Homework 8

1. Download and calculate daily returns

We first read the stock data from `AMS_Homework8_data.csv` and compute log returns using `returns = diff(log(prices));`.

The dataset includes 4 stocks: AAPL (asset #1), MSFT, GOOGL, and AMZN (assets #2, 3, 4).

2. Perform CVaR regression on asset #1 (α = 0.8)

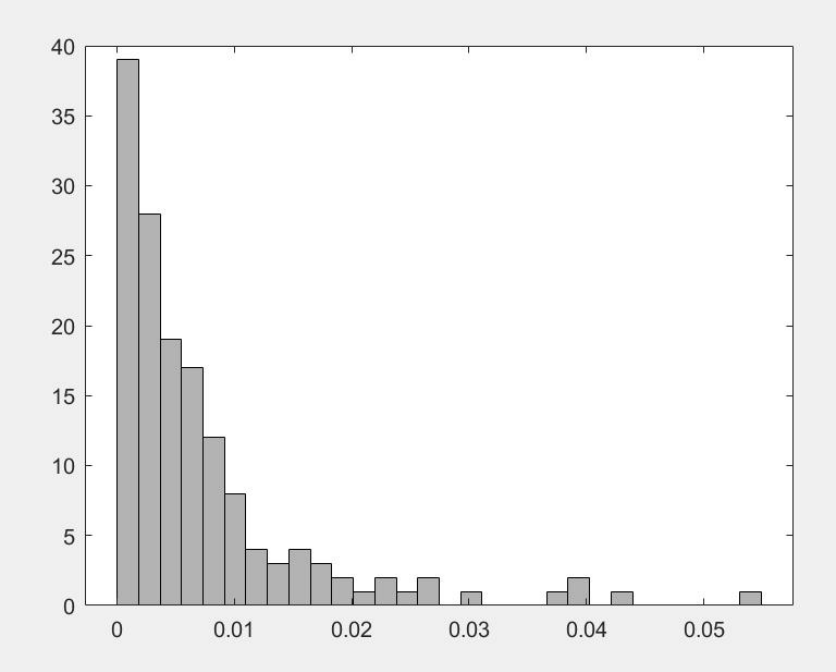
AAPL returns are used as the dependent variable, and MSFT, GOOGL, and AMZN returns are used as independent variables.

Results:

```
Intercept = 0.431323
CVaR (α = 0.8) = 0.447241
```

3. Plot histogram of residuals

We plot the histogram of tail residuals from the CVaR regression.



Observation: The distribution is right-skewed, indicating that extreme negative losses are rare but present.

4. Fit GPD using MLE

We fit a Generalized Pareto Distribution (GPD) to the tail losses using Maximum Likelihood

Estimation (MLE) and Harmonic method.

Function used: `tsallis_harmonik_params_loss`

5. Report GPD parameters

```
Mu = 0.007339
Kappa (MLE) = 0.819733
Kappa (Harmonic) = 0.830455
```

6. Predict CVaR of asset #1 using returns of assets #2, 3, 4

We use the return of MSFT, GOOGL, and AMZN on day 100 to predict the loss of AAPL using the fitted CVaR regression model.

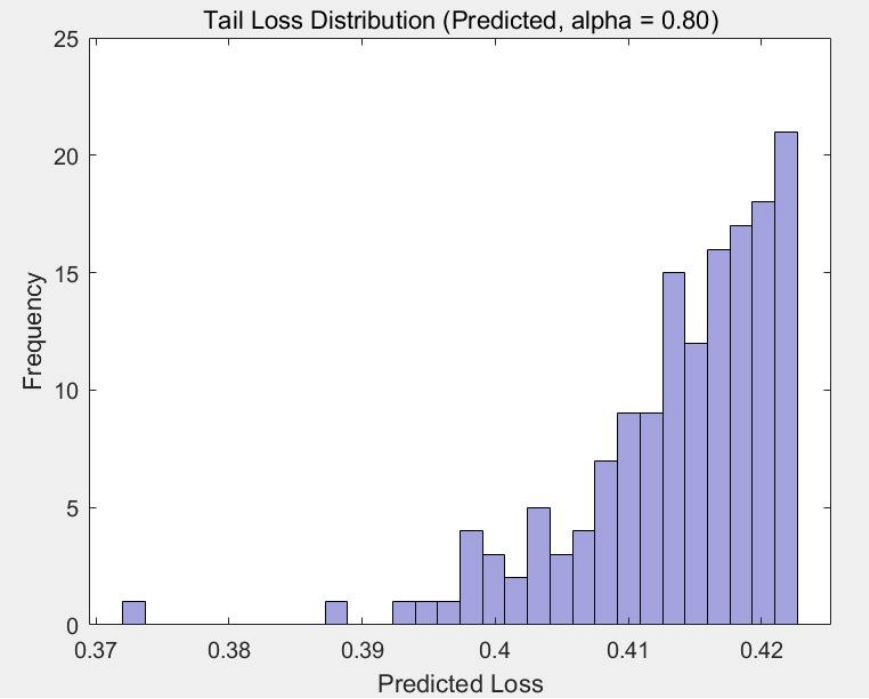
Result:

```
Predicted loss of AAPL on day 100 = 0.444042
```

7. Show predicted tail loss distribution

All return data are used to compute predicted losses from the CVaR regression model.

Tail losses (below VaR) are extracted and plotted.



Observation: The distribution is concentrated around 0.41, indicating that most predicted extreme losses are relatively stable and close in value.