 50016 | -0.14% |
| 207 | 75 | 2.0 | 7.05 | 3626.84 | 0.22 | 6.95 | 547.73 | 5465 | 50063 | -1.37% |
| 208 | 75 | 2.0 | 12.57 | 3748.83 | 0.16 | 11.51 | 481.91 | 5099 | 47644 | -8.45% |
| 209 | 75 | 2.0 | 12.63 | 3737.31 | 0.19 | 12.31 | 473.09 | 5417 | 47875 | -2.54% |
| 210 | 75 | 2.0 | 13.01 | 3731.27 | 0.11 | 12.85 | 584.50 | 5696 | 50439 | -1.18% |
| 211 | 75 | 2.0 | 14.07 | 3742.84 | 0.07 | 13.56 | 520.24 | 5486 | 52188 | -3.62% |
| 212 | 75 | 2.0 | 13.28 | 4104.80 | 0.04 | 13.16 | 434.23 | 5591 | 50208 | -0.90% |
| 213 | 75 | 2.0 | 12.01 | 4364.50 | 0.09 | 11.75 | 450.73 | 5628 | 48084 | -2.16% |
| 214 | 75 | 2.0 | 7.49 | 3742.80 | 0.11 | 7.05 | 446.81 | 5276 | 47683 | -5.97% |
| 215 | 75 | 2.0 | 7.38 | 3624.47 | 0.24 | 7.28 | 506.57 | 5308 | 48848 | -1.42% |
| 216 | 75 | 2.0 | 13.28 | 3735.99 | 0.13 | 13.07 | 516.20 | 5513 | 48266 | -1.53% |
| 217 | 75 | 2.0 | 7.52 | 3625.88 | 0.26 | 7.44 | 508.44 | 5289 | 48578 | -1.00% |
| 218 | 75 | 2.0 | 12.83 | 3737.52 | 0.12 | 12.55 | 474.24 | 5255 | 48578 | -2.22% |
| 219 | 75 | 2.0 | 7.19 | 3629.29 | 0.25 | 7.13 | 529.55 | 5464 | 49668 | -0.92% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 220 | 75 | 2.0 | 13.82 | 3743.85 | 0.13 | 13.61 | 571.95 | 5888 | 50099 | -1.51% |
| 221 | 75 | 2.0 | 6.79 | 3625.73 | 0.14 | 6.65 | 483.48 | 5255 | 48812 | -1.96% |
| 222 | 75 | 2.0 | 13.10 | 3732.00 | 0.10 | 13.01 | 323.69 | 5019 | 49098 | -0.72% |
| 223 | 75 | 2.0 | 13.56 | 3740.45 | 0.16 | 13.45 | 594.90 | 5687 | 51306 | -0.77% |
| 224 | 75 | 2.0 | 6.77 | 3626.57 | 0.04 | 6.32 | 583.58 | 5665 | 50148 | -6.65% |
| 225 | 75 | 2.0 | 14.49 | 3783.96 | 0.13 | 14.25 | 572.00 | 5640 | 51106 | -1.63% |
| 226 | 100 | 0.1 | 7.94 | 3622.20 | 0.08 | 7.50 | 4.72 | 332 | 3104 | -5.52% |
| 227 | 100 | 0.1 | 2.68 | 3693.47 | 0.14 | 2.37 | 5.57 | 342 | 3000 | -11.64% |
| 228 | 100 | 0.1 | 12.61 | 4177.40 | 0.16 | 12.49 | 4.92 | 356 | 2877 | -0.97% |
| 229 | 100 | 0.1 | 2.83 | 3692.54 | 0.10 | 2.21 | 4.51 | 330 | 2917 | -21.96% |
| 230 | 100 | 0.1 | 2.73 | 3701.43 | 0.02 | 2.23 | 4.98 | 323 | 2946 | -18.27% |
| 231 | 100 | 0.1 | 3.14 | 3689.92 | 0.06 | 2.46 | 5.22 | 375 | 3075 | -21.66% |
| 232 | 100 | 0.1 | 2.72 | 3693.98 | 0.13 | 2.61 | 5.43 | 340 | 3102 | -3.99% |
| 233 | 100 | 0.1 | 12.14 | 4284.02 | 0.23 | 11.82 | 3.78 | 361 | 3195 | -2.66% |
| 234 | 100 | 0.1 | 13.13 | 4308.74 | 0.10 | 12.93 | 5.12 | 363 | 3098 | -1.48% |
| 235 | 100 | 0.1 | 6.95 | 3736.23 | 0.16 | 6.80 | 4.41 | 330 | 3060 | -2.07% |
| 236 | 100 | 0.1 | 2.86 | 3605.10 | 0.09 | 2.47 | 5.66 | 393 | 3181 | -13.64% |
| 237 | 100 | 0.1 | 6.96 | 3740.43 | 0.04 | 6.95 | 5.48 | 356 | 2933 | -0.08% |
| 238 | 100 | 0.1 | 7.45 | 3674.20 | 0.14 | 7.40 | 5.50 | 326 | 3146 | -0.74% |
| 239 | 100 | 0.1 | 2.62 | 3685.80 | 0.11 | 1.87 | 5.31 | 331 | 3136 | -28.73% |
| 240 | 100 | 0.1 | 7.30 | 3676.80 | 0.06 | 6.50 | 7.51 | 349 | 2965 | -11.03% |
| 241 | 100 | 0.1 | 14.12 | 4425.62 | 0.07 | 13.34 | 7.62 | 312 | 3010 | -5.54% |
| 242 | 100 | 0.1 | 12.83 | 4317.80 | 0.13 | 12.75 | 8.17 | 345 | 3003 | -0.58% |
| 243 | 100 | 0.1 | 2.68 | 3691.62 | 0.16 | 2.67 | 5.25 | 330 | 3016 | -0.45% |
| 244 | 100 | 0.1 | 2.41 | 3608.00 | 0.22 | 2.39 | 5.19 | 335 | 2975 | -0.64% |
| 245 | 100 | 0.1 | 2.97 | 3694.13 | 0.11 | 2.26 | 5.67 | 369 | 3088 | -23.93% |
| 246 | 100 | 0.1 | 2.77 | 3611.20 | 0.08 | 2.71 | 4.38 | 314 | 2875 | -2.32% |
| 247 | 100 | 0.1 | 2.48 | 3615.60 | 0.06 | 2.29 | 4.54 | 359 | 3006 | -7.80% |
| 248 | 100 | 0.1 | 4.35 | 3608.94 | 0.30 | 2.81 | 5.57 | 367 | 3326 | -35.50% |
| 249 | 100 | 0.1 | 2.40 | 3611.90 | 0.01 | 2.15 | 3.63 | 358 | 3124 | -10.20% |
| 250 | 100 | 0.1 | 3.41 | 3615.60 | 0.07 | 2.43 | 4.88 | 314 | 3004 | -28.80% |
| 251 | 100 | 0.5 | 14.15 | 4379.00 | 0.09 | 14.02 | 55.77 | 1770 | 16008 | -0.96% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 252 | 100 | 0.5 | 6.88 | 3736.54 | 0.05 | 6.73 | 57.22 | 1822 | 14901 | -2.12% |
| 253 | 100 | 0.5 | 2.61 | 3611.10 | 0.18 | 2.24 | 50.16 | 1627 | 14798 | -13.97% |
| 254 | 100 | 0.5 | 6.91 | 3729.63 | 0.12 | 6.66 | 44.31 | 1635 | 14994 | -3.70% |
| 255 | 100 | 0.5 | 7.17 | 3744.79 | 0.02 | 6.71 | 39.85 | 1713 | 14601 | -6.50% |
| 256 | 100 | 0.5 | 7.75 | 3729.32 | 0.11 | 6.80 | 46.09 | 1654 | 14666 | -12.18% |
| 257 | 100 | 0.5 | 7.10 | 3732.47 | 0.13 | 6.98 | 61.10 | 1806 | 15422 | -1.64% |
| 258 | 100 | 0.5 | 2.09 | 3691.56 | 0.23 | 2.08 | 51.24 | 1637 | 14789 | -0.62% |
| 259 | 100 | 0.5 | 2.75 | 3689.87 | 0.12 | 2.62 | 49.22 | 1603 | 15254 | -4.72% |
| 260 | 100 | 0.5 | 2.43 | 3688.63 | 0.03 | 2.30 | 47.23 | 1501 | 14739 | -5.00% |
| 261 | 100 | 0.5 | 7.85 | 3722.30 | 0.19 | 7.72 | 63.34 | 1769 | 15723 | -1.57% |
| 262 | 100 | 0.5 | 12.55 | 4303.91 | 0.02 | 12.43 | 56.05 | 1648 | 15043 | -0.93% |
| 263 | 100 | 0.5 | 13.60 | 4234.90 | 0.15 | 12.59 | 61.90 | 1874 | 15414 | -7.41% |
| 264 | 100 | 0.5 | 7.31 | 3736.39 | 0.10 | 6.93 | 53.19 | 1637 | 15294 | -5.20% |
| 265 | 100 | 0.5 | 12.68 | 3868.80 | 0.05 | 12.34 | 74.67 | 1675 | 15257 | -2.70% |
| 266 | 100 | 0.5 | 2.97 | 3693.67 | 0.08 | 2.78 | 86.12 | 1632 | 15163 | -6.63% |
| 267 | 100 | 0.5 | 2.55 | 3611.00 | 0.04 | 2.44 | 42.86 | 1719 | 15463 | -4.32% |
| 268 | 100 | 0.5 | 7.75 | 3738.43 | 0.08 | 7.25 | 55.62 | 1719 | 15167 | -6.53% |
| 269 | 100 | 0.5 | 7.62 | 3725.90 | 0.19 | 7.44 | 52.90 | 1717 | 15111 | -2.36% |
| 270 | 100 | 0.5 | 7.86 | 3742.27 | 0.06 | 7.22 | 54.98 | 1714 | 15426 | -8.14% |
| 271 | 100 | 0.5 | 7.16 | 3646.30 | 0.07 | 7.06 | 50.65 | 1692 | 15050 | -1.38% |
| 272 | 100 | 0.5 | 12.61 | 11024.40 | 0.21 | 11.97 | 57.43 | 1732 | 14969 | -5.07% |
| 273 | 100 | 0.5 | 8.62 | 3637.80 | 0.30 | 7.94 | 56.08 | 1782 | 15831 | -7.89% |
| 274 | 100 | 0.5 | 7.20 | 3653.90 | 0.01 | 6.77 | 36.63 | 1623 | 15162 | -5.97% |
| 275 | 100 | 0.5 | 8.05 | 3660.50 | 0.12 | 7.22 | 59.52 | 1647 | 15230 | -10.24% |
| 276 | 100 | 2.0 | 2.77 | 3604.00 | 0.06 | 2.70 | 577.68 | 5538 | 51368 | -2.58% |
| 277 | 100 | 2.0 | 12.95 | 4350.05 | 0.08 | 12.13 | 531.47 | 5166 | 50034 | -6.34% |
| 278 | 100 | 2.0 | 7.32 | 3742.40 | 0.03 | 6.72 | 230.40 | 5574 | 49533 | -8.28% |
| 279 | 100 | 2.0 | 12.63 | 4314.04 | 0.05 | 12.03 | 216.37 | 5458 | 47347 | -4.74% |
| 280 | 100 | 2.0 | 12.47 | 4289.95 | 0.07 | 11.98 | 475.01 | 5357 | 46987 | -3.96% |
| 281 | 100 | 2.0 | 13.01 | 4312.90 | 0.09 | 12.71 | 549.58 | 5607 | 49435 | -2.29% |
| 282 | 100 | 2.0 | 13.16 | 4339.81 | 0.17 | 13.11 | 577.45 | 5595 | 49180 | -0.34% |
| 283 | 100 | 2.0 | 6.96 | 3736.75 | 0.23 | 6.53 | 613.80 | 5561 | 49080 | -6.19% |

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Table 1: Result of SimExact X SimSA-Expected (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-Expected** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | E-RPD[(a)] | T(s) | D-RPD | E-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 284 | 100 | 2.0 | 7.27 | 3737.38 | 0.06 | 7.26 | 492.16 | 5564 | 50486 | -0.18% |
| 285 | 100 | 2.0 | 12.36 | 4302.11 | 0.23 | 12.27 | 537.55 | 5481 | 48952 | -0.76% |
| 286 | 100 | 2.0 | 14.39 | 3803.20 | 0.17 | 13.43 | 673.41 | 5855 | 51983 | -6.67% |
| 287 | 100 | 2.0 | 2.49 | 3689.67 | 0.03 | 2.39 | 552.17 | 5466 | 48276 | -4.23% |
| 288 | 100 | 2.0 | 3.03 | 3609.40 | 0.15 | 2.65 | 619.57 | 5604 | 51124 | -12.63% |
| 289 | 100 | 2.0 | 12.66 | 4323.21 | 0.06 | 12.59 | 488.05 | 5263 | 47983 | -0.61% |
| 290 | 100 | 2.0 | 2.59 | 3609.30 | 0.11 | 2.34 | 712.85 | 5473 | 48406 | -9.46% |
| 291 | 100 | 2.0 | 7.84 | 3738.96 | 0.12 | 7.33 | 799.12 | 5708 | 51804 | -6.45% |
| 292 | 100 | 2.0 | 7.25 | 3668.60 | 0.11 | 7.08 | 510.01 | 5153 | 49437 | -2.37% |
| 293 | 100 | 2.0 | 13.03 | 4351.22 | 0.09 | 12.97 | 477.87 | 5456 | 48364 | -0.43% |
