MA 575 : Market and Credit Risk Models and Management Presentation

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Agenda

- Introduction
- Portfolio
- Problem Statement
- Conclusion

RISKIFY
NO RISK NO GAIN

Riskify - Your risk our model

Company

- We are a team of highly qualified risk management analysts, who have graduated top of the class in our field. Our company provides comprehensive risk management and hedge fund related services for your portfolio.

What We Do

- At our company, we specialize in risk management and hedge fund related services. We offer a range of solutions designed to help our clients navigate the complex and ever-changing world of finance.

See Our Work

- Don’t believe us? See our work in this presentation of how we handled a portfolio and applied risk management strategies to optimise the portfolio

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RISKIFY
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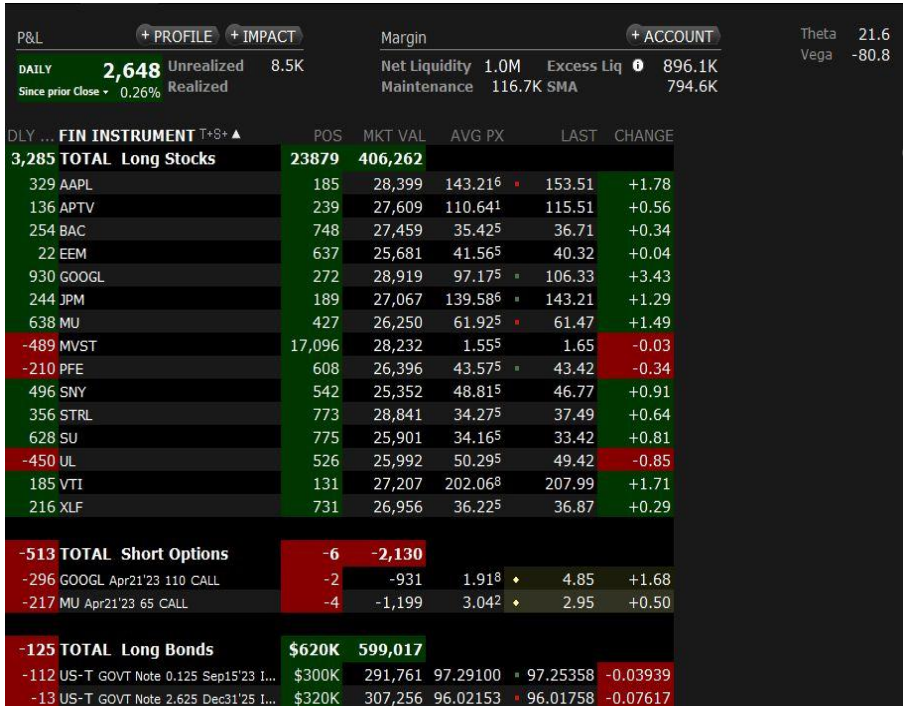
At Riskify, we use a variety of risk management strategies to ensure that our clients' portfolios are protected against market volatility and other uncertainties. These strategies include diversification, hedging, and active management.

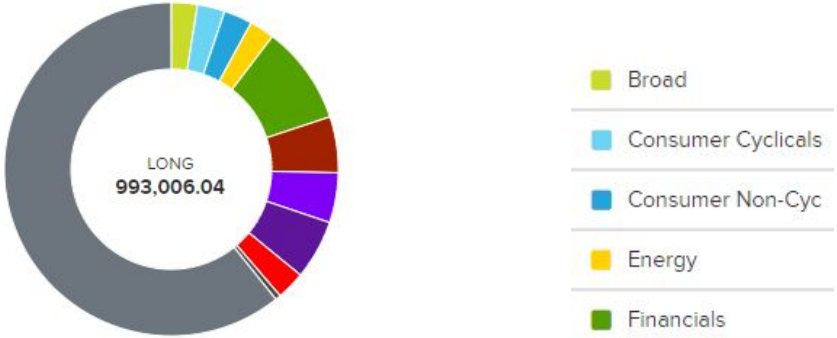
- We have invested a million dollars in a diverse portfolio that comprises of various industries and financial instruments.

- Our portfolio consists of a mix of 12 Equities, 3 ETFs, 3 Derivatives, and 2 Bonds. Each of these investments has been carefully selected which emphasizes risk management and diversification.

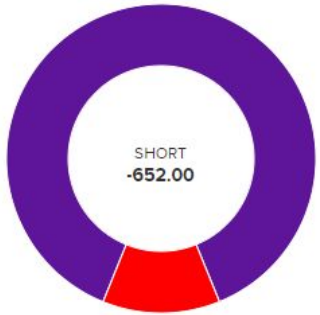


At Riskify, we use a variety of risk management strategies to ensure that our clients' portfolios are protected against market volatility and other uncertainties. These strategies include diversification, hedging, and active management.

- Our objective is to minimize the risk associated with our portfolio while maximizing returns for our clients.



- If you are looking for a risk-managed investment strategy that can help you achieve your financial goals, look no further than Riskify.



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RISKIFY
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Problem Statement 1 A :
Calculating Loss Approximations (VaR & ES)

Modelling the log-returns of the underlying assets and any other risk factor changes using a multivariate normal distribution to calculate loss approximations (VaR & ES)

- In order to estimate the loss approximations we need to first calculate the mean and the standard deviation of the whole portfolio of all the different financial instruments i.e. Stocks, Bonds and ETFs

```
# Calculate VaR for the portfolio for 0.95
VaR_n_1 = norm.ppf(1 - alpha1) * sig_h + portfolio_mean
```

Confidence Level | Standard Deviation | Mean

- We would be modelling the loss approximation by assuming the distribution to be normal and we will see the results.

