

Portfolio optimization modeling

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A simple and contemporary way to model and solve complex portfolio optimization problems with R.

- ▶ AML (algebraic modeling language) now available in R:
ROML (R Optimization Modeling Language) package.
- ▶ Access to different solvers for various problem classes based on the
ROI (R Optimization Infrastructure) package (Hornik et al., 2016).
- ▶ Portfolio optimization modeling language is built on top of the generalized AML:
ROML.portfolio package.

All available on <https://r-forge.r-project.org/>.

Minimum variance portfolio:

```
m <- model()  
m$variable(portfolio, lb = 0)  
m$minimize(markowitz(portfolio))  
m$subject_to(budget_norm(portfolio))
```

Changing the risk-measure to 95% CVaR?

```
m <- model()
m$variable(portfolio, lb = 0)
m$minimize(cvar(portfolio, 0.95))
m$subject_to(budget_norm(portfolio))
```

- ▶ Extensive set of complex and creative risk and return-risk measures implemented, e.g.,

markowitz

reward

mad

downside_var

downside_mad

sharpe

cvar

minimax_young

omega

...

- ▶ Different constraints: cardinality, turnover, ...
- ▶ All standard functionalities of the generalized AML.

```
install.packages("ROML.portfolio", repos="http://R-Forge.R-project.org")
install.packages("ROML", repos="http://R-Forge.R-project.org")
library(ROML); library(ROML.portfolio)
data(djia2013)

m <- model()
m$variable(portfolio, lb = -1) # portfolio choice vector
m$maximize(reward(portfolio))
m$subject_to(cvar(portfolio, 0.95) <= 0.02)
m$subject_to(cvar(portfolio, 0.99) <= 0.03)
m$subject_to(portfolio[2] + portfolio[10] + portfolio[20] <= 0.5)
m$subject_to(turnover(portfolio) <= 0.5)
solution <- optimize(m, solver = "glpk", data = list(returns = djia2013))
```

```
m <- model()
m$variable(portfolio, lb = 0)
m$maximize(omega(portfolio))
m$subject_to(cardinality(portfolio) <= 7)
m$subject_to(cvar(portfolio, 0.95) <= 0.02)
m$subject_to(markowitz(portfolio) <= 0.03^2)

solution <- optimize(m, solver = "", data = list(returns = djia2013))
```


More infos on <http://finance-r.com/portfolio/>

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References

Kurt Hornik, David Meyer, Florian Schwendinger, and Stefan Theussl. *ROI: R Optimization Infrastructure*, 2016. URL <http://R-Forge.R-project.org/projects/roi>. R package version 0.2-1.