Workshop 9 - V@R and CV@R Optimization

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1. Probabilistic Constraints

a) What is the optimal policy and the V@R for a level of significance (probability of the loss exceeding the V@R) of 1%, 5%, 10%, in a given month?

	1%	*5%*	*10%*
AAPI	0.197	0.197	0.197
MCD	0.051	0.051	0.051
QQQ	0.455	0.455	0.455
SPY	0.296	0.296	0.296
TLT	0	0	0
V@R	-0.042	-0.030	-0.023
Return	0.02	0.02	0.02

b) What is the different between the risk-averse and the risk-neutral optimal policies?

The risk-averse(1%) optimal policy is the same as the risk-neutral(5%) optimal policy. This situation is caused by the following reasons: 1) The confidence level only affect the variable b in the constraint. 2) Our objective is to maximize the return of portfolio and the optimal policy satisfies constraints under three confidence levels.

c) What is the impact of the target on the monthly return on the V@R and on the optimal policy?

Setting the target as maximizing portfolio return, the optimal policy and return will not change even when we change the confidence level, while the value of V@R will change. The lower confidence level (larger α), the smaller V@R.

2. CV@R Optimization

a) What is the optimal policy for beta of 0.9, 0.95 and 0.99? What is the CV@R, V@R, and expect return of the optimal policies?

	0.9	*0.95*	*0.99*
AAPI	0.073	0.066	0.057
MCD	0.176	0.176	0.193
QQQ	0.268	0.257	0.233
SPY	0.481	0.491	0.501
TLT	0.001	0.009	0.016
CV@R	0.005	0.009	0.016
V@R	-3.66E-04	0.004	0.012
Return	0.016	0.016	0.015

b) How does the number of scenarios influence the previous solution?

Taking confidence level = 0.95 as an example,

Scenarios	*10*	*1000*	*10000*	*20000*
AAPI	0	0.075	**0.066**	0.063
MCD	0.027	0.159	**0.176**	0.179
QQQ	0.654	0.212	**0.257**	0.265
SPY	0.197	0.506	**0.491**	0.493
TLT	0.121	0.048	**0.009**	0
CV@R	-0.002	0.009	**0.009**	0.009
V@R	-0.002	0.004	**0.004**	0.004
Return	0.017	0.015	**0.016**	0.016

When the number of scenarios is not extremely small (i.e. >100), the value of CV@R and V@R fluctuate little, while both values decrease sharply even to negative value, when the number of scenarios is less than 100.

c) You believe that the historical correlations between the security returns and the SPY are not representative. Choose a correlation matrix that, in your view better represents the future behavior of the stock returns and re-address question A)

	0.9	*0.95*	*0.99*
AAPI	0.042	0.028	0.018
MCD	0.143	0.150	0.153
QQQ	0	0	0
SPY	0.755	0.760	0.764
TLT	0.059	0.062	0.065
CV@R	0.019	0.024	0.034
V@R	0.010	0.017	0.028
Return	0.012	0.012	0.012

We choose QQQ as the new correlation benchmark.

With the new correlation matrix, the optimal solutions, the CV@R, the V@R and the return all changed, which indicates that the correlation among securities matter a lot in the portfolio choice and risk management.