**投资学案例分析作业**

**金融工程 冷学琪 2017302350052**

1. **STP和LTP的配置**

在给定的风险资产配置组合下，（55%的美国股票+30%的外国股票+15%的长期债券）由于风险系数的不同导致不同风险偏好的投资者会选择不同的风险资产和无风险资产的资产配置是不相同的，在下图中我列举了**风险厌恶系数从1到30**的投资者的风险资产配置组合，并选取A=12和A=20进行作图分析。

运用方法：

求出在各种风险厌恶程度下，风险资产与无风险资产的配置比例。

* 3种风险资产（美国股票 外国股票 长期债券）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **0** | **Risk asset%** | **Risk-free Asset%** | **Max U** | **expected-return** | **SD** |
| 1 | 585.85% | -485.85% | 0.2796 | 0.5272 | 0.7037 |
| 2 | 292.92% | -192.92% | 0.1558 | 0.2796 | 0.3519 |
| 3 | 195.28% | -95.28% | 0.1145 | 0.1971 | 0.2346 |
| 4 | 146.46% | -46.46% | 0.0939 | 0.1558 | 0.1759 |
| 5 | 117.17% | -17.17% | 0.0815 | 0.1310 | 0.1407 |
| 5.86 | 100.00% | 0.00% | 0.0743 | 0.1165 | 0.1201 |
| 6 | 97.64% | 2.36% | 0.0733 | 0.1145 | 0.1173 |
| 7 | 83.69% | 16.31% | 0.0674 | 0.1027 | 0.1005 |
| 8 | 73.23% | 26.77% | 0.0630 | 0.0939 | 0.0880 |
| 9 | 65.09% | 34.91% | 0.0595 | 0.0870 | 0.0782 |
| 10 | 58.58% | 41.42% | 0.0568 | 0.0815 | 0.0704 |
| 11 | 53.26% | 46.74% | 0.0545 | 0.0770 | 0.0640 |
| 12 | 48.82% | 51.18% | 0.0526 | 0.0733 | 0.0586 |
| 13 | 45.07% | 54.93% | 0.0510 | 0.0701 | 0.0541 |
| 14 | 41.85% | 58.15% | 0.0497 | 0.0674 | 0.0503 |
| 15 | 39.06% | 60.94% | 0.0485 | 0.0650 | 0.0469 |
| 16 | 36.62% | 63.38% | 0.0475 | 0.0630 | 0.0440 |
| 17 | 34.46% | 65.54% | 0.0466 | 0.0611 | 0.0414 |
| 18 | 32.55% | 67.45% | 0.0458 | 0.0595 | 0.0391 |
| 19 | 30.83% | 69.17% | 0.0450 | 0.0581 | 0.0370 |
| 20 | 29.29% | 70.71% | 0.0444 | 0.0568 | 0.0352 |
| 21 | 27.90% | 72.10% | 0.0438 | 0.0556 | 0.0335 |
| 22 | 26.63% | 73.37% | 0.0433 | 0.0545 | 0.0320 |
| 23 | 25.47% | 74.53% | 0.0428 | 0.0535 | 0.0306 |
| 24 | 24.41% | 75.59% | 0.0423 | 0.0526 | 0.0293 |
| 25 | 23.43% | 76.57% | 0.0419 | 0.0518 | 0.0281 |
| 26 | 22.53% | 77.47% | 0.0415 | 0.0510 | 0.0271 |
| 27 | 21.70% | 78.30% | 0.0412 | 0.0503 | 0.0261 |
| 28 | 20.92% | 79.08% | 0.0408 | 0.0497 | 0.0251 |
| 29 | 20.20% | 79.80% | 0.0405 | 0.0491 | 0.0243 |
| 30 | 19.53% | 80.47% | 0.0403 | 0.0485 | 0.0235 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **0** | **Risk asset%** | **Risk-free Asset%** | **Max U** | **expected-return** | **SD** |
| 1 | 596.52% | -496.52% | 0.2875 | 0.5429 | 0.7148 |
| 2 | 298.26% | -198.26% | 0.1597 | 0.2875 | 0.3574 |
| 3 | 198.84% | -98.84% | 0.1172 | 0.2023 | 0.2383 |
| 4 | 149.13% | -49.13% | 0.0959 | 0.1597 | 0.1787 |
| 5 | 119.30% | -19.30% | 0.0831 | 0.1342 | 0.1430 |
| 5.97 | 100.00% | 0.00% | 0.0748 | 0.1177 | 0.1198 |
| 6 | 99.42% | 0.58% | 0.0746 | 0.1172 | 0.1191 |
| 7 | 85.22% | 14.78% | 0.0685 | 0.1050 | 0.1021 |
| 8 | 74.56% | 25.44% | 0.0639 | 0.0959 | 0.0894 |
| 9 | 66.28% | 33.72% | 0.0604 | 0.0888 | 0.0794 |
| 10 | 59.65% | 40.35% | 0.0575 | 0.0831 | 0.0715 |
| 11 | 54.23% | 45.77% | 0.0552 | 0.0784 | 0.0650 |
| 12 | 49.71% | 50.29% | 0.0533 | 0.0746 | 0.0596 |
| 13 | 45.89% | 54.11% | 0.0517 | 0.0713 | 0.0550 |
| 14 | 42.61% | 57.39% | 0.0502 | 0.0685 | 0.0511 |
| 15 | 39.77% | 60.23% | 0.0490 | 0.0661 | 0.0477 |
| 16 | 37.28% | 62.72% | 0.0480 | 0.0639 | 0.0447 |
| 17 | 35.09% | 64.91% | 0.0470 | 0.0621 | 0.0420 |
| 18 | 33.14% | 66.86% | 0.0462 | 0.0604 | 0.0397 |
| 19 | 31.40% | 68.60% | 0.0454 | 0.0589 | 0.0376 |
| 20 | 29.83% | 70.17% | 0.0448 | 0.0575 | 0.0357 |
| 21 | 28.41% | 71.59% | 0.0442 | 0.0563 | 0.0340 |
| 22 | 27.11% | 72.89% | 0.0436 | 0.0552 | 0.0325 |
| 23 | 25.94% | 74.06% | 0.0431 | 0.0542 | 0.0311 |
| 24 | 24.85% | 75.15% | 0.0426 | 0.0533 | 0.0298 |
| 25 | 23.86% | 76.14% | 0.0422 | 0.0524 | 0.0286 |
| 26 | 22.94% | 77.06% | 0.0418 | 0.0517 | 0.0275 |
| 27 | 22.09% | 77.91% | 0.0415 | 0.0509 | 0.0265 |
| 28 | 21.30% | 78.70% | 0.0411 | 0.0502 | 0.0255 |
| 29 | 20.57% | 79.43% | 0.0408 | 0.0496 | 0.0246 |
| 30 | 19.88% | 80.12% | 0.0405 | 0.0490 |  |

