- **Organizational Matters:**

  - **Projects**

- **Session 5:**

  - **GARCH**

  - **DCC-GARCH**

  - **COPULA**

  - **COPULA-GARCH**

SESSION 5:

THE GARCH-MODEL:

KEY TAKEAWAYS:

- Generalized Autoregressive Conditional Heteroskedasticity, or GARCH, is a model that incorporates a moving average component together with the autoregressive component.

- Specifically, the model includes lag variance terms together with lag residual errors from a mean process.

- The introduction of a moving average component allows the model to both model the conditional change in variance over time as well as changes in the time-dependent variance.

- As such, the model uses two parameters "p" and "q" that describes the number of lag variance terms:
  - **p**: The number of lag variances to include in the GARCH model.
  - **q**: The number of lag residual errors to include in the GARCH model.

- A generally accepted notation for a GARCH model is to specify the GARCH() function with the p and q parameters GARCH(p, q); for example GARCH(1, 1) would be a first order GARCH model.

THE DCC-GARCH-MODEL:

KEY TAKEAWAYS:

- Generalizes the volatility and variance terms to multivariate setting
- Think about it as a nested approach by decomposing each individual component properly
  - CCC – Constant-Conditional-Correlation
  - DCC – Dynamic-Conditional-Correlation
- Use your favorite GARCH-model for estimating the individual time series parameters

COPULA:

KEY TAKEAWAYS:

- Sklar's Theorem is the foundation of Copula Theory

- Represent multivariate distributions via their dependence structure and marginals
  - Pearson correlation (potentially flawed)
  - Spearman correlation (ranks)
  - Kendall's Tau (pairs)

- Parametric families i.e. Gauss-Copula or mixtures are possible

- Archimedean copulas as a nested approach

- Vine-copula as a graph-like approach

COPULA-GARCH:

KEY TAKEAWAYS:

- It`s just a more advanced approach for studying time series

- Don`t take the math to serious - try to apply the tools to real datasets

TASKS UNTIL NEXT WEEK

- **Completion of the learning material of week 4: watch the GARCH+Copula-Videos**

- **Complete/prepare the IPython-Notebooks:**
- **i.e. Fourier-Transform: Energy**
- **i.e. Kalman Filtering: Finance-1**
- **i.e. Wavelets: Environment**
- **i.e. Smoothing-Techniques: Finance2**

- Check out the GitHub-Repos:
- https://github.com/kboroz/TimeSeriesPredictionWS2023
- https://github.com/Apress/advanced-forecasting-python

- **Bring questions!**