| 294 | 100 | 2.0 | 13.29 | 3835.40 | 0.03 | 13.11 | 229.74 | 5687 | 49507 | -1.39% |
| 295 | 100 | 2.0 | 13.57 | 4349.52 | 0.05 | 12.89 | 525.43 | 5532 | 49791 | -4.99% |
| 296 | 100 | 2.0 | 13.34 | 4244.40 | 0.06 | 13.18 | 523.26 | 5600 | 50335 | -1.22% |
| 297 | 100 | 2.0 | 6.90 | 3632.40 | 0.12 | 6.88 | 457.71 | 5239 | 47942 | -0.31% |
| 298 | 100 | 2.0 | 14.90 | 4134.42 | 0.30 | 13.61 | 558.75 | 5560 | 52383 | -8.65% |
| 299 | 100 | 2.0 | 12.49 | 11021.80 | 0.17 | 12.43 | 465.35 | 5264 | 48393 | -0.55% |
| 300 | 100 | 2.0 | 13.13 | 4045.80 | 0.10 | 12.53 | 536.40 | 5602 | 49935 | -4.57% |

## 2. SimSA-VaR X SimExact

Table 2: Result of SimExact x `SimSA-VaR`

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 1 | 25 | 0.1 | 19.10 | 200.30 | 0.44 | 18.09 | 8.06 | 356 | 3307 | -5.29% |
| 2 | 25 | 0.1 | 21.31 | 187.00 | 1.04 | 18.03 | 2.60 | 337 | 3014 | -15.42% |
| 3 | 25 | 0.1 | 22.17 | 134.10 | 0.20 | 20.62 | 2.45 | 411 | 3699 | -6.98% |
| 4 | 25 | 0.1 | 21.27 | 374.80 | 0.60 | 20.32 | 1.92 | 346 | 3245 | -4.46% |
| 5 | 25 | 0.1 | 18.90 | 265.40 | 0.64 | 18.56 | 2.30 | 363 | 3038 | -1.83% |
| 6 | 25 | 0.1 | 20.96 | 228.40 | 0.50 | 19.55 | 2.26 | 354 | 3304 | -6.73% |
| 7 | 25 | 0.1 | 21.85 | 3604.91 | 0.23 | 16.53 | 1.75 | 314 | 2905 | -24.37% |
| 8 | 25 | 0.1 | 20.94 | 381.00 | 0.29 | 18.74 | 1.81 | 292 | 3041 | -10.52% |
| 9 | 25 | 0.1 | 19.47 | 346.40 | 0.35 | 17.92 | 2.13 | 379 | 3034 | -7.97% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD$^{(a)}$ | T(s) | D-RPD | V-RPD$^{(b)}$ | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 10 | 25 | 0.1 | 21.68 | 265.20 | 0.54 | 20.36 | 2.39 | 372 | 3268 | -6.09% |
| 11 | 25 | 0.1 | 22.92 | 366.60 | 0.44 | 18.26 | 2.24 | 345 | 3139 | -20.32% |
| 12 | 25 | 0.1 | 22.92 | 168.70 | 0.36 | 17.29 | 1.84 | 342 | 2969 | -24.55% |
| 13 | 25 | 0.1 | 19.68 | 285.30 | 0.94 | 16.99 | 1.62 | 286 | 2683 | -13.64% |
| 14 | 25 | 0.1 | 20.79 | 342.60 | 0.34 | 19.88 | 2.93 | 357 | 3261 | -4.35% |
| 15 | 25 | 0.1 | 17.96 | 257.20 | 0.81 | 17.81 | 1.93 | 332 | 2935 | -0.85% |
| 16 | 25 | 0.1 | 22.03 | 391.40 | 0.37 | 18.26 | 2.57 | 348 | 2874 | -17.10% |
| 17 | 25 | 0.1 | 23.30 | 243.80 | 0.47 | 18.14 | 1.71 | 341 | 2968 | -22.14% |
| 18 | 25 | 0.1 | 19.57 | 218.00 | 0.36 | 18.07 | 3.20 | 411 | 3425 | -7.64% |
| 19 | 25 | 0.1 | 46.89 | 638.00 | 0.17 | 18.06 | 2.23 | 374 | 3106 | -61.49% |
| 20 | 25 | 0.1 | 18.74 | 368.10 | 0.32 | 17.88 | 2.68 | 338 | 2980 | -4.60% |
| 21 | 25 | 0.1 | 18.03 | 3607.43 | 0.59 | 17.37 | 2.41 | 332 | 2945 | -3.67% |
| 22 | 25 | 0.1 | 53.88 | 1070.50 | 0.36 | 21.32 | 3.26 | 394 | 3513 | -60.43% |
| 23 | 25 | 0.1 | 19.78 | 318.30 | 0.59 | 16.43 | 2.45 | 311 | 2940 | -16.96% |
| 24 | 25 | 0.1 | 21.06 | 194.20 | 0.47 | 17.69 | 1.99 | 300 | 2928 | -16.00% |
| 25 | 25 | 0.1 | 19.30 | 359.70 | 0.81 | 17.23 | 2.46 | 347 | 2880 | -10.74% |
| 26 | 25 | 0.5 | 44.11 | 342.30 | 1.07 | 42.51 | 27.81 | 1576 | 13729 | -3.63% |
| 27 | 25 | 0.5 | 50.24 | 214.00 | 0.78 | 45.76 | 40.74 | 1739 | 15419 | -8.91% |
| 28 | 25 | 0.5 | 48.03 | 240.50 | 0.19 | 47.73 | 38.86 | 1805 | 16295 | -0.63% |
| 29 | 25 | 0.5 | 47.70 | 458.20 | 0.60 | 44.40 | 36.91 | 1693 | 14606 | -6.90% |
| 30 | 25 | 0.5 | 43.25 | 276.10 | 0.41 | 42.99 | 32.88 | 1519 | 14310 | -0.60% |
| 31 | 25 | 0.5 | 46.31 | 297.40 | 0.30 | 46.25 | 36.45 | 1747 | 15078 | -0.13% |
| 32 | 25 | 0.5 | 43.80 | 3617.21 | 0.17 | 41.04 | 27.67 | 1531 | 13618 | -6.30% |
| 33 | 25 | 0.5 | 48.01 | 460.90 | 1.20 | 44.86 | 40.77 | 1755 | 15768 | -6.55% |
| 34 | 25 | 0.5 | 45.77 | 432.30 | 0.73 | 42.41 | 39.75 | 1595 | 14212 | -7.35% |
| 35 | 25 | 0.5 | 49.53 | 400.40 | 1.02 | 46.38 | 42.55 | 1586 | 14919 | -6.35% |
| 36 | 25 | 0.5 | 45.54 | 450.80 | 0.47 | 43.93 | 40.23 | 1719 | 14973 | -3.54% |
| 37 | 25 | 0.5 | 47.01 | 266.10 | 0.47 | 44.66 | 17.29 | 1632 | 14992 | -5.00% |
| 38 | 25 | 0.5 | 45.63 | 291.30 | 0.65 | 44.75 | 33.20 | 1694 | 14730 | -1.93% |
| 39 | 25 | 0.5 | 53.83 | 432.00 | 1.26 | 52.67 | 76.09 | 2160 | 19321 | -2.16% |
| 40 | 25 | 0.5 | 45.28 | 325.90 | 0.00 | 43.42 | 32.65 | 1632 | 14822 | -4.09% |
| 41 | 25 | 0.5 | 49.58 | 467.20 | 0.24 | 49.48 | 46.62 | 1891 | 16830 | -0.20% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 42 | 25 | 0.5 | 48.01 | 309.70 | 0.93 | 44.91 | 39.77 | 1613 | 14430 | -6.47% |
| 43 | 25 | 0.5 | 46.57 | 252.40 | 0.29 | 45.79 | 41.26 | 1792 | 15340 | -1.67% |
| 44 | 25 | 0.5 | 90.73 | 243.20 | 0.25 | 45.24 | 39.49 | 1669 | 15602 | -50.13% |
| 45 | 25 | 0.5 | 42.22 | 380.20 | 0.47 | 41.49 | 37.17 | 1614 | 14052 | -1.74% |
| 46 | 25 | 0.5 | 44.07 | 3626.84 | 0.79 | 43.06 | 32.03 | 1625 | 13784 | -2.30% |
| 47 | 25 | 0.5 | 115.70 | 307.60 | 0.80 | 53.88 | 71.51 | 1954 | 18099 | -53.43% |
| 48 | 25 | 0.5 | 44.56 | 415.30 | 0.17 | 43.35 | 41.04 | 1605 | 14600 | -2.72% |
| 49 | 25 | 0.5 | 47.67 | 222.50 | 1.03 | 42.77 | 43.07 | 1508 | 14084 | -10.27% |
| 50 | 25 | 0.5 | 44.37 | 367.70 | 1.03 | 44.21 | 41.99 | 1596 | 14034 | -0.34% |
| 51 | 25 | 2.0 | 86.96 | 915.20 | 0.27 | 85.52 | 362.27 | 5081 | 46399 | -1.66% |
| 52 | 25 | 2.0 | 92.69 | 791.40 | 0.88 | 91.74 | 486.80 | 5711 | 51099 | -1.03% |
| 53 | 25 | 2.0 | 91.23 | 441.10 | 0.63 | 88.21 | 451.42 | 5411 | 49240 | -3.31% |
| 54 | 25 | 2.0 | 90.63 | 828.80 | 0.61 | 86.19 | 377.38 | 5332 | 46863 | -4.89% |
| 55 | 25 | 2.0 | 87.91 | 850.70 | 0.38 | 85.54 | 445.75 | 5234 | 46282 | -2.70% |
| 56 | 25 | 2.0 | 90.33 | 974.90 | 0.71 | 89.76 | 454.33 | 5385 | 49253 | -0.63% |
| 57 | 25 | 2.0 | 84.74 | 3770.04 | 0.44 | 82.22 | 413.85 | 5047 | 45284 | -2.97% |
| 58 | 25 | 2.0 | 89.88 | 1099.90 | 1.65 | 88.21 | 491.79 | 5572 | 49611 | -1.85% |
| 59 | 25 | 2.0 | 85.94 | 777.40 | 0.43 | 85.88 | 409.47 | 5454 | 47773 | -0.07% |
| 60 | 25 | 2.0 | 89.82 | 751.20 | 0.89 | 89.38 | 405.55 | 5314 | 48055 | -0.49% |
| 61 | 25 | 2.0 | 88.05 | 630.90 | 0.35 | 86.31 | 420.67 | 5301 | 48334 | -1.98% |
| 62 | 25 | 2.0 | 89.08 | 904.60 | 0.90 | 87.77 | 459.10 | 5337 | 48127 | -1.47% |
| 63 | 25 | 2.0 | 89.73 | 584.70 | 1.08 | 89.12 | 389.23 | 5143 | 47567 | -0.68% |
| 64 | 25 | 2.0 | 116.19 | 616.70 | 1.03 | 111.71 | 1053.66 | 7789 | 68871 | -3.86% |
| 65 | 25 | 2.0 | 92.45 | 640.90 | 1.25 | 92.05 | 580.14 | 6042 | 52756 | -0.44% |
| 66 | 25 | 2.0 | 101.54 | 607.20 | 0.22 | 101.14 | 588.01 | 6359 | 58268 | -0.39% |
| 67 | 25 | 2.0 | 89.11 | 710.20 | 0.42 | 86.53 | 368.91 | 5390 | 47189 | -2.89% |
| 68 | 25 | 2.0 | 93.35 | 813.00 | 0.22 | 93.31 | 497.16 | 5637 | 51253 | -0.04% |
| 69 | 25 | 2.0 | 91.06 | 359.20 | 0.27 | 90.26 | 476.84 | 5436 | 49283 | -0.87% |
| 70 | 25 | 2.0 | 83.23 | 879.60 | 0.16 | 81.95 | 321.88 | 5087 | 45608 | -1.54% |
| 71 | 25 | 2.0 | 84.00 | 3844.08 | 0.64 | 82.06 | 288.66 | 4632 | 44784 | -2.31% |
| 72 | 25 | 2.0 | 115.91 | 405.10 | 0.14 | 114.59 | 965.39 | 7332 | 69347 | -1.14% |
| 73 | 25 | 2.0 | 87.78 | 882.40 | 0.39 | 85.99 | 488.24 | 5476 | 48375 | -2.05% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 74 | 25 | 2.0 | 88.16 | 937.60 | 0.63 | 87.10 | 463.23 | 5292 | 47667 | -1.20% |
| 75 | 25 | 2.0 | 84.55 | 765.90 | 0.56 | 84.49 | 426.70 | 5079 | 45848 | -0.07% |
| 76 | 50 | 0.1 | 44.53 | 4289.80 | 0.24 | 17.61 | 3.71 | 374 | 3035 | -60.47% |
| 77 | 50 | 0.1 | 19.28 | 3611.12 | 0.11 | 19.07 | 3.71 | 353 | 3371 | -1.08% |
| 78 | 50 | 0.1 | 19.71 | 3610.67 | 0.09 | 18.74 | 3.56 | 321 | 3381 | -4.93% |
| 79 | 50 | 0.1 | 20.50 | 3617.11 | 0.12 | 17.90 | 3.55 | 347 | 2965 | -12.73% |
| 80 | 50 | 0.1 | 17.69 | 3636.41 | 0.04 | 16.98 | 3.61 | 337 | 3056 | -4.03% |
| 81 | 50 | 0.1 | 19.86 | 3621.79 | 0.15 | 16.92 | 3.92 | 379 | 3023 | -14.80% |