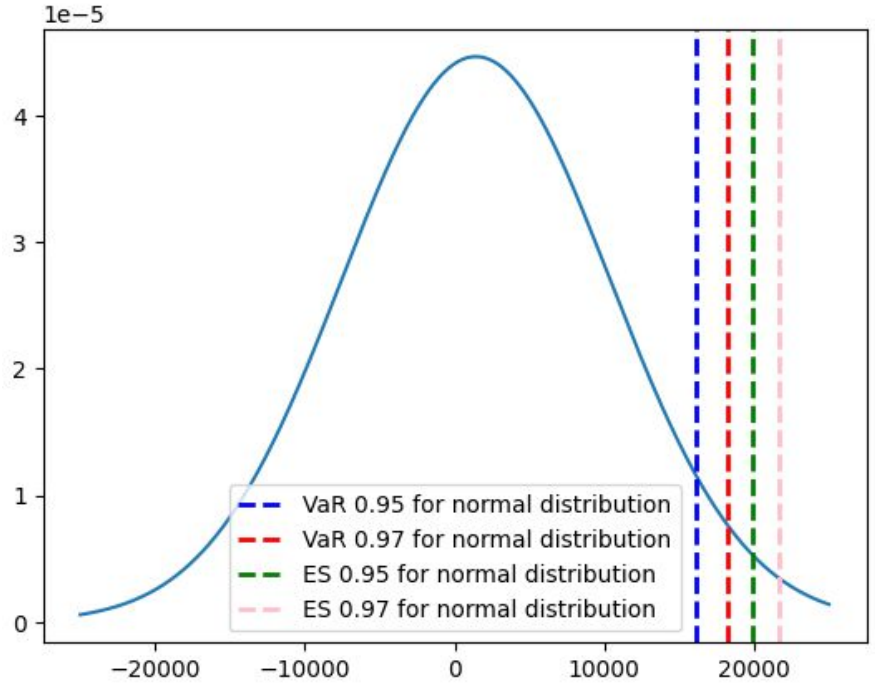
```
# Calculate Expected Shortfall (CVaR) for 95% confidence level
ES_n1 = (1 / (1 - alpha1)) * (norm.pdf(norm.ppf(alpha1)) * sig_h) + portfolio_mean
```

Confidence Level | Standard Deviation | Mean

We calculate the VaR & ES at two confidence level 95% and 97%

Expected Shortfall (ES) considers the more extreme losses that are not captured by the Value At Risk (VaR) indicating portfolio has potential for extreme losses.

	VaR	ES
At 95%	$ 16137.02	$ 19875.23
At 97%	$ 18247.76	$ 21712.33



Modelling the log-returns of the underlying assets and any other risk factor changes using a multivariate t distribution to calculate loss approximations (VaR & ES)

- In order to estimate the loss approximations we need to first calculate the mean and the standard deviation of the whole portfolio of all the different financial instruments i.e. Stocks, Bonds and ETFs

```
# Calculate VaR
var_t_1 = (t_stat_1 * std_dev) + mean
```

Confidence Level — Standard Deviation — Mean

- We would be modelling the loss approximation by assuming t distribution and we will see the results.

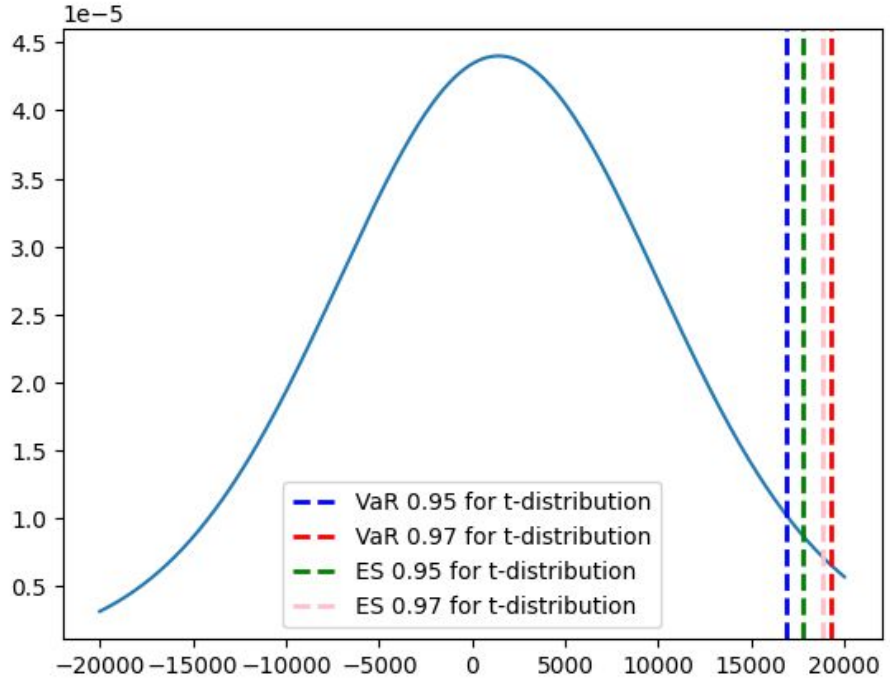
```
# Calculate Expected Shortfall (CVaR) for 95% confidence level
ES_t_1 = ((t.pdf(t.ppf(alpha1, n), n) / (1 - alpha1)) * sig_h_t) + portfolio_mean
```

