

Finance Quantitative

Exercice: Modèle Moyenne-Variance

Patrick Hénaff

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Données

Séries de rendement quotidien pour 11 valeurs:

```
daily.ret.file <- file.path(get.data.folder(), "daily.ret.rda")
load(daily.ret.file)
kable(table.Stats(daily.ret), "latex", booktabs=T) %>% kable_styling(latex_options="scale_down")
```

Rendement annuel moyen:

```
kable(252*100*colMeans(daily.ret), "latex", booktabs=T, digits=1, col.names=c("Rendement (%)"),
      caption="Rendement annuel moyen")
```

Matrice de corrélation des rendements:

```
correl <- cor(daily.ret)
correl[lower.tri(correl)] <- NA
```

| | AAPL | AMZN | MSFT | F | SPY | QQQ | XOM | MMM | HD | PG | KO |
|-----------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Observations | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 | 3308.0000 |
| NAs | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 | 0.0000 |
| Minimum | -0.1792 | -0.1278 | -0.1171 | -0.2500 | -0.0984 | -0.0896 | -0.1395 | -0.1295 | -0.0822 | -0.0790 | -0.0867 |
| Quartile 1 | -0.0077 | -0.0094 | -0.0073 | -0.0103 | -0.0038 | -0.0047 | -0.0068 | -0.0055 | -0.0067 | -0.0046 | -0.0047 |
| Median | 0.0010 | 0.0008 | 0.0005 | 0.0000 | 0.0006 | 0.0010 | 0.0001 | 0.0008 | 0.0006 | 0.0004 | 0.0007 |
| Arithmetic Mean | 0.0012 | 0.0015 | 0.0008 | 0.0005 | 0.0004 | 0.0006 | 0.0001 | 0.0004 | 0.0008 | 0.0004 | 0.0005 |
| Geometric Mean | 0.0010 | 0.0012 | 0.0006 | 0.0001 | 0.0003 | 0.0005 | 0.0000 | 0.0003 | 0.0006 | 0.0003 | 0.0004 |
| Quartile 3 | 0.0112 | 0.0123 | 0.0088 | 0.0106 | 0.0056 | 0.0070 | 0.0073 | 0.0070 | 0.0082 | 0.0055 | 0.0059 |
| Maximum | 0.1390 | 0.2695 | 0.1860 | 0.2952 | 0.1452 | 0.1216 | 0.1719 | 0.0988 | 0.1407 | 0.1021 | 0.1388 |
| SE Mean | 0.0003 | 0.0004 | 0.0003 | 0.0005 | 0.0002 | 0.0002 | 0.0003 | 0.0002 | 0.0003 | 0.0002 | 0.0002 |
| LCL Mean (0.95) | 0.0005 | 0.0006 | 0.0002 | -0.0005 | 0.0000 | 0.0002 | -0.0004 | -0.0001 | 0.0002 | 0.0000 | 0.0001 |
| UCL Mean (0.95) | 0.0019 | 0.0023 | 0.0013 | 0.0014 | 0.0008 | 0.0011 | 0.0006 | 0.0009 | 0.0013 | 0.0007 | 0.0009 |
| Variance | 0.0004 | 0.0006 | 0.0003 | 0.0007 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.0001 | 0.0001 |
| Stdev | 0.0196 | 0.0243 | 0.0170 | 0.0266 | 0.0121 | 0.0130 | 0.0150 | 0.0140 | 0.0162 | 0.0109 | 0.0113 |
| Skewness | -0.2151 | 1.4889 | 0.4319 | 0.7627 | 0.1379 | -0.0084 | 0.4199 | -0.3815 | 0.5114 | 0.0555 | 0.5004 |
| Kurtosis | 6.2706 | 16.8872 | 10.2176 | 20.9458 | 15.2824 | 7.3976 | 15.4203 | 7.3856 | 6.4641 | 8.1017 | 14.3236 |

Table 1: Rendement annuel moyen

| | Rendement (%) |
|------|---------------|
| AAPL | 30.2 |
| AMZN | 37.2 |
| MSFT | 19.0 |
| F | 11.4 |
| SPY | 9.9 |
| QQQ | 15.3 |
| XOM | 3.5 |
| MMM | 9.9 |
| HD | 19.2 |
| PG | 9.3 |
| KO | 12.5 |

Table 2: Corrélation des rendements quotidiens

| | AAPL | AMZN | MSFT | F | SPY | QQQ | XOM | MMM | HD | PG | KO |
|------|------|------|------|------|------|------|------|------|------|------|------|
| AAPL | 1 | 0.46 | 0.49 | 0.37 | 0.61 | 0.75 | 0.40 | 0.45 | 0.42 | 0.32 | 0.32 |
| AMZN | | 1.00 | 0.50 | 0.33 | 0.56 | 0.66 | 0.39 | 0.41 | 0.44 | 0.27 | 0.30 |
| MSFT | | | 1.00 | 0.39 | 0.71 | 0.76 | 0.53 | 0.53 | 0.49 | 0.44 | 0.46 |
| F | | | | 1.00 | 0.56 | 0.53 | 0.37 | 0.44 | 0.46 | 0.30 | 0.31 |
| SPY | | | | | 1.00 | 0.92 | 0.77 | 0.75 | 0.71 | 0.62 | 0.60 |
| QQQ | | | | | | 1.00 | 0.64 | 0.69 | 0.66 | 0.52 | 0.52 |
| XOM | | | | | | | 1.00 | 0.60 | 0.47 | 0.52 | 0.49 |
| MMM | | | | | | | | 1.00 | 0.55 | 0.50 | 0.47 |
| HD | | | | | | | | | 1.00 | 0.45 | 0.44 |
| PG | | | | | | | | | | 1.00 | 0.57 |
| KO | | | | | | | | | | | 1.00 |

```
options(knitr.kable.NA = '')
kable(correl, "latex", booktabs=T, digits=2, caption="Corrélation des rendements quotidiens") %>%
kable_styling(latex_options="scale_down")
```

Modèle Moyenne Variance

Le portefeuille de variance minimale formé à l'aide des 11 titres ci-dessus:

```
cov.all <- cov(daily.ret)
n <- ncol(daily.ret)
dvec <- rep(0, n)
Amat <- matrix(1, nrow=n, ncol=1)
bvec <- 1
sol <- solve.QP(cov.all, dvec, Amat, bvec, meq=1)
print(sol$solution)
```

```
## [1] -0.01320343 -0.02835419 -0.06276821 -0.02662540 -0.22783928 0.38753904
```

```
## [7] 0.03330669 0.10340429 0.02978403 0.42888328 0.37587318
```

Questions

Modifier le programme ci-dessus pour imposer des poids positifs.

Calculer le portefeuille risqué qui procure un rendement espéré de 13% par an.

Si le taux sans risque est de 4%, quel est le portefeuille tangent correspondant?