| 82 | 50 | 0.1 | 18.19 | 3611.40 | 0.25 | 17.74 | 3.39 | 319 | 3121 | -2.46% |
| 83 | 50 | 0.1 | 18.29 | 3623.80 | 0.29 | 18.19 | 3.58 | 320 | 3184 | -0.56% |
| 84 | 50 | 0.1 | 18.18 | 3623.38 | 0.38 | 17.60 | 3.84 | 350 | 3083 | -3.20% |
| 85 | 50 | 0.1 | 20.39 | 3624.27 | 0.17 | 17.87 | 3.76 | 320 | 2939 | -12.32% |
| 86 | 50 | 0.1 | 43.27 | 3999.92 | 0.19 | 17.23 | 3.29 | 376 | 2881 | -60.17% |
| 87 | 50 | 0.1 | 43.43 | 3989.07 | 0.21 | 18.16 | 2.59 | 333 | 3065 | -58.17% |
| 88 | 50 | 0.1 | 18.08 | 3623.76 | 0.12 | 17.95 | 3.12 | 340 | 3210 | -0.73% |
| 89 | 50 | 0.1 | 20.40 | 3619.14 | 0.05 | 17.67 | 2.98 | 331 | 2960 | -13.40% |
| 90 | 50 | 0.1 | 20.42 | 3622.31 | 0.78 | 17.86 | 2.93 | 303 | 3046 | -12.53% |
| 91 | 50 | 0.1 | 19.03 | 3623.80 | 0.34 | 18.19 | 3.12 | 351 | 2957 | -4.42% |
| 92 | 50 | 0.1 | 18.65 | 3623.15 | 0.82 | 18.55 | 3.12 | 359 | 3172 | -0.52% |
| 93 | 50 | 0.1 | 18.55 | 3623.84 | 0.16 | 17.49 | 2.66 | 284 | 2813 | -5.67% |
| 94 | 50 | 0.1 | 45.44 | 4053.18 | 0.11 | 17.55 | 2.68 | 341 | 2762 | -61.37% |
| 95 | 50 | 0.1 | 17.85 | 3624.75 | 0.60 | 17.42 | 2.92 | 256 | 3078 | -2.40% |
| 96 | 50 | 0.1 | 20.26 | 3617.77 | 0.12 | 19.87 | 3.26 | 366 | 3458 | -1.93% |
| 97 | 50 | 0.1 | 18.27 | 3629.96 | 0.39 | 17.79 | 2.88 | 273 | 2901 | -2.65% |
| 98 | 50 | 0.1 | 19.68 | 3621.90 | 0.15 | 17.77 | 2.98 | 338 | 2938 | -9.70% |
| 99 | 50 | 0.1 | 18.36 | 3616.26 | 0.32 | 18.24 | 3.23 | 300 | 3159 | -0.67% |
| 100 | 50 | 0.1 | 18.50 | 3609.72 | 0.39 | 18.45 | 3.54 | 353 | 3153 | -0.28% |
| 101 | 50 | 0.5 | 86.74 | 3605.90 | 0.16 | 43.23 | 42.85 | 1669 | 14604 | -50.17% |
| 102 | 50 | 0.5 | 47.64 | 3621.85 | 0.11 | 46.81 | 48.62 | 1734 | 15285 | -1.73% |
| 103 | 50 | 0.5 | 45.88 | 3620.20 | 0.79 | 44.65 | 50.93 | 1658 | 15391 | -2.69% |
| 104 | 50 | 0.5 | 46.64 | 3627.14 | 0.19 | 45.52 | 51.05 | 1685 | 14733 | -2.39% |
| 105 | 50 | 0.5 | 43.32 | 3669.47 | 0.08 | 42.53 | 43.14 | 1554 | 14308 | -1.84% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 106 | 50 | 0.5 | 45.20 | 3642.91 | 0.23 | 43.38 | 49.40 | 1659 | 14426 | -4.02% |
| 107 | 50 | 0.5 | 45.70 | 3668.60 | 0.14 | 44.98 | 46.40 | 1571 | 15283 | -1.57% |
| 108 | 50 | 0.5 | 90.17 | 4052.75 | 0.30 | 44.63 | 49.04 | 1613 | 15192 | -50.51% |
| 109 | 50 | 0.5 | 44.40 | 3645.66 | 0.32 | 44.13 | 48.50 | 1593 | 14548 | -0.60% |
| 110 | 50 | 0.5 | 47.42 | 3650.40 | 0.23 | 45.99 | 50.39 | 1562 | 15334 | -3.01% |
| 111 | 50 | 0.5 | 84.82 | 3623.50 | 0.19 | 43.27 | 40.26 | 1552 | 14281 | -48.98% |
| 112 | 50 | 0.5 | 85.78 | 3619.58 | 0.19 | 43.43 | 39.09 | 1494 | 14417 | -49.37% |
| 113 | 50 | 0.5 | 45.01 | 3644.29 | 0.20 | 44.62 | 51.34 | 1682 | 15301 | -0.87% |
| 114 | 50 | 0.5 | 45.57 | 3643.95 | 0.10 | 44.30 | 45.08 | 1469 | 14465 | -2.78% |
| 115 | 50 | 0.5 | 45.56 | 3643.58 | 0.81 | 45.46 | 49.48 | 1617 | 15460 | -0.23% |
| 116 | 50 | 0.5 | 45.79 | 3648.49 | 0.28 | 45.45 | 42.72 | 1577 | 14911 | -0.75% |
| 117 | 50 | 0.5 | 47.67 | 3647.74 | 0.31 | 45.94 | 55.58 | 1726 | 15442 | -3.62% |
| 118 | 50 | 0.5 | 88.20 | 4029.41 | 0.07 | 44.83 | 31.14 | 1646 | 15151 | -49.17% |
| 119 | 50 | 0.5 | 91.36 | 3624.77 | 0.14 | 43.88 | 44.80 | 1680 | 14991 | -51.97% |
| 120 | 50 | 0.5 | 42.78 | 3644.03 | 0.49 | 42.74 | 33.05 | 1499 | 14315 | -0.09% |
| 121 | 50 | 0.5 | 47.21 | 3627.63 | 0.18 | 46.11 | 50.81 | 1692 | 15526 | -2.33% |
| 122 | 50 | 0.5 | 44.76 | 3646.86 | 0.24 | 43.43 | 48.50 | 1662 | 14858 | -2.97% |
| 123 | 50 | 0.5 | 46.88 | 3638.27 | 0.25 | 46.27 | 48.93 | 1747 | 15616 | -1.31% |
| 124 | 50 | 0.5 | 44.99 | 3626.09 | 0.23 | 44.14 | 41.50 | 1600 | 14673 | -1.88% |
| 125 | 50 | 0.5 | 45.32 | 3619.02 | 0.33 | 43.25 | 45.06 | 1583 | 14459 | -4.57% |
| 126 | 50 | 2.0 | 87.01 | 3660.80 | 0.29 | 86.74 | 467.25 | 5297 | 48444 | -0.31% |
| 127 | 50 | 2.0 | 91.65 | 3742.81 | 0.08 | 91.03 | 529.30 | 5427 | 50727 | -0.67% |
| 128 | 50 | 2.0 | 87.17 | 3720.23 | 0.59 | 86.87 | 509.46 | 5365 | 48351 | -0.35% |
| 129 | 50 | 2.0 | 91.65 | 3806.36 | 0.26 | 90.24 | 594.20 | 5696 | 50038 | -1.54% |
| 130 | 50 | 2.0 | 83.80 | 4124.58 | 0.12 | 83.27 | 511.49 | 5084 | 46301 | -0.63% |
| 131 | 50 | 2.0 | 86.06 | 3846.18 | 0.16 | 84.55 | 520.72 | 5485 | 47993 | -1.76% |
| 132 | 50 | 2.0 | 88.91 | 3797.90 | 0.24 | 87.98 | 513.15 | 5471 | 49469 | -1.05% |
| 133 | 50 | 2.0 | 90.59 | 3650.09 | 0.19 | 90.17 | 524.14 | 5580 | 50026 | -0.46% |
| 134 | 50 | 2.0 | 85.03 | 4005.65 | 0.45 | 83.23 | 445.01 | 5138 | 45303 | -2.11% |
| 135 | 50 | 2.0 | 95.12 | 4096.08 | 0.06 | 94.21 | 537.40 | 5846 | 52312 | -0.96% |
| 136 | 50 | 2.0 | 85.27 | 3645.09 | 0.39 | 84.82 | 442.56 | 5183 | 46294 | -0.53% |
| 137 | 50 | 2.0 | 84.52 | 3648.72 | 0.22 | 83.79 | 503.76 | 5558 | 47304 | -0.86% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 138 | 50 | 2.0 | 91.58 | 4044.07 | 0.20 | 89.42 | 630.55 | 5716 | 50405 | -2.36% |
| 139 | 50 | 2.0 | 87.06 | 3948.95 | 0.03 | 86.39 | 474.36 | 5454 | 48125 | -0.77% |
| 140 | 50 | 2.0 | 90.40 | 4036.42 | 0.91 | 89.53 | 384.71 | 5358 | 49856 | -0.96% |
| 141 | 50 | 2.0 | 89.46 | 4012.63 | 0.31 | 87.53 | 471.20 | 6497 | 51278 | -2.16% |
| 142 | 50 | 2.0 | 89.92 | 4056.53 | 0.01 | 89.14 | 489.28 | 5439 | 49613 | -0.87% |
| 143 | 50 | 2.0 | 88.56 | 3652.33 | 0.15 | 87.89 | 462.27 | 5050 | 48560 | -0.76% |
| 144 | 50 | 2.0 | 92.10 | 3645.63 | 0.14 | 91.13 | 578.47 | 5806 | 51126 | -1.05% |
| 145 | 50 | 2.0 | 83.56 | 3980.05 | 0.51 | 83.24 | 430.14 | 5078 | 46211 | -0.38% |
| 146 | 50 | 2.0 | 92.39 | 3784.06 | 0.28 | 92.02 | 576.61 | 5781 | 52166 | -0.40% |
| 147 | 50 | 2.0 | 88.73 | 3818.03 | 0.40 | 87.20 | 556.91 | 5575 | 48379 | -1.73% |
| 148 | 50 | 2.0 | 94.38 | 3947.41 | 0.22 | 93.87 | 624.30 | 5734 | 52547 | -0.54% |
| 149 | 50 | 2.0 | 88.13 | 3772.46 | 0.32 | 88.05 | 514.46 | 5370 | 48483 | -0.10% |
| 150 | 50 | 2.0 | 85.12 | 3707.72 | 0.46 | 85.07 | 538.39 | 5207 | 47582 | -0.07% |
| 151 | 75 | 0.1 | 17.45 | 3606.90 | 0.20 | 17.04 | 4.25 | 294 | 2794 | -2.35% |
| 152 | 75 | 0.1 | 45.69 | 4018.50 | 0.18 | 17.41 | 5.56 | 335 | 3049 | -61.90% |
| 153 | 75 | 0.1 | 19.72 | 3606.20 | 0.19 | 18.74 | 6.36 | 380 | 3088 | -4.99% |
| 154 | 75 | 0.1 | 19.56 | 3615.41 | 0.19 | 18.35 | 5.46 | 397 | 3116 | -6.20% |
| 155 | 75 | 0.1 | 44.14 | 3712.40 | 0.08 | 17.67 | 4.91 | 374 | 2985 | -59.96% |
| 156 | 75 | 0.1 | 18.37 | 3615.45 | 0.47 | 17.60 | 4.52 | 331 | 3011 | -4.22% |
| 157 | 75 | 0.1 | 45.66 | 3732.92 | 0.23 | 17.57 | 4.47 | 306 | 2998 | -61.52% |
| 158 | 75 | 0.1 | 17.44 | 3615.57 | 0.14 | 17.35 | 4.22 | 294 | 2877 | -0.53% |
| 159 | 75 | 0.1 | 17.88 | 3616.11 | 0.23 | 17.85 | 5.68 | 311 | 2960 | -0.18% |
| 160 | 75 | 0.1 | 19.33 | 3613.54 | 0.18 | 18.49 | 5.30 | 353 | 3132 | -4.34% |
| 161 | 75 | 0.1 | 19.23 | 3616.25 | 0.07 | 18.71 | 4.81 | 375 | 3158 | -2.73% |
| 162 | 75 | 0.1 | 17.99 | 3610.60 | 0.08 | 17.74 | 4.76 | 355 | 2976 | -1.41% |
| 163 | 75 | 0.1 | 17.61 | 3605.80 | 0.47 | 17.41 | 4.17 | 336 | 2884 | -1.16% |
| 164 | 75 | 0.1 | 44.57 | 3978.80 | 0.25 | 18.26 | 5.15 | 323 | 3047 | -59.03% |
| 165 | 75 | 0.1 | 43.72 | 3723.88 | 0.20 | 18.58 | 4.82 | 341 | 3154 | -57.49% |
| 166 | 75 | 0.1 | 19.11 | 3615.68 | 0.13 | 18.24 | 4.64 | 311 | 3139 | -4.58% |
| 167 | 75 | 0.1 | 18.95 | 3614.89 | 0.25 | 18.62 | 5.42 | 373 | 3201 | -1.73% |
| 168 | 75 | 0.1 | 17.76 | 3615.71 | 0.17 | 17.48 | 4.23 | 271 | 2819 | -1.58% |
| 169 | 75 | 0.1 | 45.85 | 3754.21 | 0.22 | 18.10 | 5.00 | 406 | 3297 | -60.51% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 170 | 75 | 0.1 | 18.61 | 3615.36 | 0.17 | 18.13 | 4.45 | 334 | 3152 | -2.58% |
| 171 | 75 | 0.1 | 45.02 | 3738.69 | 0.27 | 18.05 | 4.51 | 307 | 3110 | -59.89% |