Confidence Level — Standard Deviation — Mean

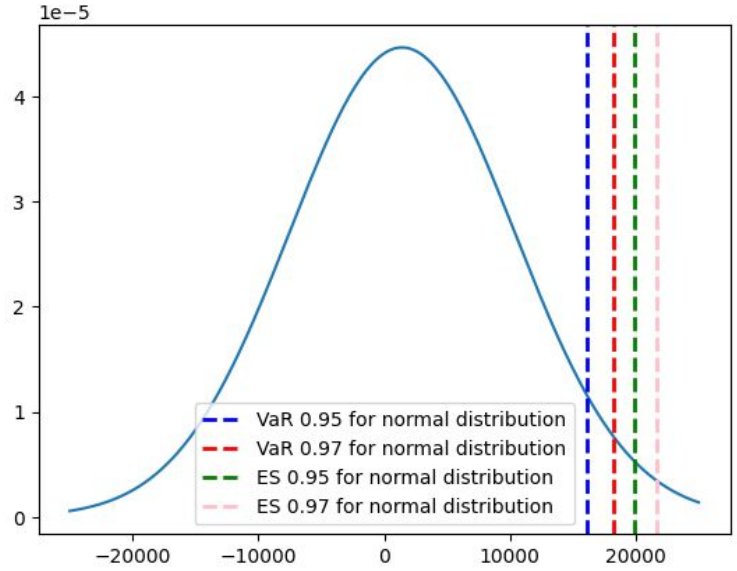
We calculate the VaR & ES at two confidence level 95% and 97%

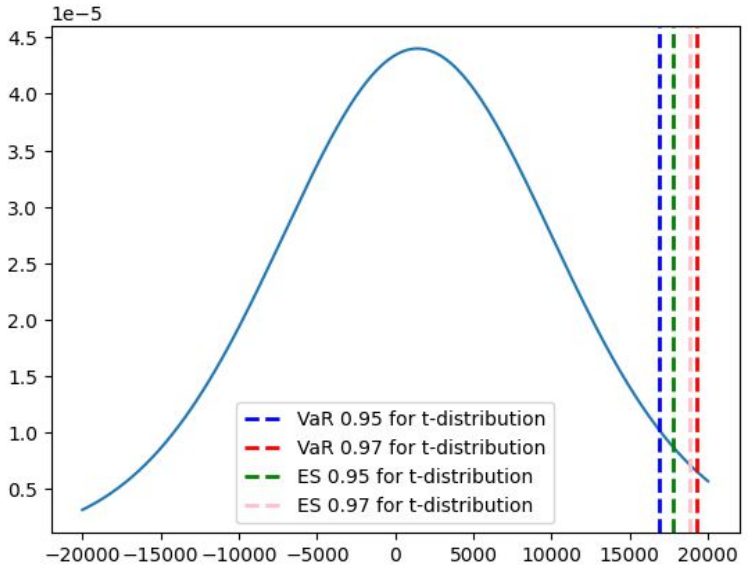
Expected Shortfall (ES) considers the more extreme losses that are not captured by the Value At Risk (VaR) indicating portfolio has potential for extreme losses.

	VaR	ES
At 95%	$ 16890.99	$ 17758.74
At 97%	$ 19314.35	$ 18798.21



At both confidence levels (95% and 97%), the VaR and ES are higher for the t distribution than for the normal distribution. This is due to the fact that the t distribution has fatter tails than the normal distribution, which captures the possibility of more extreme losses.



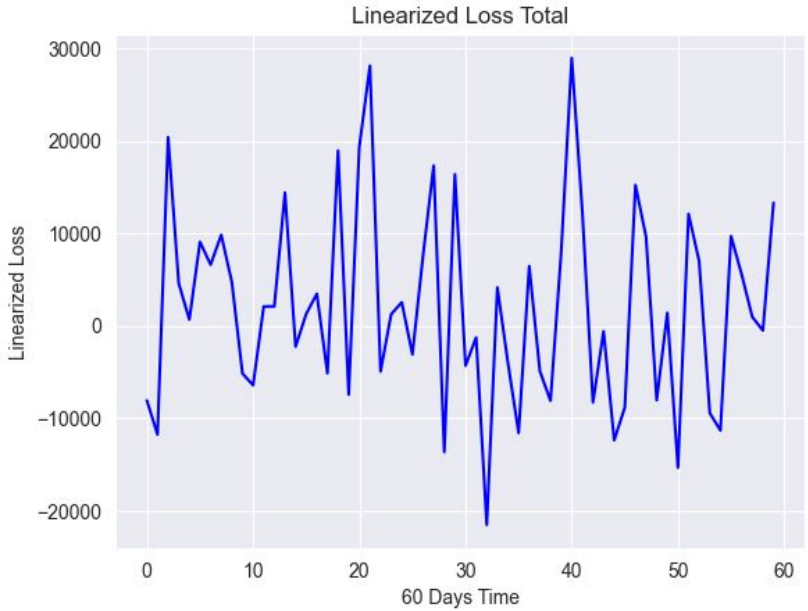


The difference between the VaR and ES estimates is greater at the 97% confidence level compared to the 95% confidence level. This is consistent with the fact that the ES measures the expected loss beyond the VaR, which becomes more significant as the confidence level increases and more extreme losses become more likely.