* 5种风险资产（美国股票 外国股票 长期债券 REITs Commodities）

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **A** | **P%** | **F%** | **Max U** | **expected-return** | **SD** |
| 1 | 862.65% | -762.65% | 0.3650 | 0.6980 | 0.8161 |
| 2 | 431.33% | -331.33% | 0.1985 | 0.3650 | 0.4080 |
| 3 | 287.55% | -187.55% | 0.1430 | 0.2540 | 0.2720 |
| 4 | 215.66% | -115.66% | 0.1152 | 0.1985 | 0.2040 |
| 5 | 172.53% | -72.53% | 0.0986 | 0.1652 | 0.1632 |
| 6 | 143.78% | -43.78% | 0.0875 | 0.1430 | 0.1360 |
| 7 | 123.24% | -23.24% | 0.0796 | 0.1271 | 0.1166 |
| 8 | 107.83% | -7.83% | 0.0736 | 0.1152 | 0.1020 |
| 8.63 | 100.00% | 0.00% | 0.0706 | 0.1092 | 0.0946 |
| 9 | 95.85% | 4.15% | 0.0690 | 0.1060 | 0.0907 |
| 10 | 86.27% | 13.73% | 0.0653 | 0.0986 | 0.0816 |
| 11 | 78.42% | 21.58% | 0.0623 | 0.0925 | 0.0742 |
| 12 | 71.89% | 28.11% | 0.0597 | 0.0875 | 0.0680 |
| 13 | 66.36% | 33.64% | 0.0576 | 0.0832 | 0.0628 |
| 14 | 61.62% | 38.38% | 0.0558 | 0.0796 | 0.0583 |
| 15 | 57.51% | 42.49% | 0.0542 | 0.0764 | 0.0544 |
| 16 | 53.92% | 46.08% | 0.0528 | 0.0736 | 0.0510 |
| 17 | 50.74% | 49.26% | 0.0516 | 0.0712 | 0.0480 |
| 18 | 47.93% | 52.07% | 0.0505 | 0.0690 | 0.0453 |
| 19 | 45.40% | 54.60% | 0.0495 | 0.0671 | 0.0430 |
| 20 | 43.13% | 56.87% | 0.0486 | 0.0653 | 0.0408 |
| 21 | 41.08% | 58.92% | 0.0479 | 0.0637 | 0.0389 |
| 22 | 39.21% | 60.79% | 0.0471 | 0.0623 | 0.0371 |
| 23 | 37.51% | 62.49% | 0.0465 | 0.0610 | 0.0355 |
| 24 | 35.94% | 64.06% | 0.0459 | 0.0597 | 0.0340 |
| 25 | 34.51% | 65.49% | 0.0453 | 0.0586 | 0.0326 |
| 26 | 33.18% | 66.82% | 0.0448 | 0.0576 | 0.0314 |
| 27 | 31.95% | 68.05% | 0.0443 | 0.0567 | 0.0302 |
| 28 | 30.81% | 69.19% | 0.0439 | 0.09558 | 0.0291 |
| 29 | 29.75% | 70.25% | 0.0435 | 0.0550 | 0.0281 |
| 30 | 28.76% | 71.24% | 0.0431 | 0.0542 | 0.0272 |