| 172 | 75 | 0.1 | 18.47 | 3615.15 | 0.23 | 18.28 | 4.41 | 334 | 3048 | -1.00% |
| 173 | 75 | 0.1 | 19.01 | 3614.02 | 0.09 | 17.19 | 4.48 | 354 | 2923 | -9.57% |
| 174 | 75 | 0.1 | 17.64 | 3616.30 | 0.13 | 16.16 | 4.59 | 316 | 2704 | -8.38% |
| 175 | 75 | 0.1 | 19.72 | 3623.43 | 0.11 | 18.91 | 5.14 | 371 | 3167 | -4.12% |
| 176 | 75 | 0.5 | 44.83 | 3665.10 | 0.19 | 44.75 | 54.99 | 1627 | 14736 | -0.18% |
| 177 | 75 | 0.5 | 92.00 | 3605.70 | 0.17 | 45.69 | 62.44 | 1577 | 15288 | -50.34% |
| 178 | 75 | 0.5 | 46.82 | 3670.30 | 0.19 | 46.37 | 68.38 | 1776 | 15481 | -0.95% |
| 179 | 75 | 0.5 | 44.93 | 3625.83 | 0.18 | 44.58 | 61.73 | 1656 | 14746 | -0.79% |
| 180 | 75 | 0.5 | 44.80 | 3607.30 | 0.18 | 44.09 | 57.76 | 1666 | 14869 | -1.58% |
| 181 | 75 | 0.5 | 46.41 | 3626.65 | 0.34 | 45.21 | 61.31 | 1567 | 15200 | -2.58% |
| 182 | 75 | 0.5 | 89.22 | 3614.02 | 0.22 | 45.65 | 58.86 | 1652 | 15037 | -48.84% |
| 183 | 75 | 0.5 | 44.47 | 3626.84 | 0.18 | 43.54 | 57.13 | 1615 | 14205 | -2.09% |
| 184 | 75 | 0.5 | 44.67 | 3626.06 | 0.18 | 44.58 | 54.03 | 1634 | 15094 | -0.21% |
| 185 | 75 | 0.5 | 46.08 | 3624.66 | 0.03 | 44.32 | 48.95 | 1679 | 14916 | -3.82% |
| 186 | 75 | 0.5 | 46.81 | 3626.13 | 0.12 | 45.64 | 58.39 | 1635 | 15487 | -2.49% |
| 187 | 75 | 0.5 | 45.90 | 3631.30 | 0.09 | 45.22 | 44.34 | 1716 | 14954 | -1.49% |
| 188 | 75 | 0.5 | 43.65 | 3620.10 | 0.26 | 43.31 | 53.88 | 1552 | 14755 | -0.77% |
| 189 | 75 | 0.5 | 88.24 | 3609.70 | 0.23 | 44.57 | 63.34 | 1683 | 14772 | -49.49% |
| 190 | 75 | 0.5 | 87.26 | 3615.09 | 0.20 | 43.72 | 46.02 | 1691 | 14710 | -49.90% |
| 191 | 75 | 0.5 | 45.75 | 3625.98 | 0.16 | 45.14 | 51.72 | 1606 | 15116 | -1.33% |
| 192 | 75 | 0.5 | 89.09 | 3729.23 | 0.17 | 45.86 | 52.47 | 1615 | 15348 | -48.52% |
| 193 | 75 | 0.5 | 44.46 | 3625.73 | 0.16 | 44.32 | 53.39 | 1643 | 14640 | -0.32% |
| 194 | 75 | 0.5 | 89.36 | 3616.54 | 0.23 | 45.85 | 66.99 | 1812 | 15773 | -48.70% |
| 195 | 75 | 0.5 | 45.49 | 3626.31 | 0.14 | 45.29 | 57.18 | 1605 | 15048 | -0.44% |
| 196 | 75 | 0.5 | 88.76 | 3615.08 | 0.88 | 45.02 | 46.54 | 1526 | 14854 | -49.28% |
| 197 | 75 | 0.5 | 44.53 | 3624.52 | 0.15 | 44.29 | 40.32 | 1643 | 14621 | -0.52% |
| 198 | 75 | 0.5 | 46.75 | 3624.74 | 0.08 | 45.83 | 53.43 | 1758 | 15295 | -1.97% |
| 199 | 75 | 0.5 | 84.86 | 3721.12 | 0.07 | 43.45 | 47.45 | 1520 | 14662 | -48.80% |
| 200 | 75 | 0.5 | 47.34 | 3633.66 | 0.10 | 46.90 | 64.89 | 1717 | 15806 | -0.92% |
| 201 | 75 | 2.0 | 87.45 | 3809.00 | 0.35 | 86.82 | 493.50 | 5275 | 47741 | -0.72% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 202 | 75 | 2.0 | 92.65 | 3645.50 | 0.17 | 91.84 | 641.25 | 5427 | 52552 | -0.88% |
| 203 | 75 | 2.0 | 90.81 | 4060.70 | 0.16 | 90.20 | 684.60 | 5702 | 50871 | -0.67% |
| 204 | 75 | 2.0 | 87.51 | 3728.00 | 0.19 | 86.91 | 537.13 | 5315 | 47441 | -0.68% |
| 205 | 75 | 2.0 | 87.92 | 4086.60 | 0.13 | 87.44 | 583.15 | 5642 | 49670 | -0.54% |
| 206 | 75 | 2.0 | 88.70 | 3728.05 | 0.19 | 88.19 | 563.32 | 5686 | 49278 | -0.57% |
| 207 | 75 | 2.0 | 88.70 | 3626.84 | 0.20 | 87.97 | 539.24 | 5293 | 50037 | -0.83% |
| 208 | 75 | 2.0 | 86.34 | 3748.83 | 0.14 | 84.95 | 593.23 | 5228 | 47321 | -1.61% |
| 209 | 75 | 2.0 | 86.80 | 3737.31 | 0.32 | 85.22 | 600.64 | 5107 | 48074 | -1.82% |
| 210 | 75 | 2.0 | 88.66 | 3731.27 | 0.18 | 87.59 | 636.23 | 5337 | 49343 | -1.21% |
| 211 | 75 | 2.0 | 91.79 | 3742.84 | 0.09 | 91.17 | 690.30 | 5732 | 52049 | -0.67% |
| 212 | 75 | 2.0 | 90.28 | 4104.80 | 0.27 | 89.15 | 745.33 | 6322 | 50721 | -1.26% |
| 213 | 75 | 2.0 | 86.92 | 4364.50 | 0.25 | 85.50 | 568.64 | 5113 | 48856 | -1.63% |
| 214 | 75 | 2.0 | 86.89 | 3742.80 | 0.07 | 86.13 | 557.31 | 5721 | 49494 | -0.88% |
| 215 | 75 | 2.0 | 87.42 | 3624.47 | 0.15 | 87.26 | 602.41 | 5501 | 49551 | -0.18% |
| 216 | 75 | 2.0 | 88.08 | 3735.99 | 0.18 | 87.96 | 564.57 | 5321 | 48373 | -0.14% |
| 217 | 75 | 2.0 | 89.27 | 3625.88 | 0.34 | 88.39 | 664.75 | 5652 | 48873 | -0.98% |
| 218 | 75 | 2.0 | 88.59 | 3737.52 | 0.33 | 86.43 | 607.93 | 5350 | 48388 | -2.43% |
| 219 | 75 | 2.0 | 89.95 | 3629.29 | 0.13 | 89.36 | 267.64 | 5639 | 50191 | -0.65% |
| 220 | 75 | 2.0 | 91.06 | 3743.85 | 0.16 | 89.23 | 637.18 | 5433 | 49317 | -2.01% |
| 221 | 75 | 2.0 | 86.96 | 3625.73 | 0.16 | 86.04 | 552.72 | 5360 | 49796 | -1.05% |
| 222 | 75 | 2.0 | 87.73 | 3732.00 | 0.24 | 86.35 | 586.00 | 5441 | 48935 | -1.57% |
| 223 | 75 | 2.0 | 91.55 | 3740.45 | 0.10 | 90.16 | 594.08 | 5788 | 50870 | -1.52% |
| 224 | 75 | 2.0 | 83.79 | 3626.57 | 0.17 | 82.98 | 558.92 | 5171 | 47061 | -0.97% |
| 225 | 75 | 2.0 | 93.15 | 3783.96 | 0.21 | 92.25 | 777.65 | 5700 | 51659 | -0.97% |
| 226 | 100 | 0.1 | 90.65 | 3622.20 | 0.10 | 18.48 | 6.32 | 350 | 3127 | -79.62% |
| 227 | 100 | 0.1 | 18.69 | 3693.47 | 0.10 | 17.20 | 5.67 | 323 | 2900 | -7.96% |
| 228 | 100 | 0.1 | 44.94 | 4177.40 | 0.11 | 18.19 | 5.18 | 339 | 3050 | -59.52% |
| 229 | 100 | 0.1 | 19.35 | 3692.54 | 0.15 | 17.23 | 5.26 | 333 | 2878 | -10.95% |
| 230 | 100 | 0.1 | 18.88 | 3701.43 | 0.12 | 16.87 | 5.69 | 331 | 2963 | -10.64% |
| 231 | 100 | 0.1 | 18.82 | 3689.92 | 0.04 | 17.97 | 5.34 | 322 | 2941 | -4.53% |
| 232 | 100 | 0.1 | 18.32 | 3693.98 | 0.76 | 17.69 | 5.86 | 345 | 3025 | -3.41% |
| 233 | 100 | 0.1 | 44.33 | 4284.02 | 0.54 | 17.31 | 5.84 | 357 | 3021 | -60.96% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD$^{(a)}$ | T(s) | D-RPD | V-RPD$^{(b)}$ | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 234 | 100 | 0.1 | 45.60 | 4308.74 | 0.12 | 18.43 | 5.30 | 336 | 3010 | -59.58% |
| 235 | 100 | 0.1 | 44.88 | 3736.23 | 0.31 | 18.11 | 5.49 | 388 | 3234 | -59.65% |
| 236 | 100 | 0.1 | 19.05 | 3605.10 | 0.15 | 17.84 | 5.14 | 319 | 3001 | -6.38% |
| 237 | 100 | 0.1 | 86.94 | 3740.43 | 0.09 | 17.34 | 5.83 | 291 | 2869 | -80.05% |
| 238 | 100 | 0.1 | 90.94 | 3674.20 | 0.18 | 19.29 | 6.13 | 391 | 3295 | -78.79% |
| 239 | 100 | 0.1 | 18.93 | 3685.80 | 0.09 | 18.35 | 5.44 | 375 | 3182 | -3.06% |
| 240 | 100 | 0.1 | 88.22 | 3676.80 | 0.10 | 17.96 | 5.15 | 295 | 2971 | -79.64% |
| 241 | 100 | 0.1 | 46.09 | 4425.62 | 0.06 | 17.93 | 5.12 | 311 | 3056 | -61.10% |
| 242 | 100 | 0.1 | 45.50 | 4317.80 | 0.16 | 18.60 | 5.67 | 362 | 3168 | -59.12% |
| 243 | 100 | 0.1 | 19.10 | 3691.62 | 0.16 | 18.12 | 5.12 | 259 | 2880 | -5.08% |
| 244 | 100 | 0.1 | 18.47 | 3608.00 | 0.13 | 18.00 | 5.55 | 354 | 3068 | -2.57% |
| 245 | 100 | 0.1 | 20.51 | 3694.13 | 0.05 | 17.59 | 5.10 | 257 | 3022 | -14.22% |
| 246 | 100 | 0.1 | 18.60 | 3611.20 | 0.05 | 18.04 | 4.93 | 332 | 2937 | -3.01% |
| 247 | 100 | 0.1 | 18.34 | 3615.60 | 0.09 | 17.09 | 5.39 | 332 | 2944 | -6.82% |
| 248 | 100 | 0.1 | 19.88 | 3608.94 | 0.62 | 17.83 | 5.77 | 303 | 3041 | -10.31% |
| 249 | 100 | 0.1 | 17.88 | 3611.90 | 0.70 | 16.83 | 4.88 | 340 | 2923 | -5.91% |
| 250 | 100 | 0.1 | 19.12 | 3615.60 | 0.16 | 17.93 | 5.56 | 333 | 3087 | -6.20% |
| 251 | 100 | 0.5 | 47.23 | 4379.00 | 0.09 | 46.39 | 58.58 | 1765 | 15681 | -1.78% |
| 252 | 100 | 0.5 | 45.52 | 3736.54 | 0.07 | 44.50 | 59.18 | 1763 | 14886 | -2.25% |
| 253 | 100 | 0.5 | 88.27 | 3611.10 | 0.15 | 44.94 | 53.09 | 1608 | 14893 | -49.09% |
| 254 | 100 | 0.5 | 44.83 | 3729.63 | 0.08 | 44.56 | 52.29 | 1735 | 15014 | -0.59% |
| 255 | 100 | 0.5 | 44.85 | 3744.79 | 0.08 | 44.71 | 55.18 | 1670 | 14804 | -0.30% |
| 256 | 100 | 0.5 | 45.28 | 3729.32 | 0.08 | 45.21 | 54.01 | 1623 | 14869 | -0.16% |
| 257 | 100 | 0.5 | 46.39 | 3732.47 | 0.66 | 45.47 | 60.09 | 1758 | 15342 | -1.98% |
| 258 | 100 | 0.5 | 86.08 | 3691.56 | 0.60 | 44.33 | 58.59 | 1720 | 15018 | -48.51% |
| 259 | 100 | 0.5 | 88.88 | 3689.87 | 0.23 | 45.60 | 61.45 | 1772 | 15068 | -48.70% |
| 260 | 100 | 0.5 | 45.01 | 3688.63 | 0.23 | 44.37 | 58.52 | 1733 | 14892 | -1.43% |