Problem Statement 1 B : Calculating Linearized Loss

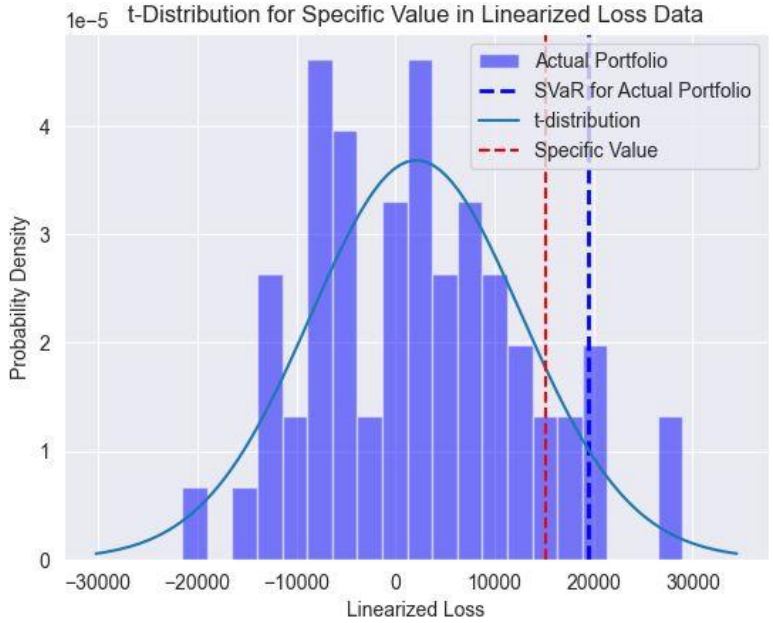
Linearized Loss Of Portfolio = Linearized Loss of Equity + Linearized Loss of Options + Linearized Loss of Bonds

- In order to get linearized loss of the portfolio we need to calculate the daily linearized loss of stocks, options and bonds for 60 days



VaR for t distribution for a specific value can be calculated using the linearized loss data for any actual portfolio

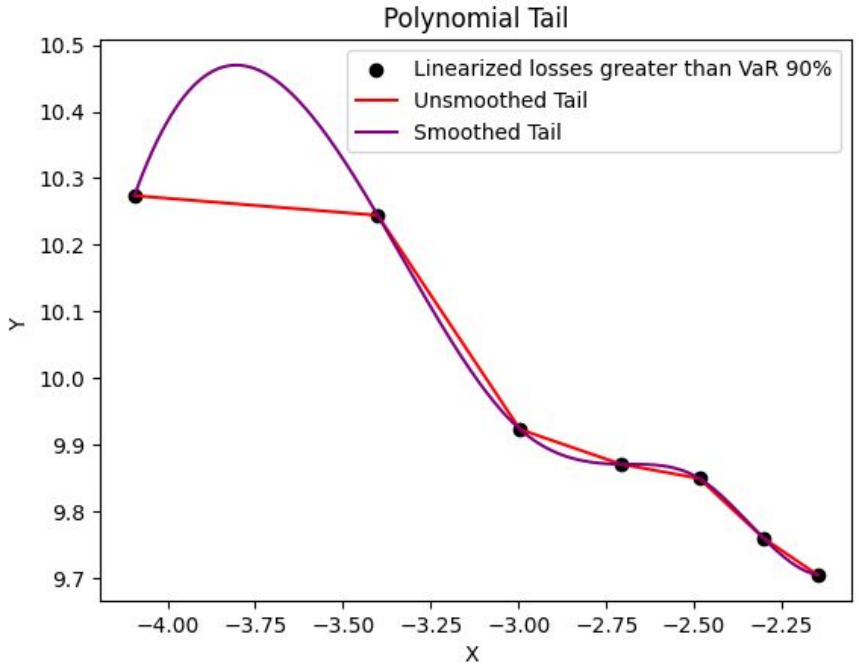
- After finding out the linearized loss we fit this into a t distribution and now we can calculate the VaR for a specific value.



Problem Statement 2 : Polynomial Tail Modelling

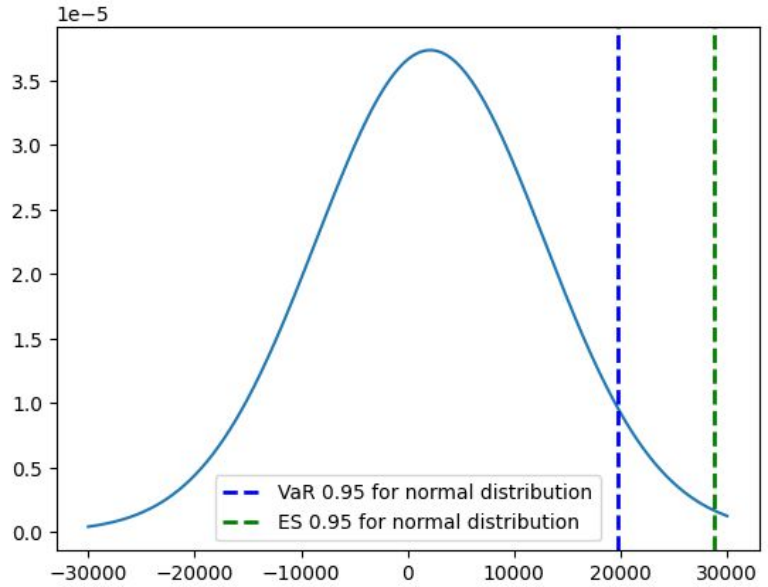
Using this semiparametric model, we can calculate the VaR and ES for the portfolio at a given confidence level

- Sort the linearized losses in ascending order and select the data beyond 90% confidence level
- This data is often referred to as the "extreme value" or "tail" of the distribution
- Model the tail of the distribution, we can use a semiparametric approach that combines a parametric distribution with a nonparametric estimation of the tail behavior



Analyzing the tail of the loss distribution using a semiparametric approach, we can gain insights into the potential losses of a portfolio and inform risk management decisions.