**2. 最优风险资产组合配置**

当前的LTP配置并不是最优的，最优的结果如下表示：

* 3种风险资产（第二题答案）

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **MAX-Sharpe-Portfolio** | | | | |
| **Assert** | **US Equity** | **Foreign Equity** | **Bonds** | **Sum** |
| **Portion** | **40.66%** | **47.01%** | **12.33%** | **100.00%** |
| **expected-return** | **0.1177** | | | |
| **SD** | **0.1198** | | | |
| **Sharpe ratio** |  | | | |

方法：

通过学习本章附录中用**Excel中的solver插件**进行最优风险组合配置的方法，本人将此方法运用到此题中，通过优化求解的方式计算出方差最小的投资组合以及夏普比率最高的投资组合。再通过改变各类资产的比例计算出最小方差边界的投资组合，绘出有效的最小方差边界，最后利用相关系数绘出CAL曲线。（具体的计算流程以及数据的筛选处理在Excel中体现。

最终计算出三种资产中最优的风险资产配置，分别为40.66%的US Equity，47.01%的Foreign Equity，12.33%的Bonds，此时最大的夏普比率为0.7148。通过观察最优Sharpe处的Portfolio中各个资产比例，可以明确的发现LTP的最优配置情况和报告中的配置情况不相符合，由此可见报告中并不是最优资产组合。

**3.多种风险资产配置**

* 3种风险资产+REITs

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **MAX-Sharpe-Portfolio** | | | | |
| Assert | US Equity | Foreign Equity | Bonds | REITs |
| Portion | 32.27% | 43.07% | 11.10% | 13.55% |
| expected-return | 0.1140 | | | |
| SD | 0.1138 | | | |
| sharpe | 0.7212 | | | |

* 3种资产+Commodities

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **MAX-Sharpe-Portfolio** | | | | |
| Assert | US Equity | Foreign Equity | Bonds | REITs |
| Portion | 29.99% | 33.14% | 11.70% | 25.17% |
| expected-return | 0.1116 | | | |
| SD | 0.0982 | | | |
| sharpe | 0.8104 | | | |

* 5种资产(第三题答案)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **MAX-Sharpe-Portfolio** | | | | | |  |
| **Assert** | **US Equity** | **Foreign Equity** | **Bonds** | **REITs** | **Commodities** |
| **Portion** | **0.2432** | **0.3087** | **0.1083** | **0.0991** | **0.2407** |
| **expected-return** | **0.1092** | | | | |  |
| **SD** | **0.0946** | | | | |  |
| **sharpe** | **0.8160** | | | | |  |

之后，将原始三种资产组合，添加REITs的组合，添加commodities的组合以及五种资产组合的risk-return曲线进行对比，画在同一幅图中，如图所示：

在进行分析后，得到如下结论

1. 整体上新的资产配置优于原始的三种资产的配置组合。
2. 只添加Commodities的四种资产组合的配置优于只添加REITs的四种资产组合的配置。
3. 在这几种组合中，Bonds能很好的降低整体风险，其他的资产具有相对较好的预期收益，如US Equity，也有风险相对较高的Commodities，综合考虑还是5种资产的配置组合效果最佳。