| 261 | 100 | 0.5 | 47.58 | 3722.30 | 0.17 | 47.43 | 78.49 | 1874 | 16123 | -0.30% |
| 262 | 100 | 0.5 | 44.80 | 4303.91 | 0.77 | 44.23 | 56.92 | 1570 | 14549 | -1.29% |
| 263 | 100 | 0.5 | 46.50 | 4234.90 | 0.15 | 46.13 | 65.98 | 1658 | 15541 | -0.80% |
| 264 | 100 | 0.5 | 45.97 | 3736.39 | 0.11 | 45.52 | 58.72 | 1778 | 15356 | -0.98% |
| 265 | 100 | 0.5 | 44.55 | 3868.80 | 0.04 | 44.54 | 52.73 | 1635 | 14971 | -0.03% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD[(a)] | T(s) | D-RPD | V-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 266 | 100 | 0.5 | 91.96 | 3693.67 | 0.09 | 46.09 | 68.99 | 1757 | 15372 | -49.88% |
| 267 | 100 | 0.5 | 87.60 | 3611.00 | 0.10 | 45.38 | 65.52 | 1639 | 15211 | -48.19% |
| 268 | 100 | 0.5 | 46.56 | 3738.43 | 0.11 | 46.25 | 57.99 | 1765 | 15484 | -0.68% |
| 269 | 100 | 0.5 | 46.05 | 3725.90 | 0.28 | 45.40 | 60.09 | 1635 | 15331 | -1.43% |
| 270 | 100 | 0.5 | 46.69 | 3742.27 | 0.15 | 46.47 | 67.73 | 1618 | 15520 | -0.46% |
| 271 | 100 | 0.5 | 46.32 | 3646.30 | 0.12 | 46.05 | 61.03 | 1660 | 15143 | -0.58% |
| 272 | 100 | 0.5 | 86.65 | 11024.40 | 0.11 | 44.71 | 53.53 | 1735 | 15087 | -48.40% |
| 273 | 100 | 0.5 | 47.34 | 3637.80 | 0.54 | 46.35 | 64.97 | 1684 | 15502 | -2.10% |
| 274 | 100 | 0.5 | 44.80 | 3653.90 | 0.34 | 44.72 | 61.16 | 1573 | 14788 | -0.20% |
| 275 | 100 | 0.5 | 45.38 | 3660.50 | 0.06 | 45.10 | 57.20 | 1679 | 15074 | -0.62% |
| 276 | 100 | 2.0 | 90.73 | 3604.00 | 0.06 | 90.65 | 615.36 | 5613 | 50446 | -0.09% |
| 277 | 100 | 2.0 | 87.83 | 4350.05 | 0.18 | 86.81 | 582.74 | 5302 | 48753 | -1.17% |
| 278 | 100 | 2.0 | 86.85 | 3742.40 | 0.16 | 85.99 | 551.26 | 5563 | 48764 | -0.99% |
| 279 | 100 | 2.0 | 87.62 | 4314.04 | 0.25 | 87.60 | 569.99 | 5507 | 49812 | -0.02% |
| 280 | 100 | 2.0 | 85.71 | 4289.95 | 0.00 | 84.66 | 508.94 | 5391 | 48027 | -1.23% |
| 281 | 100 | 2.0 | 87.40 | 4312.90 | 0.21 | 86.99 | 622.38 | 5357 | 48299 | -0.46% |
| 282 | 100 | 2.0 | 88.23 | 4339.81 | 0.60 | 88.10 | 625.62 | 5433 | 49473 | -0.15% |
| 283 | 100 | 2.0 | 86.37 | 3736.75 | 0.71 | 86.08 | 606.90 | 5612 | 48571 | -0.33% |
| 284 | 100 | 2.0 | 88.60 | 3737.38 | 0.17 | 87.78 | 593.95 | 5317 | 49467 | -0.92% |
| 285 | 100 | 2.0 | 86.99 | 4302.11 | 0.24 | 85.63 | 501.07 | 5438 | 47315 | -1.56% |
| 286 | 100 | 2.0 | 94.17 | 3803.20 | 0.17 | 93.96 | 766.93 | 6009 | 53910 | -0.23% |
| 287 | 100 | 2.0 | 87.72 | 3689.67 | 0.70 | 86.85 | 596.05 | 5192 | 48768 | -1.00% |
| 288 | 100 | 2.0 | 88.85 | 3609.40 | 0.12 | 87.97 | 656.32 | 5496 | 51275 | -0.98% |
| 289 | 100 | 2.0 | 86.22 | 4323.21 | 0.03 | 86.17 | 637.78 | 5330 | 50215 | -0.06% |
| 290 | 100 | 2.0 | 87.37 | 3609.30 | 0.16 | 86.67 | 550.98 | 5675 | 49571 | -0.80% |
| 291 | 100 | 2.0 | 90.88 | 3738.96 | 0.06 | 89.91 | 663.24 | 5725 | 51255 | -1.07% |
| 292 | 100 | 2.0 | 88.41 | 3668.60 | 0.09 | 87.51 | 550.66 | 5392 | 48894 | -1.02% |
| 293 | 100 | 2.0 | 88.36 | 4351.22 | 0.01 | 88.14 | 637.28 | 5710 | 49713 | -0.25% |
| 294 | 100 | 2.0 | 89.09 | 3835.40 | 0.23 | 88.81 | 549.72 | 5808 | 49672 | -0.30% |
| 295 | 100 | 2.0 | 89.51 | 4349.52 | 0.15 | 89.03 | 623.46 | 5672 | 50799 | -0.53% |
| 296 | 100 | 2.0 | 90.64 | 4244.40 | 0.13 | 88.68 | 609.56 | 5563 | 50656 | -2.17% |
| 297 | 100 | 2.0 | 85.81 | 3632.40 | 0.28 | 85.04 | 485.82 | 5460 | 48133 | -0.91% |

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Table 2: Result of SimExact X SimSA-VaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-VaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | V-RPD$^{(a)}$ | T(s) | D-RPD | V-RPD$^{(b)}$ | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 298 | 100 | 2.0 | 91.67 | 4134.42 | 0.72 | 89.29 | 573.78 | 5923 | 51503 | -2.59% |
| 299 | 100 | 2.0 | 86.44 | 11021.80 | 0.30 | 85.24 | 507.14 | 5303 | 48295 | -1.39% |
| 300 | 100 | 2.0 | 85.14 | 4045.80 | 0.66 | 84.85 | 580.48 | 5430 | 47682 | -0.34% |

## 3. SimSA-CVaR X SimExact

Table 3: Result of SimExact x `SimSA-CVaR`

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD$^{(a)}$ | T(s) | D-RPD | C-RPD$^{(b)}$ | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 1 | 25 | 0.1 | 19.10 | 200.30 | 0.44 | 18.09 | 8.06 | 356 | 3307 | -5.29% |
| 2 | 25 | 0.1 | 21.31 | 187.00 | 1.04 | 18.03 | 2.60 | 337 | 3014 | -15.42% |
| 3 | 25 | 0.1 | 22.17 | 134.10 | 0.20 | 20.62 | 2.45 | 411 | 3699 | -6.98% |
| 4 | 25 | 0.1 | 21.27 | 374.80 | 0.60 | 20.32 | 1.92 | 346 | 3245 | -4.46% |
| 5 | 25 | 0.1 | 18.90 | 265.40 | 0.64 | 18.56 | 2.30 | 363 | 3038 | -1.83% |
| 6 | 25 | 0.1 | 20.96 | 228.40 | 0.50 | 19.55 | 2.26 | 354 | 3304 | -6.73% |
| 7 | 25 | 0.1 | 21.85 | 3604.91 | 0.23 | 16.53 | 1.75 | 314 | 2905 | -24.37% |
| 8 | 25 | 0.1 | 20.94 | 381.00 | 0.29 | 18.74 | 1.81 | 292 | 3041 | -10.52% |
| 9 | 25 | 0.1 | 19.47 | 346.40 | 0.35 | 17.92 | 2.13 | 379 | 3034 | -7.97% |
| 10 | 25 | 0.1 | 21.68 | 265.20 | 0.54 | 20.36 | 2.39 | 372 | 3268 | -6.09% |
| 11 | 25 | 0.1 | 22.92 | 366.60 | 0.44 | 18.26 | 2.24 | 345 | 3139 | -20.32% |
| 12 | 25 | 0.1 | 22.92 | 168.70 | 0.36 | 17.29 | 1.84 | 342 | 2969 | -24.55% |
| 13 | 25 | 0.1 | 19.68 | 285.30 | 0.94 | 16.99 | 1.62 | 286 | 2683 | -13.64% |
| 14 | 25 | 0.1 | 20.79 | 342.60 | 0.34 | 19.88 | 2.93 | 357 | 3261 | -4.35% |
| 15 | 25 | 0.1 | 17.96 | 257.20 | 0.81 | 17.81 | 1.93 | 332 | 2935 | -0.85% |
| 16 | 25 | 0.1 | 22.03 | 391.40 | 0.37 | 18.26 | 2.57 | 348 | 2874 | -17.10% |
| 17 | 25 | 0.1 | 23.30 | 243.80 | 0.47 | 18.14 | 1.71 | 341 | 2968 | -22.14% |
| 18 | 25 | 0.1 | 19.57 | 218.00 | 0.36 | 18.07 | 3.20 | 411 | 3425 | -7.64% |
| 19 | 25 | 0.1 | 46.89 | 638.00 | 0.17 | 18.06 | 2.23 | 374 | 3106 | -61.49% |
| 20 | 25 | 0.1 | 18.74 | 368.10 | 0.32 | 17.88 | 2.68 | 338 | 2980 | -4.60% |
| 21 | 25 | 0.1 | 18.03 | 3607.43 | 0.59 | 17.37 | 2.41 | 332 | 2945 | -3.67% |
| 22 | 25 | 0.1 | 53.88 | 1070.50 | 0.36 | 21.32 | 3.26 | 394 | 3513 | -60.43% |
| 23 | 25 | 0.1 | 19.78 | 318.30 | 0.59 | 16.43 | 2.45 | 311 | 2940 | -16.96% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD[(a)] | T(s) | D-RPD | C-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 24 | 25 | 0.1 | 21.06 | 194.20 | 0.47 | 17.69 | 1.99 | 300 | 2928 | -16.00% |
| 25 | 25 | 0.1 | 19.30 | 359.70 | 0.81 | 17.23 | 2.46 | 347 | 2880 | -10.74% |
| 26 | 25 | 0.5 | 44.11 | 342.30 | 1.07 | 42.51 | 27.81 | 1576 | 13729 | -3.63% |
| 27 | 25 | 0.5 | 50.24 | 214.00 | 0.78 | 45.76 | 40.74 | 1739 | 15419 | -8.91% |
| 28 | 25 | 0.5 | 48.03 | 240.50 | 0.19 | 47.73 | 38.86 | 1805 | 16295 | -0.63% |
| 29 | 25 | 0.5 | 47.70 | 458.20 | 0.60 | 44.40 | 36.91 | 1693 | 14606 | -6.90% |
| 30 | 25 | 0.5 | 43.25 | 276.10 | 0.41 | 42.99 | 32.88 | 1519 | 14310 | -0.60% |
| 31 | 25 | 0.5 | 46.31 | 297.40 | 0.30 | 46.25 | 36.45 | 1747 | 15078 | -0.13% |
| 32 | 25 | 0.5 | 43.80 | 3617.21 | 0.17 | 41.04 | 27.67 | 1531 | 13618 | -6.30% |
| 33 | 25 | 0.5 | 48.01 | 460.90 | 1.20 | 44.86 | 40.77 | 1755 | 15768 | -6.55% |
| 34 | 25 | 0.5 | 45.77 | 432.30 | 0.73 | 42.41 | 39.75 | 1595 | 14212 | -7.35% |
| 35 | 25 | 0.5 | 49.53 | 400.40 | 1.02 | 46.38 | 42.55 | 1586 | 14919 | -6.35% |
| 36 | 25 | 0.5 | 45.54 | 450.80 | 0.47 | 43.93 | 40.23 | 1719 | 14973 | -3.54% |
| 37 | 25 | 0.5 | 47.01 | 266.10 | 0.47 | 44.66 | 17.29 | 1632 | 14992 | -5.00% |
| 38 | 25 | 0.5 | 45.63 | 291.30 | 0.65 | 44.75 | 33.20 | 1694 | 14730 | -1.93% |
| 39 | 25 | 0.5 | 53.83 | 432.00 | 1.26 | 52.67 | 76.09 | 2160 | 19321 | -2.16% |
| 40 | 25 | 0.5 | 45.28 | 325.90 | 0.00 | 43.42 | 32.65 | 1632 | 14822 | -4.09% |
| 41 | 25 | 0.5 | 49.58 | 467.20 | 0.24 | 49.48 | 46.62 | 1891 | 16830 | -0.20% |
| 42 | 25 | 0.5 | 48.01 | 309.70 | 0.93 | 44.91 | 39.77 | 1613 | 14430 | -6.47% |
