Unemployment Data Analysis

Ryan Honea

Austin Peay State University

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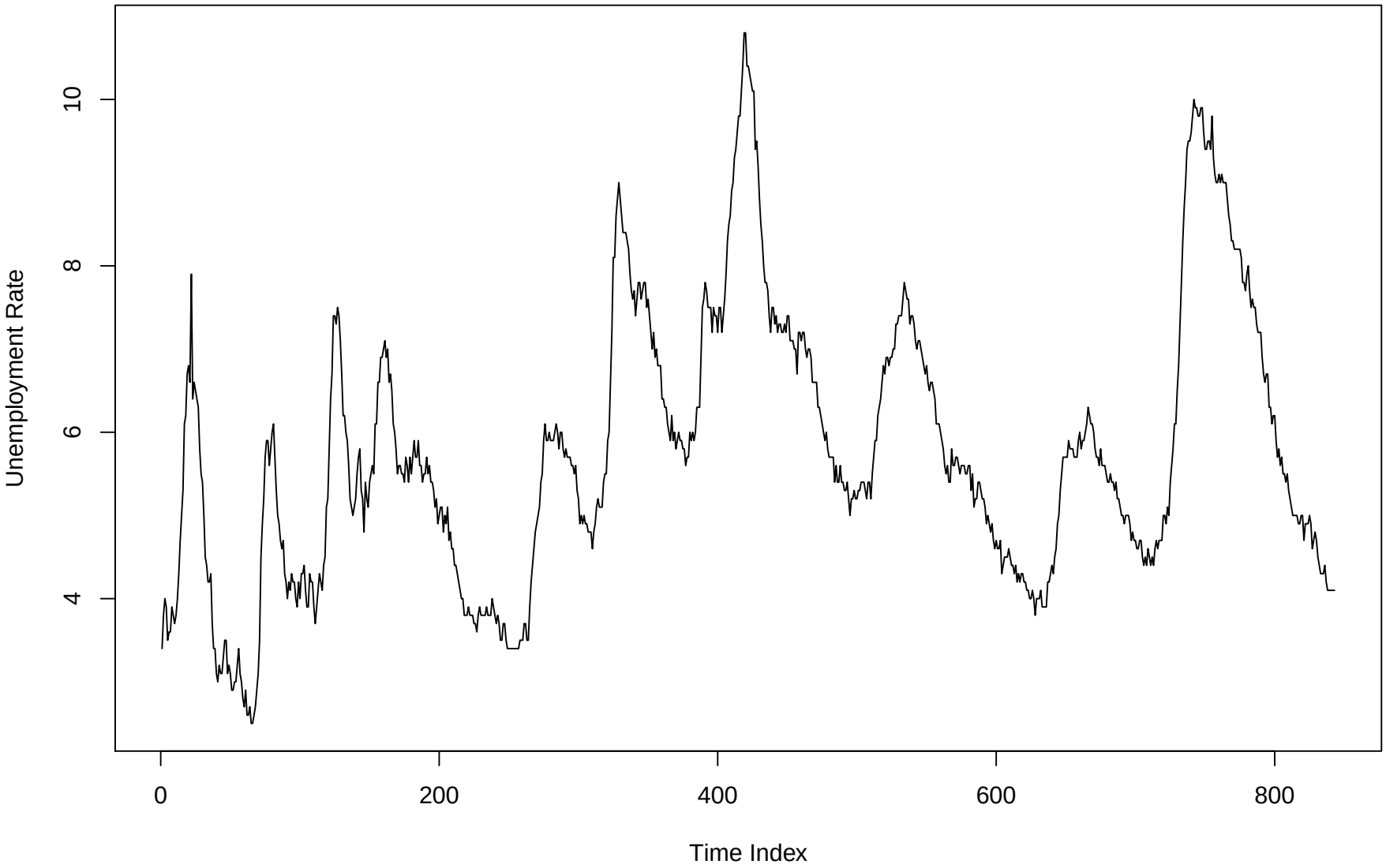
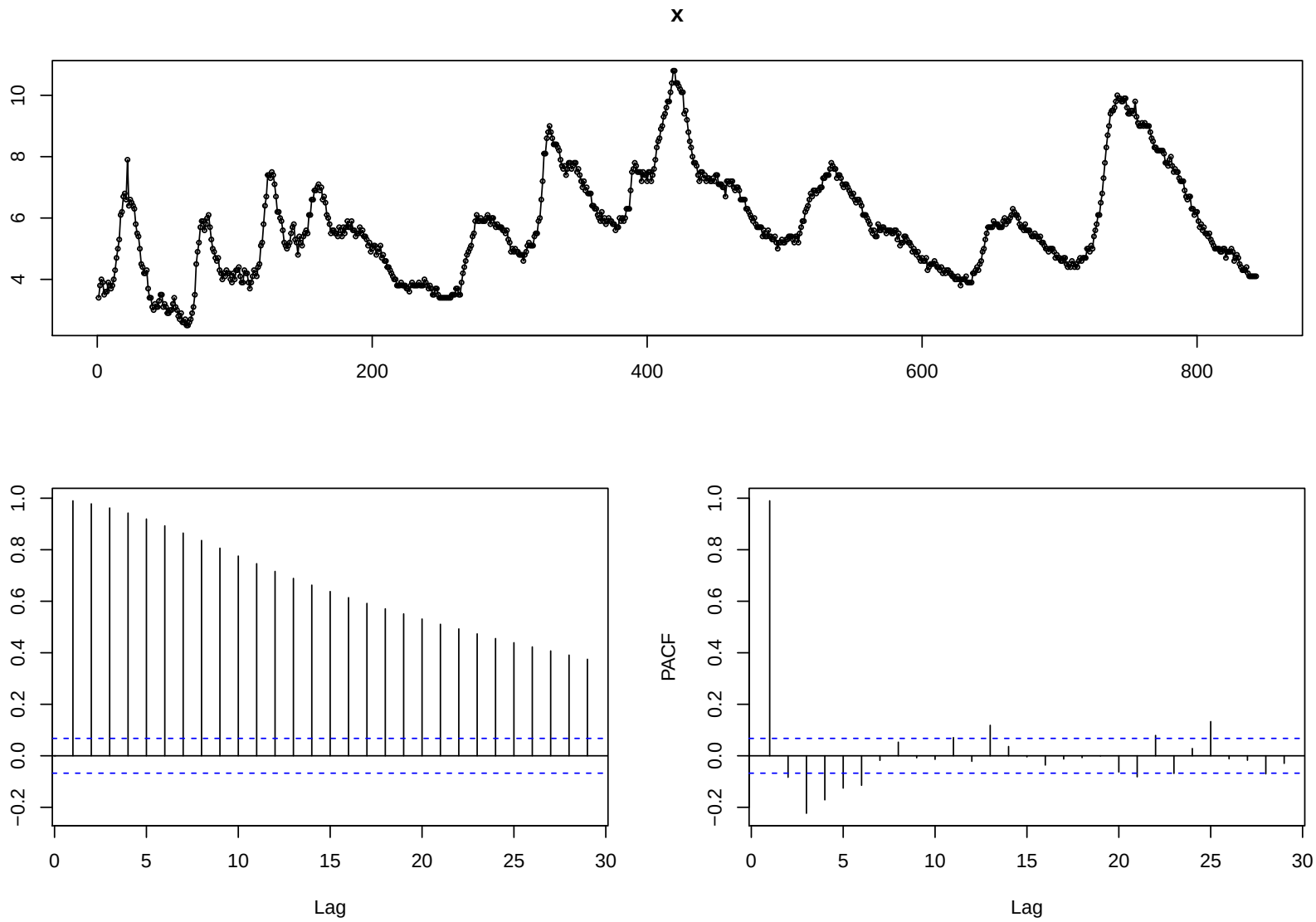
Initial Plotting