	VaR	ES
At 95%	$ 19670.20	$ 28713.23



If the VaR and ES estimates are higher than expected, we may want to consider adjusting our position sizes or implementing hedging strategies to reduce our exposure to potential losses

Problem Statement 3 : Stress Test (Scenario 1)

Modelling the log-returns of the underlying assets and any other risk factor changes using a multivariate normal vs t distribution to calculate loss approximations (VaR & ES) for 2008 housing loan crash period

Normal distribution

	VaR	ES
At 95%	$ 25285.96	$ 23329.11

T distribution

	VaR	ES
At 95%	$ 26643.09	$ 28205.02

At both confidence levels (95% and 97%), the VaR and ES are higher for the t distribution than for the normal distribution. This is due to the fact that the t distribution has fatter tails than the normal distribution, which captures the possibility of more extreme losses.

The difference between the VaR and ES estimates is greater at the 97% confidence level compared to the 95% confidence level. This is consistent with the fact that the ES measures the expected loss beyond the VaR, which becomes more significant as the confidence level increases and more extreme losses become more likely.

Problem Statement 3 : Stress Test (Scenario 2)

Modelling the log-returns of the underlying assets and any other risk factor changes using a multivariate normal vs t distribution to calculate loss approximations (VaR & ES) for 2020 COVID - 19 period

Normal distribution

	VaR	ES
At 95%	$ 18634.97	$ 30230.33

T distribution

	VaR	ES
At 95%	$ 19581.74	$ 20671.39

At both confidence levels (95% and 97%), the VaR and ES are higher for the t distribution than for the normal distribution. This is due to the fact that the t distribution has fatter tails than the normal distribution, which captures the possibility of more extreme losses.

The difference between the VaR and ES estimates is greater at the 97% confidence level compared to the 95% confidence level. This is consistent with the fact that the ES measures the expected loss beyond the VaR, which becomes more significant as the confidence level increases and more extreme losses become more likely.

Problem Statement 3 : Stress Test (Scenario 3)

Modelling the log-returns of the underlying assets and any other risk factor changes using a multivariate normal vs t distribution to calculate loss approximations (VaR & ES) for current period

Normal distribution

	VaR	ES
At 95%	$ 10341.06	$ 13032.95
At 97%	$ 11861.01	$ 14355.85

T distribution

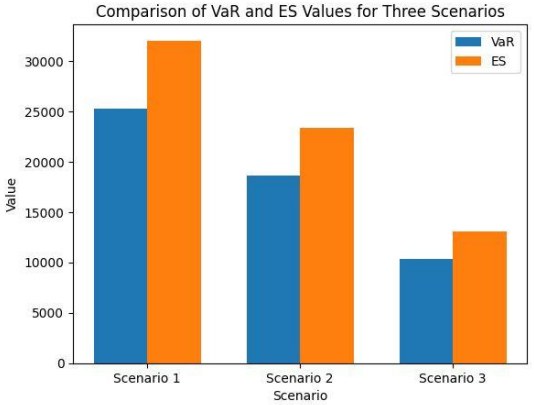
	VaR	ES
At 95%	$ 21511.62	$ 45861.56
At 97%	$ 25137.83	$ 41585.05

At both confidence levels (95% and 97%), the VaR and ES are higher for the t distribution than for the normal distribution. This is due to the fact that the t distribution has fatter tails than the normal distribution, which captures the possibility of more extreme losses.

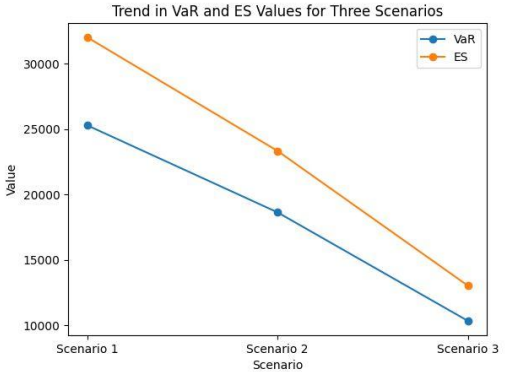
The difference between the VaR and ES estimates is greater at the 97% confidence level compared to the 95% confidence level. This is consistent with the fact that the ES measures the expected loss beyond the VaR, which becomes more significant as the confidence level increases and more extreme losses become more likely.

The lower VaR and ES values in the current period could be attributed to the overall stable economic conditions, low inflation rates, and low interest rates compared to the other two scenarios

- The 2008 housing loan crash period was characterized by a major financial crisis, the VaR and ES values were significantly higher than those of the other two scenarios, indicating higher risk and potential losses in the portfolio.



- The VaR and ES values for the 2020 Covid period were also higher than the current period, reflecting the economic uncertainty and market volatility caused by the pandemic.