| 43 | 25 | 0.5 | 46.57 | 252.40 | 0.29 | 45.79 | 41.26 | 1792 | 15340 | -1.67% |
| 44 | 25 | 0.5 | 90.73 | 243.20 | 0.25 | 45.24 | 39.49 | 1669 | 15602 | -50.13% |
| 45 | 25 | 0.5 | 42.22 | 380.20 | 0.47 | 41.49 | 37.17 | 1614 | 14052 | -1.74% |
| 46 | 25 | 0.5 | 44.07 | 3626.84 | 0.79 | 43.06 | 32.03 | 1625 | 13784 | -2.30% |
| 47 | 25 | 0.5 | 115.70 | 307.60 | 0.80 | 53.88 | 71.51 | 1954 | 18099 | -53.43% |
| 48 | 25 | 0.5 | 44.56 | 415.30 | 0.17 | 43.35 | 41.04 | 1605 | 14600 | -2.72% |
| 49 | 25 | 0.5 | 47.67 | 222.50 | 1.03 | 42.77 | 43.07 | 1508 | 14084 | -10.27% |
| 50 | 25 | 0.5 | 44.37 | 367.70 | 1.03 | 44.21 | 41.99 | 1596 | 14034 | -0.34% |
| 51 | 25 | 2.0 | 86.96 | 915.20 | 0.27 | 85.52 | 362.27 | 5081 | 46399 | -1.66% |
| 52 | 25 | 2.0 | 92.69 | 791.40 | 0.88 | 91.74 | 486.80 | 5711 | 51099 | -1.03% |
| 53 | 25 | 2.0 | 91.23 | 441.10 | 0.63 | 88.21 | 451.42 | 5411 | 49240 | -3.31% |
| 54 | 25 | 2.0 | 90.63 | 828.80 | 0.61 | 86.19 | 377.38 | 5332 | 46863 | -4.89% |
| 55 | 25 | 2.0 | 87.91 | 850.70 | 0.38 | 85.54 | 445.75 | 5234 | 46282 | -2.70% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD[(a)] | T(s) | D-RPD | C-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 56 | 25 | 2.0 | 90.33 | 974.90 | 0.71 | 89.76 | 454.33 | 5385 | 49253 | -0.63% |
| 57 | 25 | 2.0 | 84.74 | 3770.04 | 0.44 | 82.22 | 413.85 | 5047 | 45284 | -2.97% |
| 58 | 25 | 2.0 | 89.88 | 1099.90 | 1.65 | 88.21 | 491.79 | 5572 | 49611 | -1.85% |
| 59 | 25 | 2.0 | 85.94 | 777.40 | 0.43 | 85.88 | 409.47 | 5454 | 47773 | -0.07% |
| 60 | 25 | 2.0 | 89.82 | 751.20 | 0.89 | 89.38 | 405.55 | 5314 | 48055 | -0.49% |
| 61 | 25 | 2.0 | 88.05 | 630.90 | 0.35 | 86.31 | 420.67 | 5301 | 48334 | -1.98% |
| 62 | 25 | 2.0 | 89.08 | 904.60 | 0.90 | 87.77 | 459.10 | 5337 | 48127 | -1.47% |
| 63 | 25 | 2.0 | 89.73 | 584.70 | 1.08 | 89.12 | 389.23 | 5143 | 47567 | -0.68% |
| 64 | 25 | 2.0 | 116.19 | 616.70 | 1.03 | 111.71 | 1053.66 | 7789 | 68871 | -3.86% |
| 65 | 25 | 2.0 | 92.45 | 640.90 | 1.25 | 92.05 | 580.14 | 6042 | 52756 | -0.44% |
| 66 | 25 | 2.0 | 101.54 | 607.20 | 0.22 | 101.14 | 588.01 | 6359 | 58268 | -0.39% |
| 67 | 25 | 2.0 | 89.11 | 710.20 | 0.42 | 86.53 | 368.91 | 5390 | 47189 | -2.89% |
| 68 | 25 | 2.0 | 93.35 | 813.00 | 0.22 | 93.31 | 497.16 | 5637 | 51253 | -0.04% |
| 69 | 25 | 2.0 | 91.06 | 359.20 | 0.27 | 90.26 | 476.84 | 5436 | 49283 | -0.87% |
| 70 | 25 | 2.0 | 83.23 | 879.60 | 0.16 | 81.95 | 321.88 | 5087 | 45608 | -1.54% |
| 71 | 25 | 2.0 | 84.00 | 3844.08 | 0.64 | 82.06 | 288.66 | 4632 | 44784 | -2.31% |
| 72 | 25 | 2.0 | 115.91 | 405.10 | 0.14 | 114.59 | 965.39 | 7332 | 69347 | -1.14% |
| 73 | 25 | 2.0 | 87.78 | 882.40 | 0.39 | 85.99 | 488.24 | 5476 | 48375 | -2.05% |
| 74 | 25 | 2.0 | 88.16 | 937.60 | 0.63 | 87.10 | 463.23 | 5292 | 47667 | -1.20% |
| 75 | 25 | 2.0 | 84.55 | 765.90 | 0.56 | 84.49 | 426.70 | 5079 | 45848 | -0.07% |
| 76 | 50 | 0.1 | 44.53 | 4289.80 | 0.24 | 17.61 | 3.71 | 374 | 3035 | -60.47% |
| 77 | 50 | 0.1 | 19.28 | 3611.12 | 0.11 | 19.07 | 3.71 | 353 | 3371 | -1.08% |
| 78 | 50 | 0.1 | 19.71 | 3610.67 | 0.09 | 18.74 | 3.56 | 321 | 3381 | -4.93% |
| 79 | 50 | 0.1 | 20.50 | 3617.11 | 0.12 | 17.90 | 3.55 | 347 | 2965 | -12.73% |
| 80 | 50 | 0.1 | 17.69 | 3636.41 | 0.04 | 16.98 | 3.61 | 337 | 3056 | -4.03% |
| 81 | 50 | 0.1 | 19.86 | 3621.79 | 0.15 | 16.92 | 3.92 | 379 | 3023 | -14.80% |
| 82 | 50 | 0.1 | 18.19 | 3611.40 | 0.25 | 17.74 | 3.39 | 319 | 3121 | -2.46% |
| 83 | 50 | 0.1 | 18.29 | 3623.80 | 0.29 | 18.19 | 3.58 | 320 | 3184 | -0.56% |
| 84 | 50 | 0.1 | 18.18 | 3623.38 | 0.38 | 17.60 | 3.84 | 350 | 3083 | -3.20% |
| 85 | 50 | 0.1 | 20.39 | 3624.27 | 0.17 | 17.87 | 3.76 | 320 | 2939 | -12.32% |
| 86 | 50 | 0.1 | 43.27 | 3999.92 | 0.19 | 17.23 | 3.29 | 376 | 2881 | -60.17% |
| 87 | 50 | 0.1 | 43.43 | 3989.07 | 0.21 | 18.16 | 2.59 | 333 | 3065 | -58.17% |

Continued on the next page

Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD$^{(a)}$ | T(s) | D-RPD | C-RPD$^{(b)}$ | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 88 | 50 | 0.1 | 18.08 | 3623.76 | 0.12 | 17.95 | 3.12 | 340 | 3210 | -0.73% |
| 89 | 50 | 0.1 | 20.40 | 3619.14 | 0.05 | 17.67 | 2.98 | 331 | 2960 | -13.40% |
| 90 | 50 | 0.1 | 20.42 | 3622.31 | 0.78 | 17.86 | 2.93 | 303 | 3046 | -12.53% |
| 91 | 50 | 0.1 | 19.03 | 3623.80 | 0.34 | 18.19 | 3.12 | 351 | 2957 | -4.42% |
| 92 | 50 | 0.1 | 18.65 | 3623.15 | 0.82 | 18.55 | 3.12 | 359 | 3172 | -0.52% |
| 93 | 50 | 0.1 | 18.55 | 3623.84 | 0.16 | 17.49 | 2.66 | 284 | 2813 | -5.67% |
| 94 | 50 | 0.1 | 45.44 | 4053.18 | 0.11 | 17.55 | 2.68 | 341 | 2762 | -61.37% |
| 95 | 50 | 0.1 | 17.85 | 3624.75 | 0.60 | 17.42 | 2.92 | 256 | 3078 | -2.40% |
| 96 | 50 | 0.1 | 20.26 | 3617.77 | 0.12 | 19.87 | 3.26 | 366 | 3458 | -1.93% |
| 97 | 50 | 0.1 | 18.27 | 3629.96 | 0.39 | 17.79 | 2.88 | 273 | 2901 | -2.65% |
| 98 | 50 | 0.1 | 19.68 | 3621.90 | 0.15 | 17.77 | 2.98 | 338 | 2938 | -9.70% |
| 99 | 50 | 0.1 | 18.36 | 3616.26 | 0.32 | 18.24 | 3.23 | 300 | 3159 | -0.67% |
| 100 | 50 | 0.1 | 18.50 | 3609.72 | 0.39 | 18.45 | 3.54 | 353 | 3153 | -0.28% |
| 101 | 50 | 0.5 | 86.74 | 3605.90 | 0.16 | 43.23 | 42.85 | 1669 | 14604 | -50.17% |
| 102 | 50 | 0.5 | 47.64 | 3621.85 | 0.11 | 46.81 | 48.62 | 1734 | 15285 | -1.73% |
| 103 | 50 | 0.5 | 45.88 | 3620.20 | 0.79 | 44.65 | 50.93 | 1658 | 15391 | -2.69% |
| 104 | 50 | 0.5 | 46.64 | 3627.14 | 0.19 | 45.52 | 51.05 | 1685 | 14733 | -2.39% |
| 105 | 50 | 0.5 | 43.32 | 3669.47 | 0.08 | 42.53 | 43.14 | 1554 | 14308 | -1.84% |
| 106 | 50 | 0.5 | 45.20 | 3642.91 | 0.23 | 43.38 | 49.40 | 1659 | 14426 | -4.02% |
| 107 | 50 | 0.5 | 45.70 | 3668.60 | 0.14 | 44.98 | 46.40 | 1571 | 15283 | -1.57% |
| 108 | 50 | 0.5 | 90.17 | 4052.75 | 0.30 | 44.63 | 49.04 | 1613 | 15192 | -50.51% |
| 109 | 50 | 0.5 | 44.40 | 3645.66 | 0.32 | 44.13 | 48.50 | 1593 | 14548 | -0.60% |
| 110 | 50 | 0.5 | 47.42 | 3650.40 | 0.23 | 45.99 | 50.39 | 1562 | 15334 | -3.01% |
| 111 | 50 | 0.5 | 84.82 | 3623.50 | 0.19 | 43.27 | 40.26 | 1552 | 14281 | -48.98% |
| 112 | 50 | 0.5 | 85.78 | 3619.58 | 0.19 | 43.43 | 39.09 | 1494 | 14417 | -49.37% |
| 113 | 50 | 0.5 | 45.01 | 3644.29 | 0.20 | 44.62 | 51.34 | 1682 | 15301 | -0.87% |
| 114 | 50 | 0.5 | 45.57 | 3643.95 | 0.10 | 44.30 | 45.08 | 1469 | 14465 | -2.78% |
| 115 | 50 | 0.5 | 45.56 | 3643.58 | 0.81 | 45.46 | 49.48 | 1617 | 15460 | -0.23% |
| 116 | 50 | 0.5 | 45.79 | 3648.49 | 0.28 | 45.45 | 42.72 | 1577 | 14911 | -0.75% |
| 117 | 50 | 0.5 | 47.67 | 3647.74 | 0.31 | 45.94 | 55.58 | 1726 | 15442 | -3.62% |
| 118 | 50 | 0.5 | 88.20 | 4029.41 | 0.07 | 44.83 | 31.14 | 1646 | 15151 | -49.17% |
| 119 | 50 | 0.5 | 91.36 | 3624.77 | 0.14 | 43.88 | 44.80 | 1680 | 14991 | -51.97% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD[(a)] | T(s) | D-RPD | C-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 120 | 50 | 0.5 | 42.78 | 3644.03 | 0.49 | 42.74 | 33.05 | 1499 | 14315 | -0.09% |
| 121 | 50 | 0.5 | 47.21 | 3627.63 | 0.18 | 46.11 | 50.81 | 1692 | 15526 | -2.33% |
| 122 | 50 | 0.5 | 44.76 | 3646.86 | 0.24 | 43.43 | 48.50 | 1662 | 14858 | -2.97% |
| 123 | 50 | 0.5 | 46.88 | 3638.27 | 0.25 | 46.27 | 48.93 | 1747 | 15616 | -1.31% |
| 124 | 50 | 0.5 | 44.99 | 3626.09 | 0.23 | 44.14 | 41.50 | 1600 | 14673 | -1.88% |
| 125 | 50 | 0.5 | 45.32 | 3619.02 | 0.33 | 43.25 | 45.06 | 1583 | 14459 | -4.57% |
| 126 | 50 | 2.0 | 87.01 | 3660.80 | 0.29 | 86.74 | 467.25 | 5297 | 48444 | -0.31% |
| 127 | 50 | 2.0 | 91.65 | 3742.81 | 0.08 | 91.03 | 529.30 | 5427 | 50727 | -0.67% |
| 128 | 50 | 2.0 | 87.17 | 3720.23 | 0.59 | 86.87 | 509.46 | 5365 | 48351 | -0.35% |
| 129 | 50 | 2.0 | 91.65 | 3806.36 | 0.26 | 90.24 | 594.20 | 5696 | 50038 | -1.54% |