Time Series Display



Analysis on Plots

- The Unemployment Data covers January 1948 to March 2018 and thus covers many times of uncertainty
- Jumps from postwar uncertainty, 1980s recessions, 2000s recession
- These periods of volatility lend itself to using an ARMA GARCH model.

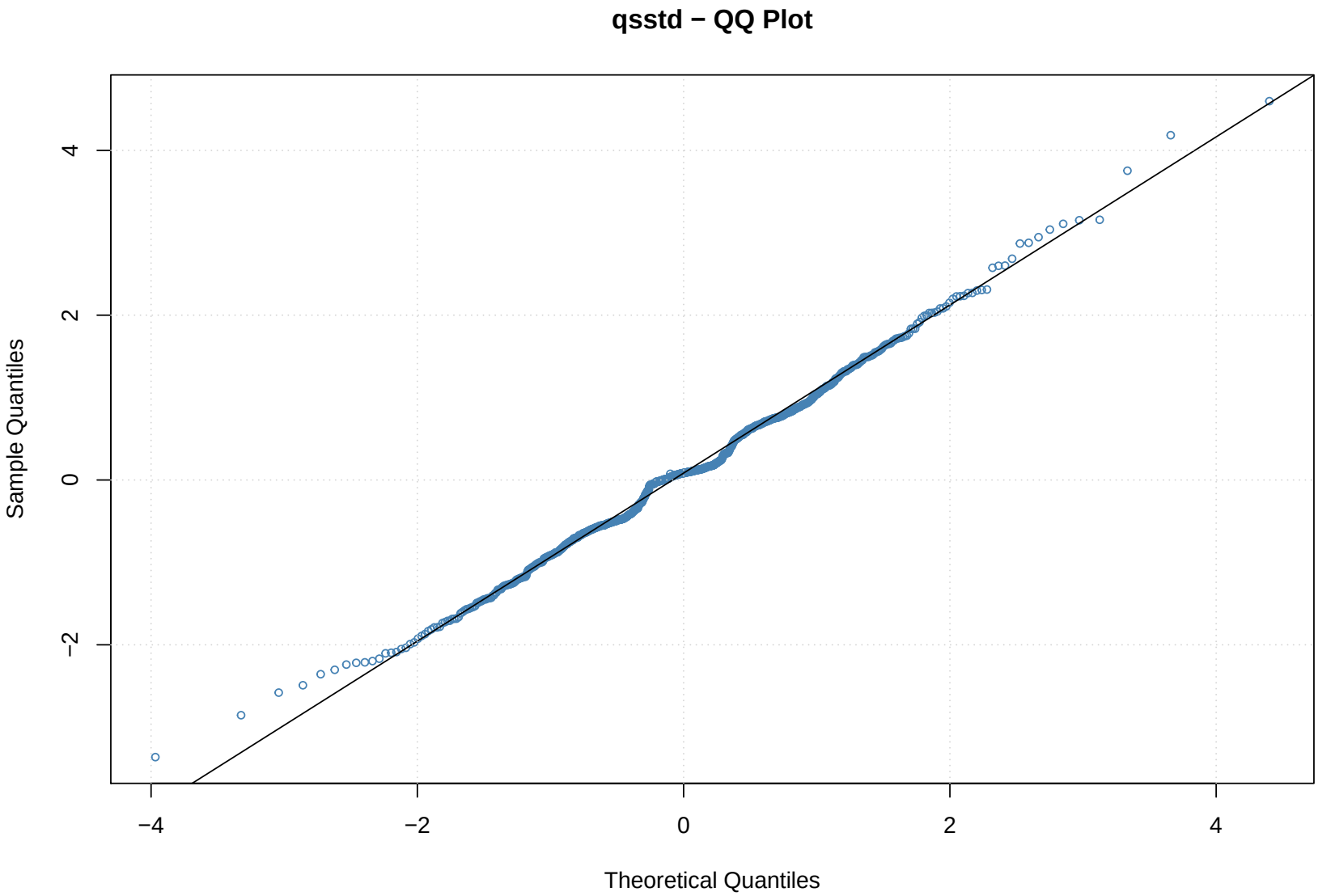
Possible Models

- Possible model are
  - ARMA(1,1) $\times$ Garch (1,1)
  - ARMA(1,1) $\times$ Garch (1,2)
  - ARMA(1,1) $\times$ Garch (2,1)