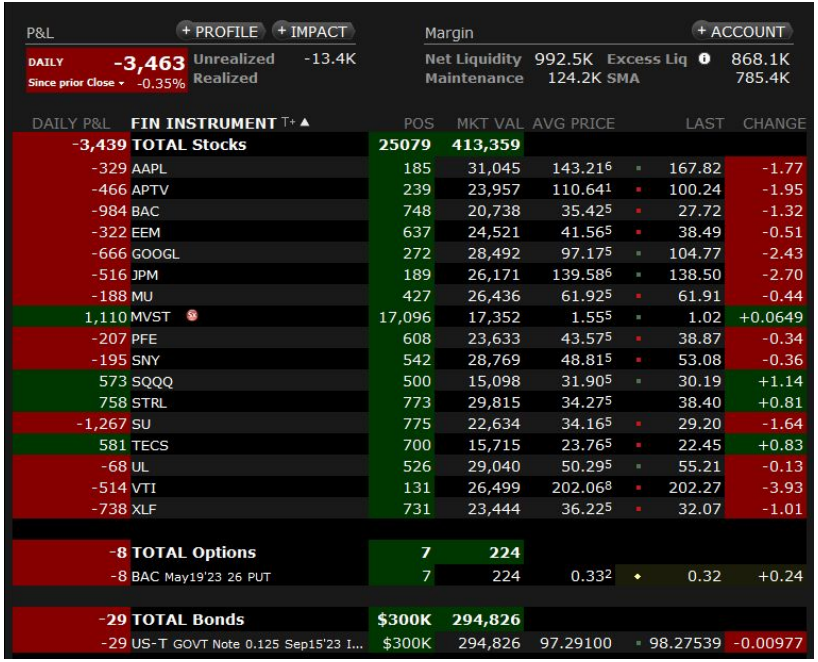


Problem Statement 4 :
Risk Reduction of the Portfolio

Due to the current market conditions around the Silicon Valley Bank collapse, we updated our portfolio by hedging current open positions with the addition of new positions, such as options to reduce the risk of our portfolio by 20%

- In order to reduce the risk of our portfolio by 20% we hedged our current open positions by buying a put option of the underlying asset (BAC) and invested in a new ETF (SQQQ & TECS) to offset the risk.

- SQQQ & TECS are both leverage inverse ETFs that helps the investor to gain profits from a bearing market.



P&L + PROFILE + IMPACT

DAILY -3,463 Unrealized -13.4K
Since prior Close -0.35% Realized

Margin + ACCOUNT

Net Liquidity 992.5K Excess Liq 868.1K
Maintenance 124.2K SMA 785.4K

DAILY P&L	FIN INSTRUMENT	POS	MKT VAL	AVG PRICE	LAST	CHANGE
-3,439	**TOTAL Stocks**	**25079**	**413,359**			
-329	AAPL	185	31,045	143.21⁶	167.82	-1.77
-466	APTV	239	23,957	110.64¹	100.24	-1.95
-984	BAC	748	20,738	35.42⁵	27.72	-1.32
-322	EEM	637	24,521	41.56⁵	38.49	-0.51
-666	GOOGL	272	28,492	97.17⁵	104.77	-2.43
-516	JPM	189	26,171	139.58⁶	138.50	-2.70
-188	MU	427	26,436	61.92⁵	61.91	-0.44
1,110	MVST	17,096	17,352	1.55⁵	1.02	+0.0649
-207	PFE	608	23,633	43.57⁵	38.87	-0.34
-195	SNY	542	28,769	48.81⁵	53.08	-0.36
573	SQQQ	500	15,098	31.90⁵	30.19	+1.14
758	STRL	773	29,815	34.27⁵	38.40	+0.81
-1,267	SU	775	22,634	34.16⁵	29.20	-1.64
581	TECS	700	15,715	23.76⁵	22.45	+0.83
-68	UL	526	29,040	50.29⁵	55.21	-0.13
-514	VTI	131	26,499	202.06⁸	202.27	-3.93
-738	XLF	731	23,444	36.22⁵	32.07	-1.01
-8	**TOTAL Options**	**7**	**224**			
-8	BAC May19'23 26 PUT	7	224	0.33²	0.32	+0.24
-29	**TOTAL Bonds**	**$300K**	**294,826**			
-29	US-T GOVT Note 0.125 Sep15'23 I...	$300K	294,826	97.29100	98.27539	-0.00977

Riskify will hedge your portfolio to suppress the potential losses by carefully analyzing the current economic conditions and choose the best hedging techniques to optimise your portfolio

Before Optimizing

Normal distribution

	VaR	ES
At 95%	$ 8434.2	$ 10473.61
At 97%	$ 9585.73	$ 11475.86

T distribution

	VaR	ES
At 95%	$ 8845.54	$ 9318.94
At 97%	$ 10167.62	$ 9886.04

After Optimizing

Normal distribution

	VaR	ES	% Change
At 95%	$ 6435.88	$ 8043.61	- 23.69
At 97%	$ 7343.67	$ 8833.71	- 23.39

T distribution

	VaR	ES	% Change
At 95%	$ 6760.15	$ 7133.35	- 23.58
At 97%	$ 7802.39	$ 7580.41	- 23.26

Problem Statement 5 : Final Analysis

We track the loss approximations of each portfolio from the time of the inception and compare the actual trends with our model.

- We calculated cumulative loss approximations for a period of 15 weeks on a weekly basis to understand the level of volatility of our portfolio to risk during this period.

