

## **Task 1**

A. The VAR and optimal policy as follows :

Alpha	VAR	AAPL	MCD	QQQ	SPY	TLT
0.01	-0.046	0.197	0.051	0.454	0.298	0
0.05	-0.035	0.197	0.051	0.454	0.298	0
0.1	-0.03	0.197	0.051	0.454	0.298	0

B. What is the different between the risk-averse and the risk-neutral optimal policies?

In general, risk averse investors are those who prefers lower returns with known risks rather than higher returns with unknown risks whereas risk neutral investors are indifferent to risk when making an investment decision.

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

When the target mean annual return on portfolio changed from 0.02 [to 0.01](#), VAR has improved with slight changes in optimal policy.

- VAR improves to from -0.03 to **-0.018** when the probability of the loss exceeding the V@R) of 10%
  - Optimal Policy : mcd 0.169, qqq 0.175, spy 0.549, tlt 0.108
- VAR improves to from -0.035 to **-0.021** when the probability of the loss exceeding the V@R) of 5%
  - Optimal Policy : mcd 0.185, qqq 0.183, spy 0.588, tlt 0.043
- VAR improves to from -0.046 to **-0.029** when the probability of the loss exceeding the V@R) of 1%
  - Optimal Policy : mcd 0.185, qqq 0.183, spy 0.588, tlt 0.043

## **Task 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?

Beta	CVAR	VAR	AAPL	MCD	QQQ	SPY	TLT
0.9	0.005	-3.6E-4	0.073	0.176	0.268	0.481	0.001
0.95	0.009	0.004	0.066	0.176	0.257	0.491	0.009
0.99	0.016	0.012	0.057	0.193	0.233	0.501	0.016

B. How does the number of scenarios influence the previous solution?

# of Scenarios	Beta	CVAR	VAR	AAPL	MCD	QQQ	SPY	TLT
10	0.95	-0.002	-0.002	0	0.025	0.610	0.184	0.181
100	0.95	0.010	0.008	0.126	0.091	0.161	0.570	0.053
1000	0.95	0.009	0.004	0.075	0.159	0.212	0.506	0.048
10000	0.95	0.009	0.004	0.066	0.176	0.257	0.491	0.009
100,000	0.95	0.009	0.004	0.061	0.174	0.260	0.466	0.039

As the number of scenarios increase with Beta at 0.95, it shows that

- CVAR and VAR reduces and reach its optimal value.
- If exclude 10 scenarios, the fraction of portfolio invested in asset AAPL, SPY, TLT reduced while MCD and QQQ increased.

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 behaviour of the stock returns and re-address question A).

Selecting the right portfolio that better represent the securities return will be able to improve the optimal policy to maximise higher expected return while reducing risk exposure.

#### Using MCD as reference

```

---- 82 VARIABLE x.L fraction of portfolio invested in asset i
      spy 0.494, aapl 0.121, qqq 0.292, tlt 0.093
---- 82 VARIABLE e_return.L = 0.016 expected return of the portfolio
      VARIABLE var.L = 0.010 value at Risk
      VARIABLE cvar.L = 0.017 conditional value at risk

```

#### using TLT as reference

```

---- 82 VARIABLE x.L fraction of portfolio invested in asset i
      spy 0.474, aapl 0.095, mcd 0.123, qqq 0.308

---- 82 VARIABLE e_return.L = 0.017 expected return of the portfolio
      VARIABLE var.L = 0.008 value at Risk
      VARIABLE cvar.L = 0.015 conditional value at risk

```