| 130 | 50 | 2.0 | 83.80 | 4124.58 | 0.12 | 83.27 | 511.49 | 5084 | 46301 | -0.63% |
| 131 | 50 | 2.0 | 86.06 | 3846.18 | 0.16 | 84.55 | 520.72 | 5485 | 47993 | -1.76% |
| 132 | 50 | 2.0 | 88.91 | 3797.90 | 0.24 | 87.98 | 513.15 | 5471 | 49469 | -1.05% |
| 133 | 50 | 2.0 | 90.59 | 3650.09 | 0.19 | 90.17 | 524.14 | 5580 | 50026 | -0.46% |
| 134 | 50 | 2.0 | 85.03 | 4005.65 | 0.45 | 83.23 | 445.01 | 5138 | 45303 | -2.11% |
| 135 | 50 | 2.0 | 95.12 | 4096.08 | 0.06 | 94.21 | 537.40 | 5846 | 52312 | -0.96% |
| 136 | 50 | 2.0 | 85.27 | 3645.09 | 0.39 | 84.82 | 442.56 | 5183 | 46294 | -0.53% |
| 137 | 50 | 2.0 | 84.52 | 3648.72 | 0.22 | 83.79 | 503.76 | 5558 | 47304 | -0.86% |
| 138 | 50 | 2.0 | 91.58 | 4044.07 | 0.20 | 89.42 | 630.55 | 5716 | 50405 | -2.36% |
| 139 | 50 | 2.0 | 87.06 | 3948.95 | 0.03 | 86.39 | 474.36 | 5454 | 48125 | -0.77% |
| 140 | 50 | 2.0 | 90.40 | 4036.42 | 0.91 | 89.53 | 384.71 | 5358 | 49856 | -0.96% |
| 141 | 50 | 2.0 | 89.46 | 4012.63 | 0.31 | 87.53 | 471.20 | 6497 | 51278 | -2.16% |
| 142 | 50 | 2.0 | 89.92 | 4056.53 | 0.01 | 89.14 | 489.28 | 5439 | 49613 | -0.87% |
| 143 | 50 | 2.0 | 88.56 | 3652.33 | 0.15 | 87.89 | 462.27 | 5050 | 48560 | -0.76% |
| 144 | 50 | 2.0 | 92.10 | 3645.63 | 0.14 | 91.13 | 578.47 | 5806 | 51126 | -1.05% |
| 145 | 50 | 2.0 | 83.56 | 3980.05 | 0.51 | 83.24 | 430.14 | 5078 | 46211 | -0.38% |
| 146 | 50 | 2.0 | 92.39 | 3784.06 | 0.28 | 92.02 | 576.61 | 5781 | 52166 | -0.40% |
| 147 | 50 | 2.0 | 88.73 | 3818.03 | 0.40 | 87.20 | 556.91 | 5575 | 48379 | -1.73% |
| 148 | 50 | 2.0 | 94.38 | 3947.41 | 0.22 | 93.87 | 624.30 | 5734 | 52547 | -0.54% |
| 149 | 50 | 2.0 | 88.13 | 3772.46 | 0.32 | 88.05 | 514.46 | 5370 | 48483 | -0.10% |
| 150 | 50 | 2.0 | 85.12 | 3707.72 | 0.46 | 85.07 | 538.39 | 5207 | 47582 | -0.07% |
| 151 | 75 | 0.1 | 17.45 | 3606.90 | 0.20 | 17.04 | 4.25 | 294 | 2794 | -2.35% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD[(a)] | T(s) | D-RPD | C-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 152 | 75 | 0.1 | 45.69 | 4018.50 | 0.18 | 17.41 | 5.56 | 335 | 3049 | -61.90% |
| 153 | 75 | 0.1 | 19.72 | 3606.20 | 0.19 | 18.74 | 6.36 | 380 | 3088 | -4.99% |
| 154 | 75 | 0.1 | 19.56 | 3615.41 | 0.19 | 18.35 | 5.46 | 397 | 3116 | -6.20% |
| 155 | 75 | 0.1 | 44.14 | 3712.40 | 0.08 | 17.67 | 4.91 | 374 | 2985 | -59.96% |
| 156 | 75 | 0.1 | 18.37 | 3615.45 | 0.47 | 17.60 | 4.52 | 331 | 3011 | -4.22% |
| 157 | 75 | 0.1 | 45.66 | 3732.92 | 0.23 | 17.57 | 4.47 | 306 | 2998 | -61.52% |
| 158 | 75 | 0.1 | 17.44 | 3615.57 | 0.14 | 17.35 | 4.22 | 294 | 2877 | -0.53% |
| 159 | 75 | 0.1 | 17.88 | 3616.11 | 0.23 | 17.85 | 5.68 | 311 | 2960 | -0.18% |
| 160 | 75 | 0.1 | 19.33 | 3613.54 | 0.18 | 18.49 | 5.30 | 353 | 3132 | -4.34% |
| 161 | 75 | 0.1 | 19.23 | 3616.25 | 0.07 | 18.71 | 4.81 | 375 | 3158 | -2.73% |
| 162 | 75 | 0.1 | 17.99 | 3610.60 | 0.08 | 17.74 | 4.76 | 355 | 2976 | -1.41% |
| 163 | 75 | 0.1 | 17.61 | 3605.80 | 0.47 | 17.41 | 4.17 | 336 | 2884 | -1.16% |
| 164 | 75 | 0.1 | 44.57 | 3978.80 | 0.25 | 18.26 | 5.15 | 323 | 3047 | -59.03% |
| 165 | 75 | 0.1 | 43.72 | 3723.88 | 0.20 | 18.58 | 4.82 | 341 | 3154 | -57.49% |
| 166 | 75 | 0.1 | 19.11 | 3615.68 | 0.13 | 18.24 | 4.64 | 311 | 3139 | -4.58% |
| 167 | 75 | 0.1 | 18.95 | 3614.89 | 0.25 | 18.62 | 5.42 | 373 | 3201 | -1.73% |
| 168 | 75 | 0.1 | 17.76 | 3615.71 | 0.17 | 17.48 | 4.23 | 271 | 2819 | -1.58% |
| 169 | 75 | 0.1 | 45.85 | 3754.21 | 0.22 | 18.10 | 5.00 | 406 | 3297 | -60.51% |
| 170 | 75 | 0.1 | 18.61 | 3615.36 | 0.17 | 18.13 | 4.45 | 334 | 3152 | -2.58% |
| 171 | 75 | 0.1 | 45.02 | 3738.69 | 0.27 | 18.05 | 4.51 | 307 | 3110 | -59.89% |
| 172 | 75 | 0.1 | 18.47 | 3615.15 | 0.23 | 18.28 | 4.41 | 334 | 3048 | -1.00% |
| 173 | 75 | 0.1 | 19.01 | 3614.02 | 0.09 | 17.19 | 4.48 | 354 | 2923 | -9.57% |
| 174 | 75 | 0.1 | 17.64 | 3616.30 | 0.13 | 16.16 | 4.59 | 316 | 2704 | -8.38% |
| 175 | 75 | 0.1 | 19.72 | 3623.43 | 0.11 | 18.91 | 5.14 | 371 | 3167 | -4.12% |
| 176 | 75 | 0.5 | 44.83 | 3665.10 | 0.19 | 44.75 | 54.99 | 1627 | 14736 | -0.18% |
| 177 | 75 | 0.5 | 92.00 | 3605.70 | 0.17 | 45.69 | 62.44 | 1577 | 15288 | -50.34% |
| 178 | 75 | 0.5 | 46.82 | 3670.30 | 0.19 | 46.37 | 68.38 | 1776 | 15481 | -0.95% |
| 179 | 75 | 0.5 | 44.93 | 3625.83 | 0.18 | 44.58 | 61.73 | 1656 | 14746 | -0.79% |
| 180 | 75 | 0.5 | 44.80 | 3607.30 | 0.18 | 44.09 | 57.76 | 1666 | 14869 | -1.58% |
| 181 | 75 | 0.5 | 46.41 | 3626.65 | 0.34 | 45.21 | 61.31 | 1567 | 15200 | -2.58% |
| 182 | 75 | 0.5 | 89.22 | 3614.02 | 0.22 | 45.65 | 58.86 | 1652 | 15037 | -48.84% |
| 183 | 75 | 0.5 | 44.47 | 3626.84 | 0.18 | 43.54 | 57.13 | 1615 | 14205 | -2.09% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD[(a)] | T(s) | D-RPD | C-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 184 | 75 | 0.5 | 44.67 | 3626.06 | 0.18 | 44.58 | 54.03 | 1634 | 15094 | -0.21% |
| 185 | 75 | 0.5 | 46.08 | 3624.66 | 0.03 | 44.32 | 48.95 | 1679 | 14916 | -3.82% |
| 186 | 75 | 0.5 | 46.81 | 3626.13 | 0.12 | 45.64 | 58.39 | 1635 | 15487 | -2.49% |
| 187 | 75 | 0.5 | 45.90 | 3631.30 | 0.09 | 45.22 | 44.34 | 1716 | 14954 | -1.49% |
| 188 | 75 | 0.5 | 43.65 | 3620.10 | 0.26 | 43.31 | 53.88 | 1552 | 14755 | -0.77% |
| 189 | 75 | 0.5 | 88.24 | 3609.70 | 0.23 | 44.57 | 63.34 | 1683 | 14772 | -49.49% |
| 190 | 75 | 0.5 | 87.26 | 3615.09 | 0.20 | 43.72 | 46.02 | 1691 | 14710 | -49.90% |
| 191 | 75 | 0.5 | 45.75 | 3625.98 | 0.16 | 45.14 | 51.72 | 1606 | 15116 | -1.33% |
| 192 | 75 | 0.5 | 89.09 | 3729.23 | 0.17 | 45.86 | 52.47 | 1615 | 15348 | -48.52% |
| 193 | 75 | 0.5 | 44.46 | 3625.73 | 0.16 | 44.32 | 53.39 | 1643 | 14640 | -0.32% |
| 194 | 75 | 0.5 | 89.36 | 3616.54 | 0.23 | 45.85 | 66.99 | 1812 | 15773 | -48.70% |
| 195 | 75 | 0.5 | 45.49 | 3626.31 | 0.14 | 45.29 | 57.18 | 1605 | 15048 | -0.44% |
| 196 | 75 | 0.5 | 88.76 | 3615.08 | 0.88 | 45.02 | 46.54 | 1526 | 14854 | -49.28% |
| 197 | 75 | 0.5 | 44.53 | 3624.52 | 0.15 | 44.29 | 40.32 | 1643 | 14621 | -0.52% |
| 198 | 75 | 0.5 | 46.75 | 3624.74 | 0.08 | 45.83 | 53.43 | 1758 | 15295 | -1.97% |
| 199 | 75 | 0.5 | 84.86 | 3721.12 | 0.07 | 43.45 | 47.45 | 1520 | 14662 | -48.80% |
| 200 | 75 | 0.5 | 47.34 | 3633.66 | 0.10 | 46.90 | 64.89 | 1717 | 15806 | -0.92% |
| 201 | 75 | 2.0 | 87.45 | 3809.00 | 0.35 | 86.82 | 493.50 | 5275 | 47741 | -0.72% |
| 202 | 75 | 2.0 | 92.65 | 3645.50 | 0.17 | 91.84 | 641.25 | 5427 | 52552 | -0.88% |
| 203 | 75 | 2.0 | 90.81 | 4060.70 | 0.16 | 90.20 | 684.60 | 5702 | 50871 | -0.67% |
| 204 | 75 | 2.0 | 87.51 | 3728.00 | 0.19 | 86.91 | 537.13 | 5315 | 47441 | -0.68% |
| 205 | 75 | 2.0 | 87.92 | 4086.60 | 0.13 | 87.44 | 583.15 | 5642 | 49670 | -0.54% |
| 206 | 75 | 2.0 | 88.70 | 3728.05 | 0.19 | 88.19 | 563.32 | 5686 | 49278 | -0.57% |
| 207 | 75 | 2.0 | 88.70 | 3626.84 | 0.20 | 87.97 | 539.24 | 5293 | 50037 | -0.83% |
| 208 | 75 | 2.0 | 86.34 | 3748.83 | 0.14 | 84.95 | 593.23 | 5228 | 47321 | -1.61% |
| 209 | 75 | 2.0 | 86.80 | 3737.31 | 0.32 | 85.22 | 600.64 | 5107 | 48074 | -1.82% |
| 210 | 75 | 2.0 | 88.66 | 3731.27 | 0.18 | 87.59 | 636.23 | 5337 | 49343 | -1.21% |
| 211 | 75 | 2.0 | 91.79 | 3742.84 | 0.09 | 91.17 | 690.30 | 5732 | 52049 | -0.67% |
| 212 | 75 | 2.0 | 90.28 | 4104.80 | 0.27 | 89.15 | 745.33 | 6322 | 50721 | -1.26% |
| 213 | 75 | 2.0 | 86.92 | 4364.50 | 0.25 | 85.50 | 568.64 | 5113 | 48856 | -1.63% |
| 214 | 75 | 2.0 | 86.89 | 3742.80 | 0.07 | 86.13 | 557.31 | 5721 | 49494 | -0.88% |
| 215 | 75 | 2.0 | 87.42 | 3624.47 | 0.15 | 87.26 | 602.41 | 5501 | 49551 | -0.18% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD[(a)] | T(s) | D-RPD | C-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 216 | 75 | 2.0 | 88.08 | 3735.99 | 0.18 | 87.96 | 564.57 | 5321 | 48373 | -0.14% |