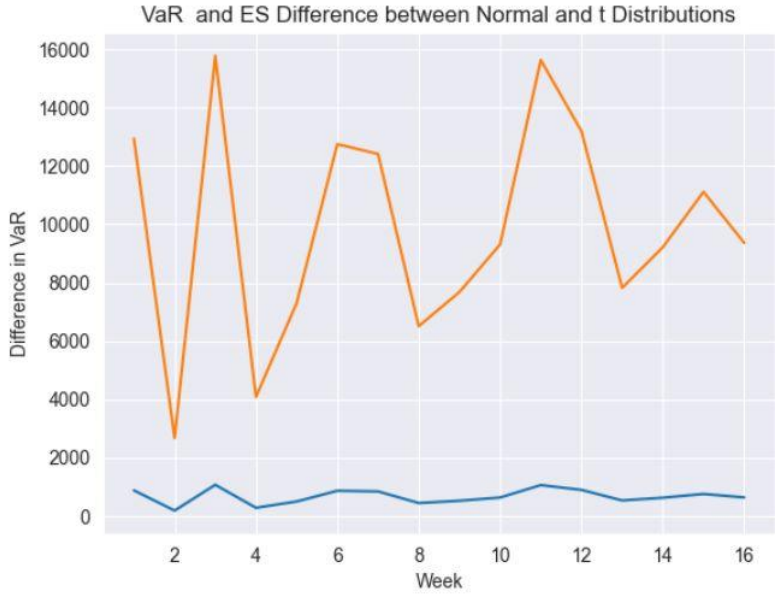
- These values are compared to the current scenario and tracks the current trend of the portfolio and gives a weekly estimate of loss approximations.

	Week	VaR_95_normal	VaR_95_t	ES_95_normal	ES_95_t
0	1	15545.037619	16418.432100	18525.323761	31472.763764
1	2	6338.946798	6518.977201	6953.264985	9622.085191
2	3	15971.842957	17036.441691	19604.575845	35386.480290
3	4	5186.973437	5462.481471	6127.090181	10211.297051
4	5	10386.084264	10878.492792	12066.331100	19365.930558
5	6	10181.624239	11041.972064	13117.391248	25871.424053
6	7	10663.476189	11501.122525	13521.778851	25939.278538
7	8	5180.131319	5619.162308	6678.237846	13186.553978
8	9	9342.577216	9860.574330	11110.140045	18789.071729
9	10	3151.467987	3779.502755	5294.512577	14604.672719
10	11	14601.390752	15656.510411	18201.778169	33843.162204
11	12	13776.572450	14666.902066	16814.646395	30013.137501
12	13	10661.175755	11188.828289	12461.685799	20283.752094
13	14	5838.142927	6459.922833	7959.844036	17177.280383
14	15	12907.549439	13657.448955	15466.433407	26583.150084
15	16	11300.616123	11932.349667	13456.282054	22821.273868

ES values are varying significantly from week to week compared to the VaR values, it is important to carefully examine the portfolio's risk profile and identify any potential areas of weakness

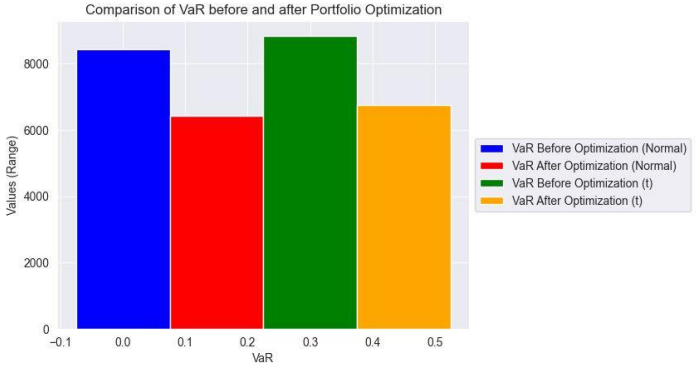
- The significant variation in ES values compared to VaR values could suggest that the portfolio is exposed to more tail risk, which is the risk of rare and extreme events.

- It also suggests that the portfolio is not well diversified. By diversifying the portfolio across different asset classes and sectors, investors can reduce the risk of large losses in any single asset or sector

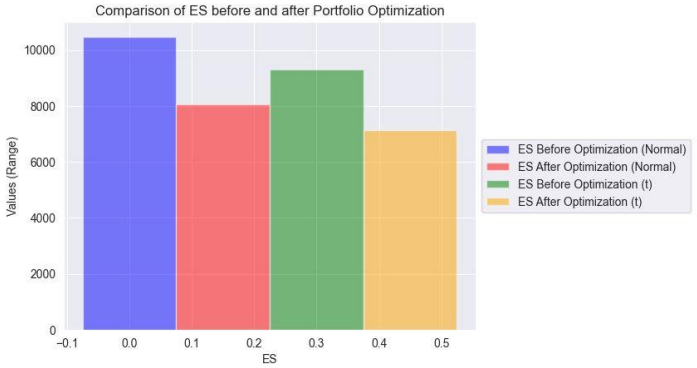


The addition of new ETFs and the purchase of a put option provided us with a more diversified portfolio and reduced our risk exposure, resulting in a significant reduction in estimated losses.

- We reduced our portfolio's risk by purchasing two new ETFs, which provided us with diversification across different sectors and asset classes. Additionally, we purchased a put option for one of our underlying assets, which acted as insurance against potential losses on that asset.



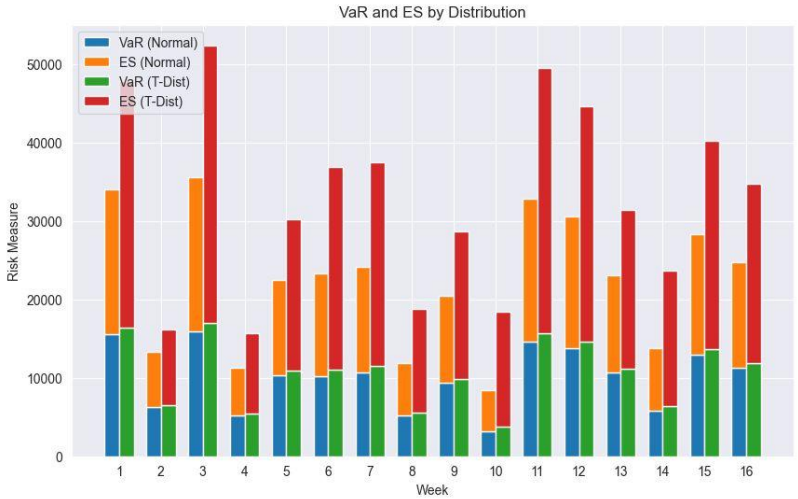
- We tracked our loss approximations before and after implementing these risk reduction measures and saw a significant reduction in our estimated losses. We have a chart graph that clearly shows this reduction and provides evidence of our risk reduction.



