SHORT-TERM FORECASTING OF GERMAN ELECTRICITY PRICES USING GARCH IN EVIEWS

1. Overview

Client:

An EU-based energy trading company focused on electricity markets and renewable energy risk management

Objective:

To build a GARCH model in EViews that forecasts the volatility of daily electricity prices in Germany. The client aimed to improve short-term trading decisions and risk exposure estimates within the European Power Exchange (EPEX SPOT).

2. Background

Electricity prices are notoriously volatile, with spikes driven by demand surges, renewable output variability, and geopolitical shocks. The client needed a statistical model capable of capturing time-varying volatility to inform operational hedging and regulatory reporting. EViews was chosen for its efficient GARCH modeling tools and clear output interpretation.

3. Data Summary

Timeframe:

January 2018 – December 2022 (5 years of daily observations)

Variable Modeled:

- **DE_Price_EPEX**: Day-ahead spot electricity price (EUR/MWh)

Data Source:

EPEX SPOT market database

4. Methodology

Software Used:

EViews 13

Model Type:

GARCH(1,1) with normal and t-distribution innovations

Steps in EViews:

1. **Data Import and Preprocessing:**
    - Daily prices imported via .csv
    - Returns generated:

$$r_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$$

2. **Exploratory Analysis:**
    - Detected volatility clustering in squared returns
    - Returns exhibited fat tails and skewness
3. **Stationarity Testing:**
    - ADF test confirmed stationarity of return series
4. **GARCH Estimation:**
    - *Quick > Estimate Equation > ARCH*
    - Mean equation: AR(1)
    - Variance equation: GARCH(1,1)
5. **Model Diagnostics:**
    - ARCH-LM test confirmed model fit
    - Residual plots and Q-tests showed no autocorrelation
    - Compared normal vs. t-distributed errors (t-distribution performed better)

5. Key Results

Parameter	**Value**	**p-value**	**Interpretation**
ω (Constant)	0.0000019	0.000	Baseline volatility
α (ARCH term)	0.082	0.001	Captures response to past price shocks
β (GARCH term)	0.912	0.000	Indicates high volatility persistence (α + β = 0.994)

Forecast Horizon RMSE	0.037	–	Low error in 10-day price volatility prediction

6. Visual Outputs (from EViews)

- Time series of conditional variance
- Actual vs. forecasted volatility plot (10-day rolling window)
- Histogram of standardized residuals
- Q-statistics plot on squared residuals
- Event overlay (e.g., Ukraine crisis, energy cap discussions)

7. Deliverables

- EViews .wf1 file with data, equations, forecasts, and diagnostics
- Forecasting report (16 pages), including:
    - GARCH modeling approach
    - Volatility interpretation and business implications
    - Forecast charts and event-based volatility insights
- PowerPoint summary deck (5 slides) for trading desk presentations

8. Client Application & Outcome

- Model used in daily risk management meetings to set VAR thresholds
- Forecasts fed into short-term hedging algorithms for price-sensitive contracts
- Provided inputs for mandatory market stress test documentation under EU REMIT regulations

9. Strategic Value Delivered

- Delivered a **quantitative tool for real-time volatility forecasting**
- Enabled **risk-adjusted bidding** in wholesale power auctions
- Increased the firm's ability to **proactively manage exposure during crisis periods**