| 217 | 75 | 2.0 | 89.27 | 3625.88 | 0.34 | 88.39 | 664.75 | 5652 | 48873 | -0.98% |
| 218 | 75 | 2.0 | 88.59 | 3737.52 | 0.33 | 86.43 | 607.93 | 5350 | 48388 | -2.43% |
| 219 | 75 | 2.0 | 89.95 | 3629.29 | 0.13 | 89.36 | 267.64 | 5639 | 50191 | -0.65% |
| 220 | 75 | 2.0 | 91.06 | 3743.85 | 0.16 | 89.23 | 637.18 | 5433 | 49317 | -2.01% |
| 221 | 75 | 2.0 | 86.96 | 3625.73 | 0.16 | 86.04 | 552.72 | 5360 | 49796 | -1.05% |
| 222 | 75 | 2.0 | 87.73 | 3732.00 | 0.24 | 86.35 | 586.00 | 5441 | 48935 | -1.57% |
| 223 | 75 | 2.0 | 91.55 | 3740.45 | 0.10 | 90.16 | 594.08 | 5788 | 50870 | -1.52% |
| 224 | 75 | 2.0 | 83.79 | 3626.57 | 0.17 | 82.98 | 558.92 | 5171 | 47061 | -0.97% |
| 225 | 75 | 2.0 | 93.15 | 3783.96 | 0.21 | 92.25 | 777.65 | 5700 | 51659 | -0.97% |
| 226 | 100 | 0.1 | 90.65 | 3622.20 | 0.10 | 18.48 | 6.32 | 350 | 3127 | -79.62% |
| 227 | 100 | 0.1 | 18.69 | 3693.47 | 0.10 | 17.20 | 5.67 | 323 | 2900 | -7.96% |
| 228 | 100 | 0.1 | 44.94 | 4177.40 | 0.11 | 18.19 | 5.18 | 339 | 3050 | -59.52% |
| 229 | 100 | 0.1 | 19.35 | 3692.54 | 0.15 | 17.23 | 5.26 | 333 | 2878 | -10.95% |
| 230 | 100 | 0.1 | 18.88 | 3701.43 | 0.12 | 16.87 | 5.69 | 331 | 2963 | -10.64% |
| 231 | 100 | 0.1 | 18.82 | 3689.92 | 0.04 | 17.97 | 5.34 | 322 | 2941 | -4.53% |
| 232 | 100 | 0.1 | 18.32 | 3693.98 | 0.76 | 17.69 | 5.86 | 345 | 3025 | -3.41% |
| 233 | 100 | 0.1 | 44.33 | 4284.02 | 0.54 | 17.31 | 5.84 | 357 | 3021 | -60.96% |
| 234 | 100 | 0.1 | 45.60 | 4308.74 | 0.12 | 18.43 | 5.30 | 336 | 3010 | -59.58% |
| 235 | 100 | 0.1 | 44.88 | 3736.23 | 0.31 | 18.11 | 5.49 | 388 | 3234 | -59.65% |
| 236 | 100 | 0.1 | 19.05 | 3605.10 | 0.15 | 17.84 | 5.14 | 319 | 3001 | -6.38% |
| 237 | 100 | 0.1 | 86.94 | 3740.43 | 0.09 | 17.34 | 5.83 | 291 | 2869 | -80.05% |
| 238 | 100 | 0.1 | 90.94 | 3674.20 | 0.18 | 19.29 | 6.13 | 391 | 3295 | -78.79% |
| 239 | 100 | 0.1 | 18.93 | 3685.80 | 0.09 | 18.35 | 5.44 | 375 | 3182 | -3.06% |
| 240 | 100 | 0.1 | 88.22 | 3676.80 | 0.10 | 17.96 | 5.15 | 295 | 2971 | -79.64% |
| 241 | 100 | 0.1 | 46.09 | 4425.62 | 0.06 | 17.93 | 5.12 | 311 | 3056 | -61.10% |
| 242 | 100 | 0.1 | 45.50 | 4317.80 | 0.16 | 18.60 | 5.67 | 362 | 3168 | -59.12% |
| 243 | 100 | 0.1 | 19.10 | 3691.62 | 0.16 | 18.12 | 5.12 | 259 | 2880 | -5.08% |
| 244 | 100 | 0.1 | 18.47 | 3608.00 | 0.13 | 18.00 | 5.55 | 354 | 3068 | -2.57% |
| 245 | 100 | 0.1 | 20.51 | 3694.13 | 0.05 | 17.59 | 5.10 | 257 | 3022 | -14.22% |
| 246 | 100 | 0.1 | 18.60 | 3611.20 | 0.05 | 18.04 | 4.93 | 332 | 2937 | -3.01% |
| 247 | 100 | 0.1 | 18.34 | 3615.60 | 0.09 | 17.09 | 5.39 | 332 | 2944 | -6.82% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD[(a)] | T(s) | D-RPD | C-RPD[(b)] | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 248 | 100 | 0.1 | 19.88 | 3608.94 | 0.62 | 17.83 | 5.77 | 303 | 3041 | -10.31% |
| 249 | 100 | 0.1 | 17.88 | 3611.90 | 0.70 | 16.83 | 4.88 | 340 | 2923 | -5.91% |
| 250 | 100 | 0.1 | 19.12 | 3615.60 | 0.16 | 17.93 | 5.56 | 333 | 3087 | -6.20% |
| 251 | 100 | 0.5 | 47.23 | 4379.00 | 0.09 | 46.39 | 58.58 | 1765 | 15681 | -1.78% |
| 252 | 100 | 0.5 | 45.52 | 3736.54 | 0.07 | 44.50 | 59.18 | 1763 | 14886 | -2.25% |
| 253 | 100 | 0.5 | 88.27 | 3611.10 | 0.15 | 44.94 | 53.09 | 1608 | 14893 | -49.09% |
| 254 | 100 | 0.5 | 44.83 | 3729.63 | 0.08 | 44.56 | 52.29 | 1735 | 15014 | -0.59% |
| 255 | 100 | 0.5 | 44.85 | 3744.79 | 0.08 | 44.71 | 55.18 | 1670 | 14804 | -0.30% |
| 256 | 100 | 0.5 | 45.28 | 3729.32 | 0.08 | 45.21 | 54.01 | 1623 | 14869 | -0.16% |
| 257 | 100 | 0.5 | 46.39 | 3732.47 | 0.66 | 45.47 | 60.09 | 1758 | 15342 | -1.98% |
| 258 | 100 | 0.5 | 86.08 | 3691.56 | 0.60 | 44.33 | 58.59 | 1720 | 15018 | -48.51% |
| 259 | 100 | 0.5 | 88.88 | 3689.87 | 0.23 | 45.60 | 61.45 | 1772 | 15068 | -48.70% |
| 260 | 100 | 0.5 | 45.01 | 3688.63 | 0.23 | 44.37 | 58.52 | 1733 | 14892 | -1.43% |
| 261 | 100 | 0.5 | 47.58 | 3722.30 | 0.17 | 47.43 | 78.49 | 1874 | 16123 | -0.30% |
| 262 | 100 | 0.5 | 44.80 | 4303.91 | 0.77 | 44.23 | 56.92 | 1570 | 14549 | -1.29% |
| 263 | 100 | 0.5 | 46.50 | 4234.90 | 0.15 | 46.13 | 65.98 | 1658 | 15541 | -0.80% |
| 264 | 100 | 0.5 | 45.97 | 3736.39 | 0.11 | 45.52 | 58.72 | 1778 | 15356 | -0.98% |
| 265 | 100 | 0.5 | 44.55 | 3868.80 | 0.04 | 44.54 | 52.73 | 1635 | 14971 | -0.03% |
| 266 | 100 | 0.5 | 91.96 | 3693.67 | 0.09 | 46.09 | 68.99 | 1757 | 15372 | -49.88% |
| 267 | 100 | 0.5 | 87.60 | 3611.00 | 0.10 | 45.38 | 65.52 | 1639 | 15211 | -48.19% |
| 268 | 100 | 0.5 | 46.56 | 3738.43 | 0.11 | 46.25 | 57.99 | 1765 | 15484 | -0.68% |
| 269 | 100 | 0.5 | 46.05 | 3725.90 | 0.28 | 45.40 | 60.09 | 1635 | 15331 | -1.43% |
| 270 | 100 | 0.5 | 46.69 | 3742.27 | 0.15 | 46.47 | 67.73 | 1618 | 15520 | -0.46% |
| 271 | 100 | 0.5 | 46.32 | 3646.30 | 0.12 | 46.05 | 61.03 | 1660 | 15143 | -0.58% |
| 272 | 100 | 0.5 | 86.65 | 11024.40 | 0.11 | 44.71 | 53.53 | 1735 | 15087 | -48.40% |
| 273 | 100 | 0.5 | 47.34 | 3637.80 | 0.54 | 46.35 | 64.97 | 1684 | 15502 | -2.10% |
| 274 | 100 | 0.5 | 44.80 | 3653.90 | 0.34 | 44.72 | 61.16 | 1573 | 14788 | -0.20% |
| 275 | 100 | 0.5 | 45.38 | 3660.50 | 0.06 | 45.10 | 57.20 | 1679 | 15074 | -0.62% |
| 276 | 100 | 2.0 | 90.73 | 3604.00 | 0.06 | 90.65 | 615.36 | 5613 | 50446 | -0.09% |
| 277 | 100 | 2.0 | 87.83 | 4350.05 | 0.18 | 86.81 | 582.74 | 5302 | 48753 | -1.17% |
| 278 | 100 | 2.0 | 86.85 | 3742.40 | 0.16 | 85.99 | 551.26 | 5563 | 48764 | -0.99% |
| 279 | 100 | 2.0 | 87.62 | 4314.04 | 0.25 | 87.60 | 569.99 | 5507 | 49812 | -0.02% |

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Table 3: Result of SimExact X SimSA-CVaR (Continued)

| **Inst** | $n$ | $\delta$ | **SimExact** | | **SimSA-CVaR** | | | | | **GAP$_{a,b}$(%)** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | C-RPD$^{(a)}$ | T(s) | D-RPD | C-RPD$^{(b)}$ | T(s) | $\#\rho_S$ | $\#\rho_L$ | |
| 280 | 100 | 2.0 | 85.71 | 4289.95 | 0.00 | 84.66 | 508.94 | 5391 | 48027 | -1.23% |
| 281 | 100 | 2.0 | 87.40 | 4312.90 | 0.21 | 86.99 | 622.38 | 5357 | 48299 | -0.46% |
| 282 | 100 | 2.0 | 88.23 | 4339.81 | 0.60 | 88.10 | 625.62 | 5433 | 49473 | -0.15% |
| 283 | 100 | 2.0 | 86.37 | 3736.75 | 0.71 | 86.08 | 606.90 | 5612 | 48571 | -0.33% |
| 284 | 100 | 2.0 | 88.60 | 3737.38 | 0.17 | 87.78 | 593.95 | 5317 | 49467 | -0.92% |
| 285 | 100 | 2.0 | 86.99 | 4302.11 | 0.24 | 85.63 | 501.07 | 5438 | 47315 | -1.56% |
| 286 | 100 | 2.0 | 94.17 | 3803.20 | 0.17 | 93.96 | 766.93 | 6009 | 53910 | -0.23% |
| 287 | 100 | 2.0 | 87.72 | 3689.67 | 0.70 | 86.85 | 596.05 | 5192 | 48768 | -1.00% |
| 288 | 100 | 2.0 | 88.85 | 3609.40 | 0.12 | 87.97 | 656.32 | 5496 | 51275 | -0.98% |
| 289 | 100 | 2.0 | 86.22 | 4323.21 | 0.03 | 86.17 | 637.78 | 5330 | 50215 | -0.06% |
| 290 | 100 | 2.0 | 87.37 | 3609.30 | 0.16 | 86.67 | 550.98 | 5675 | 49571 | -0.80% |
| 291 | 100 | 2.0 | 90.88 | 3738.96 | 0.06 | 89.91 | 663.24 | 5725 | 51255 | -1.07% |
| 292 | 100 | 2.0 | 88.41 | 3668.60 | 0.09 | 87.51 | 550.66 | 5392 | 48894 | -1.02% |
| 293 | 100 | 2.0 | 88.36 | 4351.22 | 0.01 | 88.14 | 637.28 | 5710 | 49713 | -0.25% |
| 294 | 100 | 2.0 | 89.09 | 3835.40 | 0.23 | 88.81 | 549.72 | 5808 | 49672 | -0.30% |
| 295 | 100 | 2.0 | 89.51 | 4349.52 | 0.15 | 89.03 | 623.46 | 5672 | 50799 | -0.53% |
| 296 | 100 | 2.0 | 90.64 | 4244.40 | 0.13 | 88.68 | 609.56 | 5563 | 50656 | -2.17% |
| 297 | 100 | 2.0 | 85.81 | 3632.40 | 0.28 | 85.04 | 485.82 | 5460 | 48133 | -0.91% |
| 298 | 100 | 2.0 | 91.67 | 4134.42 | 0.72 | 89.29 | 573.78 | 5923 | 51503 | -2.59% |
| 299 | 100 | 2.0 | 86.44 | 11021.80 | 0.30 | 85.24 | 507.14 | 5303 | 48295 | -1.39% |
| 300 | 100 | 2.0 | 85.14 | 4045.80 | 0.66 | 84.85 | 580.48 | 5430 | 47682 | -0.34% |