Stacked histogram of the value of ES and VaR for 16 weeks can provide valuable insights into the risk profile of the portfolio and the effectiveness of risk management measures.

- The stacked histogram provides insight into the risk tolerance of the portfolio. Wherever the values of VaR and ES are consistently high, it suggests that the portfolio is exposed to higher levels of risk

- It also highlights any outliers or extreme values in the data. This helps identify the weeks where the portfolio was exposed to significant levels of risk

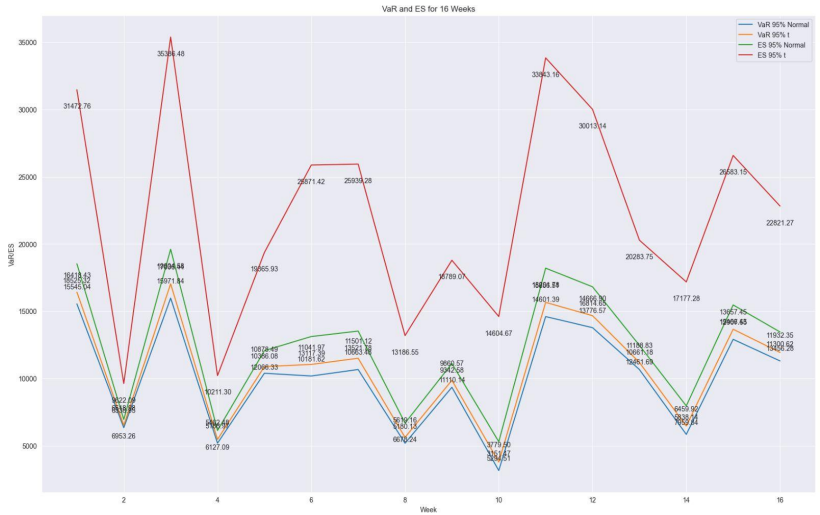


Line graph of the value of ES and VaR for 16 weeks can provide valuable insights into the risk profile of the portfolio and the effectiveness of risk management measures.

- The line graph shows trends in the portfolio's risk profile over time. For example, if the values of VaR and ES increase or decrease over time, it suggests that the portfolio is becoming more or less risky.

- It helps identify the weeks where risk management measures, such as diversification or hedging, were successful in reducing the portfolio's risk.

- It helps identify any correlations between the values of ES and VaR. The values of the two risk measures move in tandem, it suggests that the portfolio is well-diversified and that risk management measures are effective



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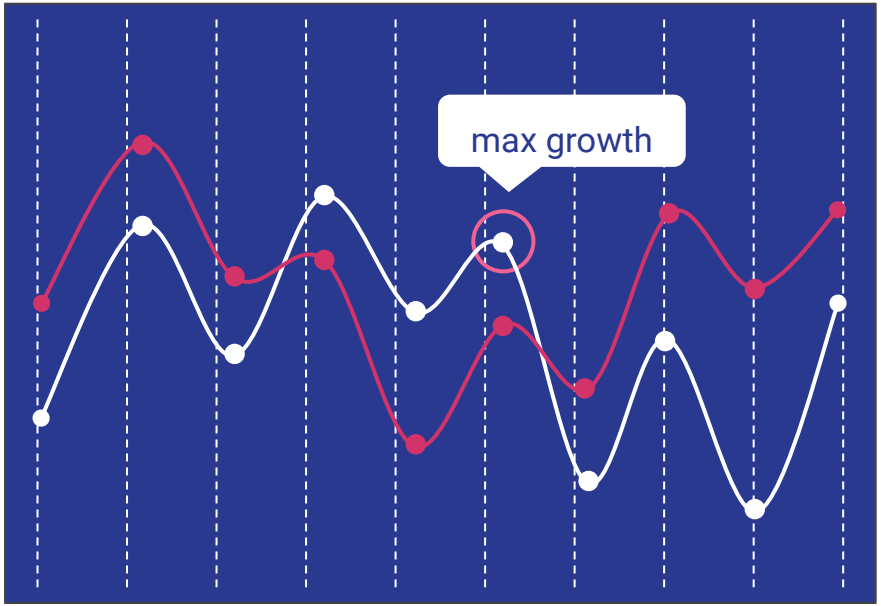
By accurately estimating potential losses and developing a strategy to reduce risk, we were able to protect the portfolio during times of market stress and decrease overall risk by 20%.

- The stress tests that we conducted on our portfolio revealed that it performed well in the 2008 home loan default crash period and the 2020 COVID-19 pandemic crash, which were both significant market events
- We were also able to successfully reduce the risk of our portfolio by 20% by adding two ETFs and one put option of an underlying asset.
- By generating VaR and ES calculations on a weekly basis, investors can ensure that their portfolios remain compliant with these regulations.



Me optimizing risk for my portfolio

Hiring Riskify to optimize risk for my portfolio

Thank You!