  - ARMA(1,1) $\times$ Garch (2,2)
- Conditional Distribution used will be skewed student t-distriution

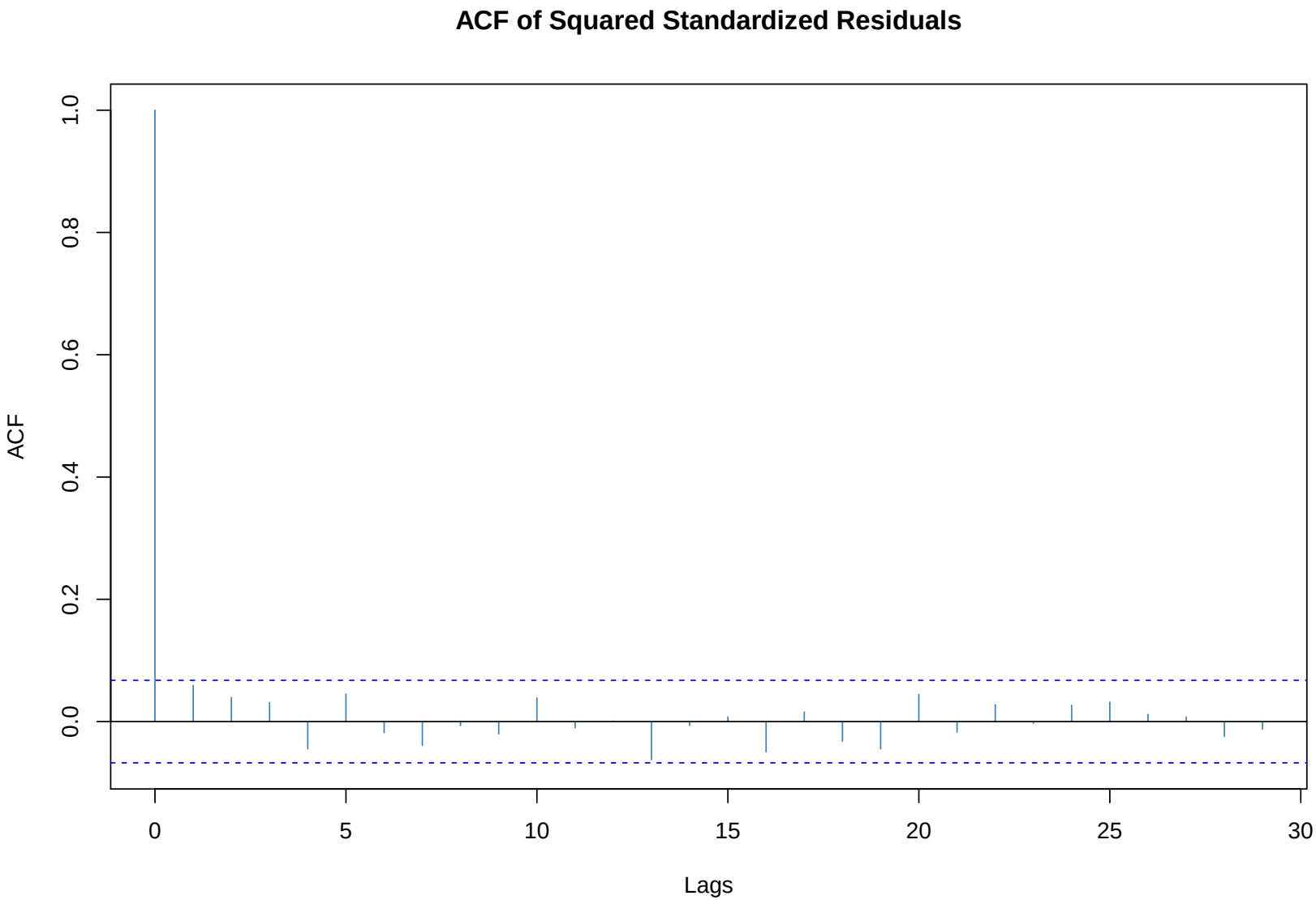
Model Input

```
fit1 <- garchFit(~arma(1,1) + garch(1,1),
                 x, cond.dist = "sstd")
fit2 <- garchFit(~arma(1,1) + garch(1,2),
                 x, cond.dist = "sstd")
fit3 <- garchFit(~arma(1,1) + garch(2,1),
                 x, cond.dist = "sstd")
fit4 <- garchFit(~arma(1,1) + garch(2,2),
                 x, cond.dist = "sstd")
```

