

## Exercises Week 3

## **1.ARCH and GARCH Models**

- 1. Explain how an ARCH Effect can be detected in a time series. What statistical tests can be used to check for the presence of ARCH effects in residuals?
- 2. Derive the conditional variance equation for an ARCH(1) model and show how it evolves over time.
- 3. Explain how the GARCH(1,1) model generalizes ARCH models. Write down the variance equation for GARCH(1,1) and discuss why GARCH(1,1) is often preferred over ARCH(q) models.



## 2. Modeling Volatility - Practice

TechNOVA Inc. is a new AI-driven tech company whose stock has been highly volatile. Analysts are interested in modeling its volatility. You can find their stock values in the file **TechNOVA\_returns.dta**.

- 1. Using the estimated residuals, test for ARCH effects. What does it imply about the residuals?
- 2. Estimate an ARCH(1) and a GARCH(1,1) model for the TechNOVA stock returns. Compare the estimated coefficients.
- 3. Suppose you also estimate EGARCH and GJR-GARCH models. What features do these models capture that GARCH(1,1) does not? Show the estimation outputs and interpret the results.
- 4. Use the GARCH(1,1) model to forecast the next 5 periods of volatility.
- 5. What does high volatility persistence tell us about the stock market? Why would investors care about forecasting volatility?