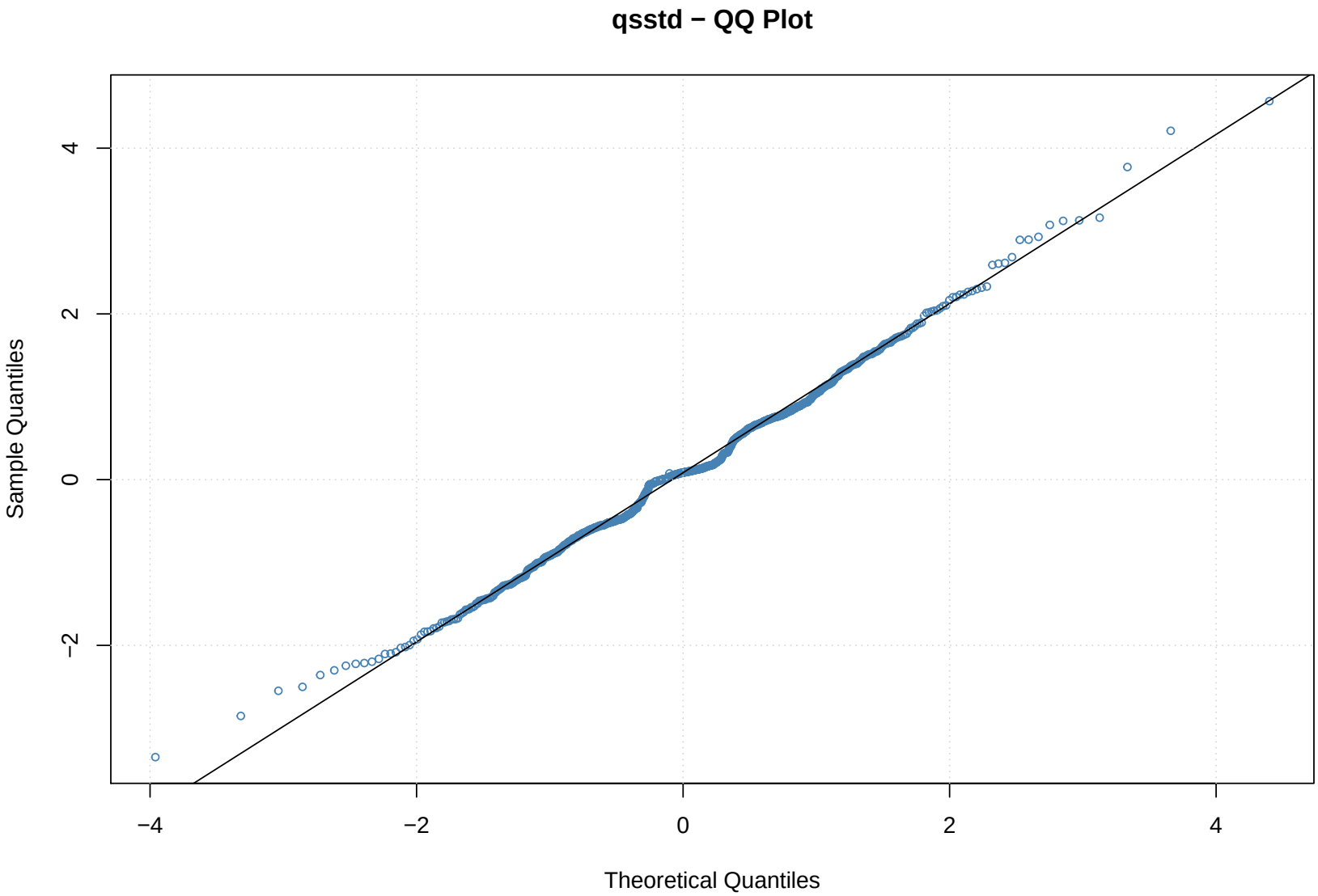
Residual Analysis Fit1 QQ SSTD Plot



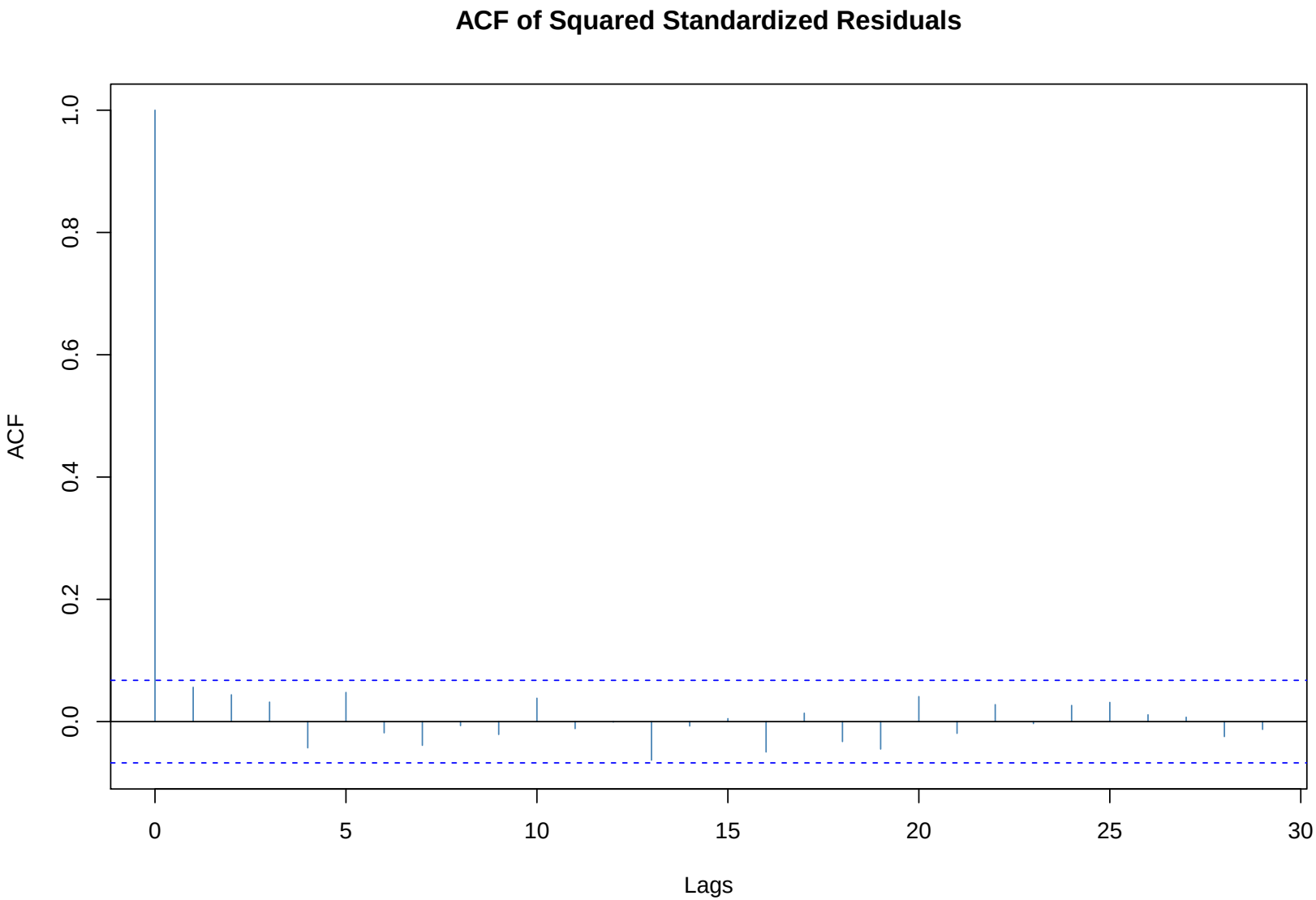
Residual Analysis Fit1 ACF



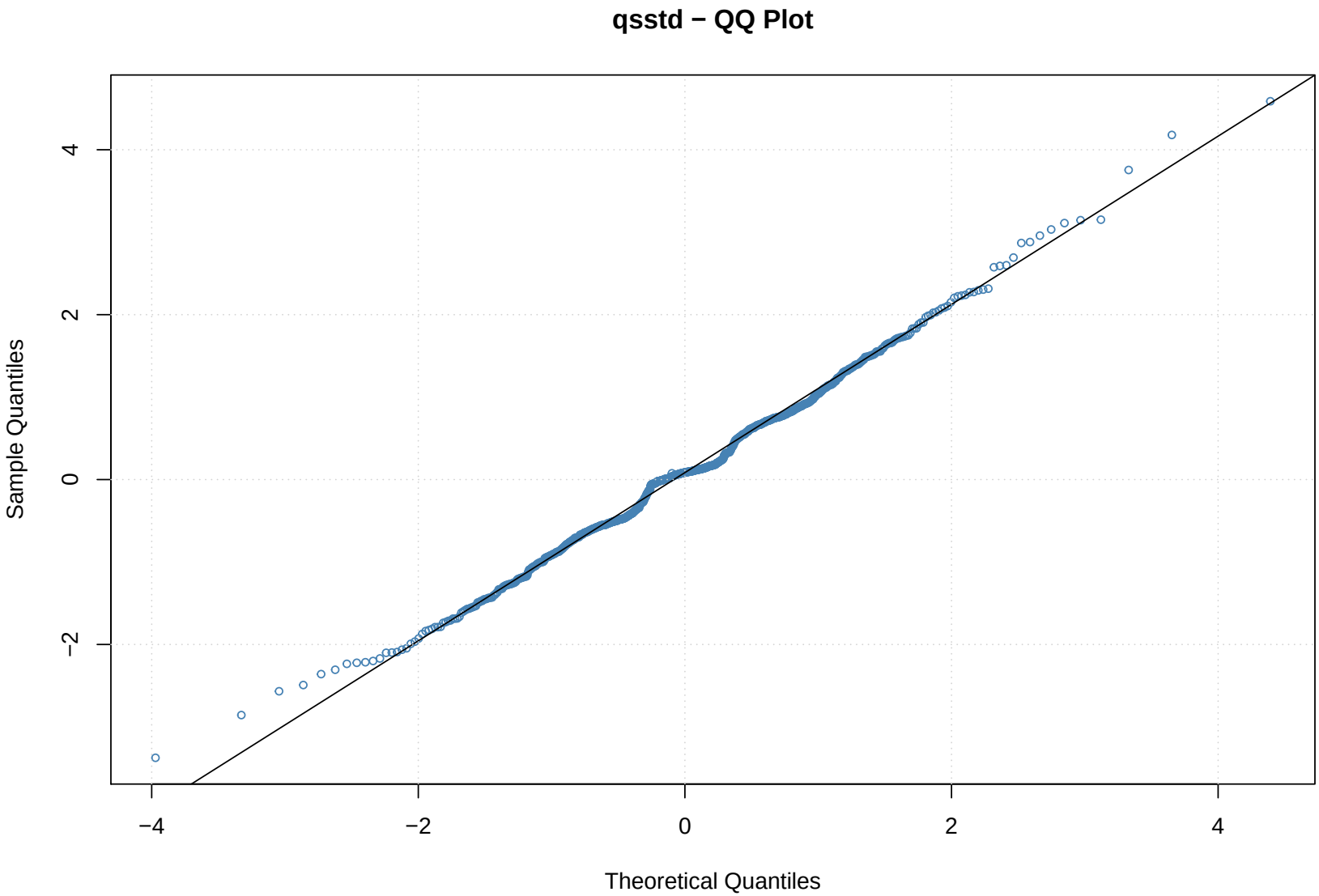
Residual Analysis Fit2 QQ SSTD Plot



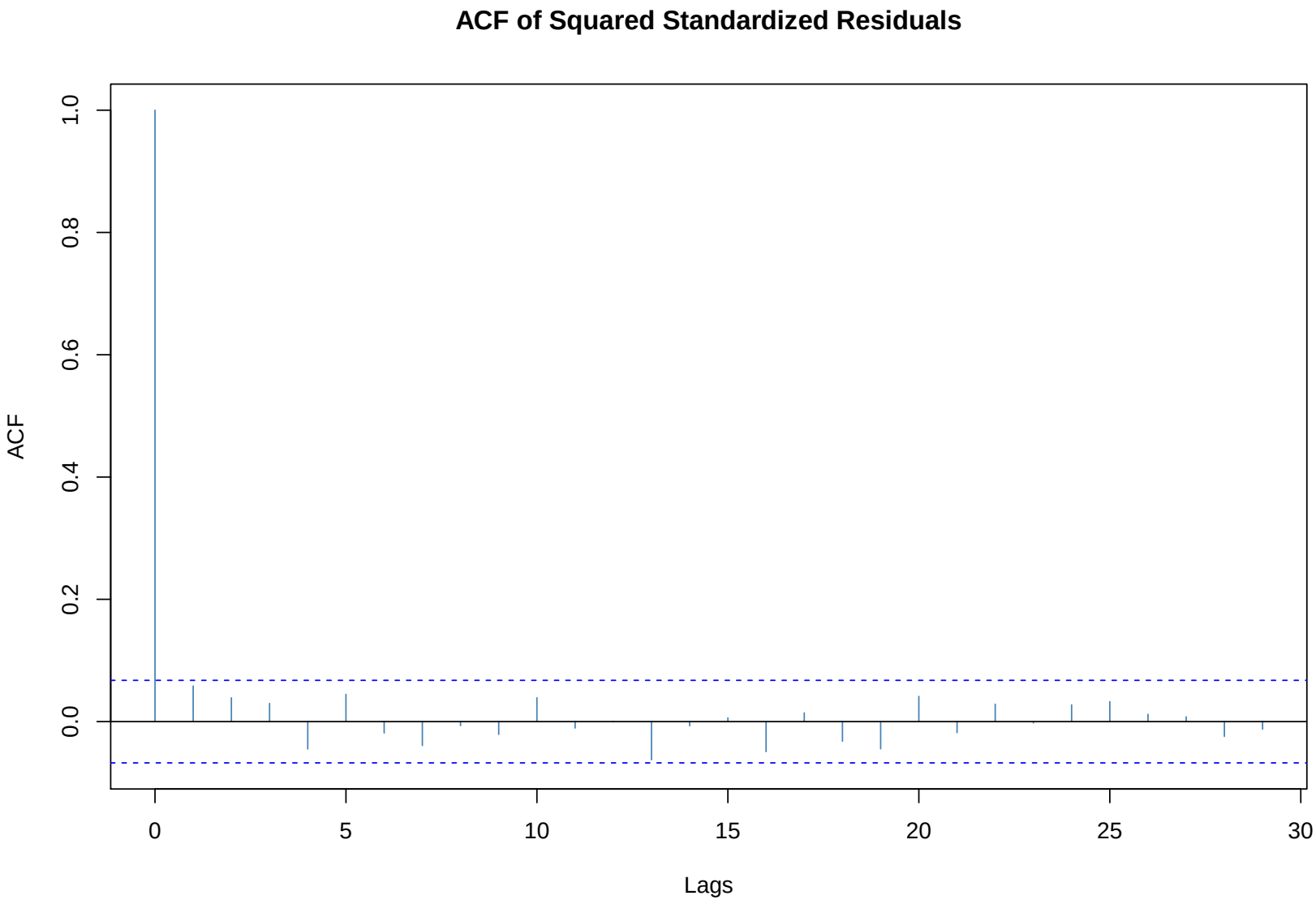
Residual Analysis Fit2 ACF



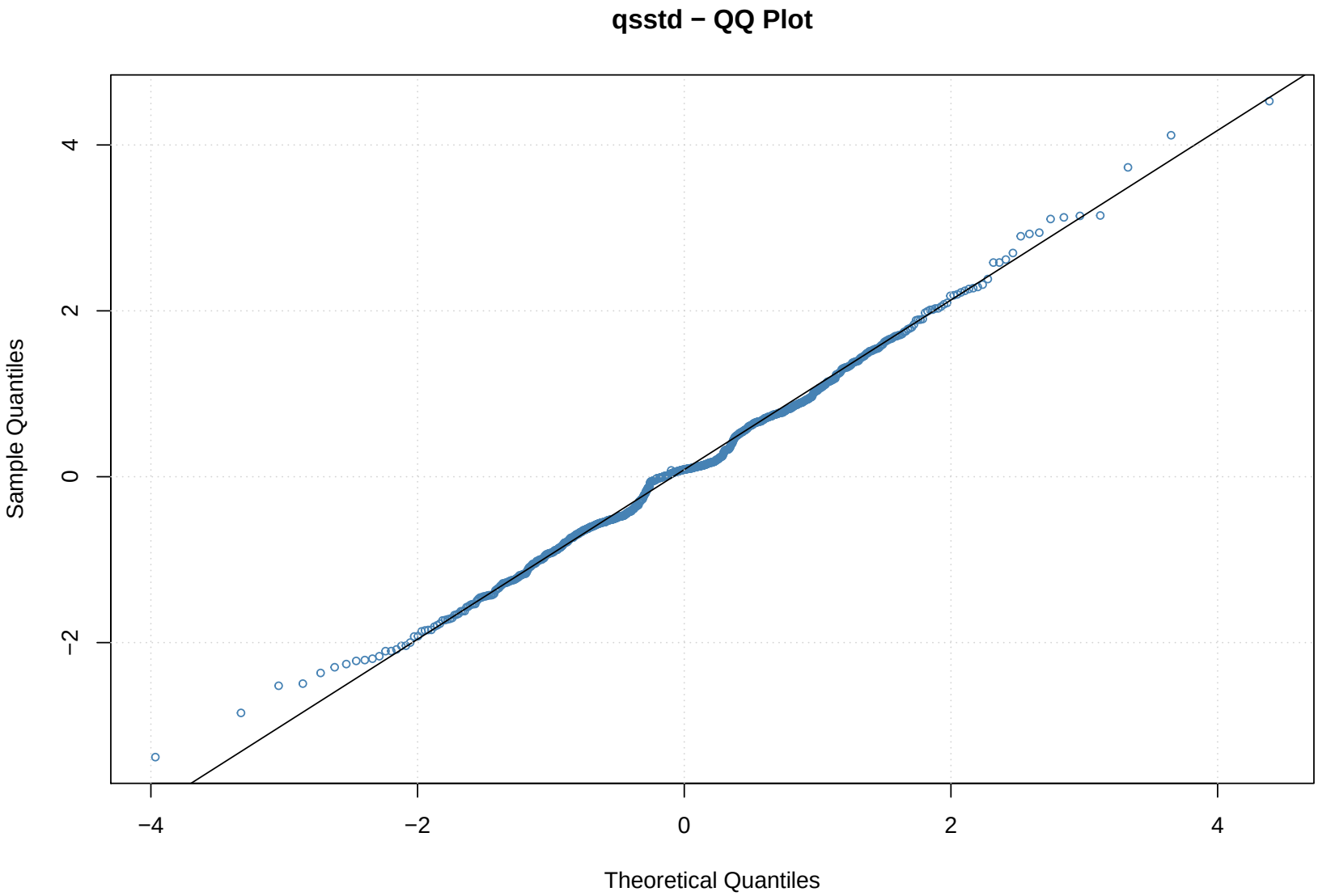
Residual Analysis Fit3 QQ SSTD Plot



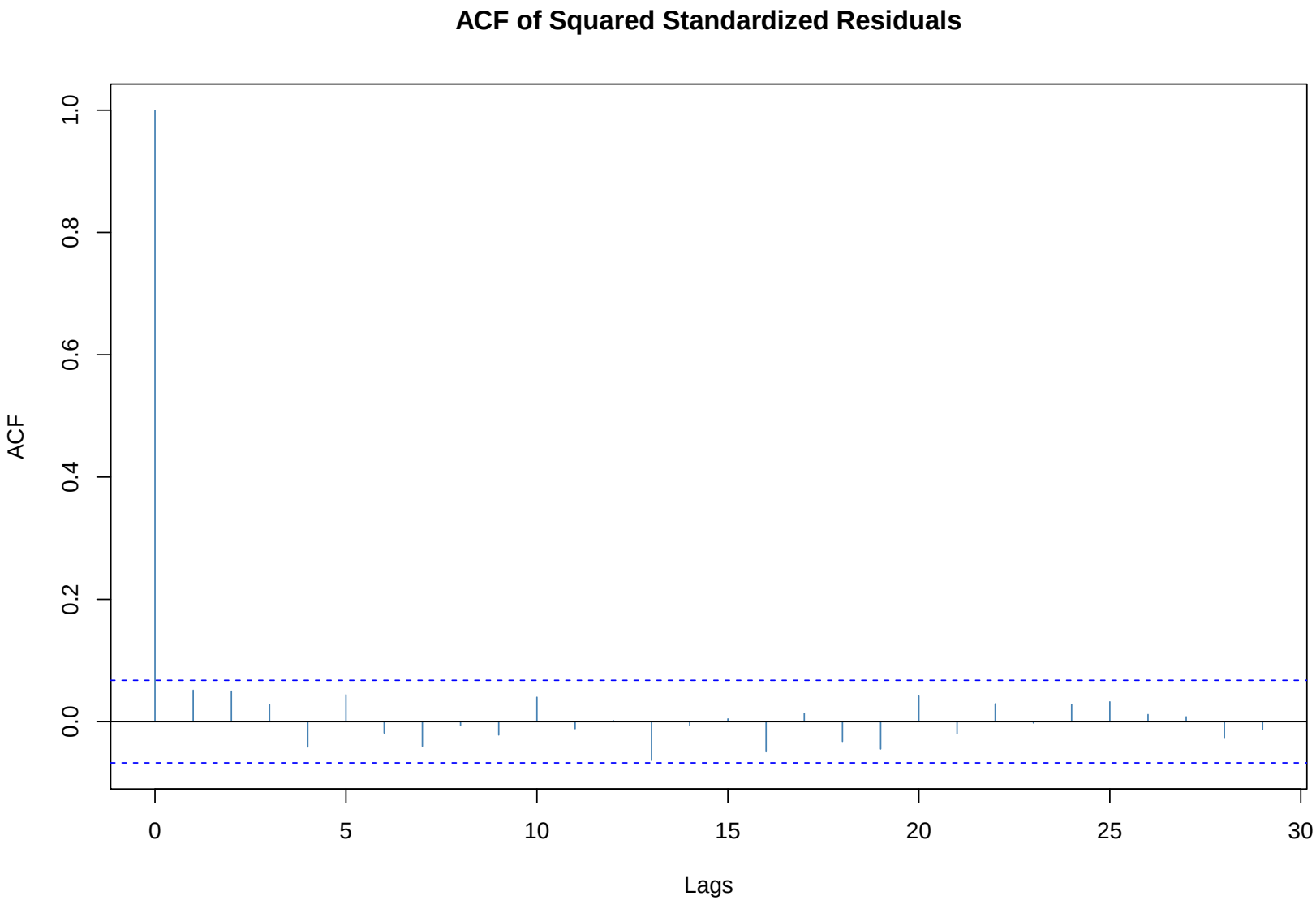
Residual Analysis Fit3 ACF



Residual Analysis Fit4 QQ SSTD Plot



Residual Analysis Fit4 ACF



Final Decision

Based on Ljung-Box values on Squared Residuals, I chose fit4 which had the best Ljung-Box Test values, the best LM Arch test values, and the best looking residuals.

Coefficients are on following slide

Coefficients of ARMA(1,1) GARCH(2,2)

	Estimate	Std. Error	t value	Pr(>|t|)
mu	0.0439456	0.0225976	1.9447054	0.0518104
ar1	0.9890527	0.0039552	250.0665096	0.0000000
ma1	0.0129376	0.0361520	0.3578674	0.7204425
omega	0.0033224	0.0002975	11.1690182	0.0000000
alpha1	0.1479734	0.0450587	3.2840177	0.0010234
alpha2	0.0846987	0.0591797	1.4312111	0.1523697
beta1	0.0973833	0.3186526	0.3056098	0.7599018
beta2	0.5863863	0.2901391	2.0210522	0.0432744
skew	1.0661094	0.0615783	17.3130699	0.0000000
shape	8.4446449	2.4102379	3.5036562	0.0004589

Forecasted Data