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STA 137 - Project 2
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Introduction.

We are provided with a data set that contains inputs from the Federal Reserve Economic Data, containing the monthly mortgage rate and federal funds rate at specific year and month. Our random variable (morg and ffr) and index by time (year and month), so this data frame is a time series. The realization of the data starts on April, 1971 and ends on November, 2011. By analyzing the plot, we can see that mortgage rates have high variance, non-stationary, for year in the data.

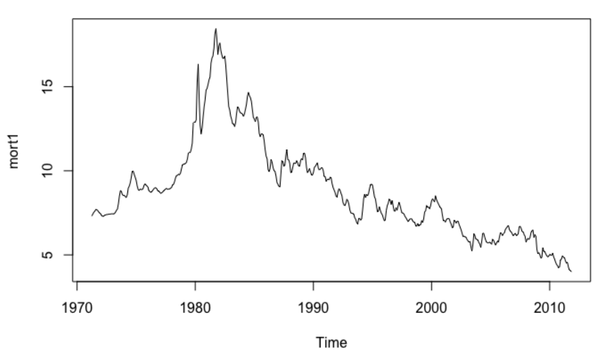
Material and Method.

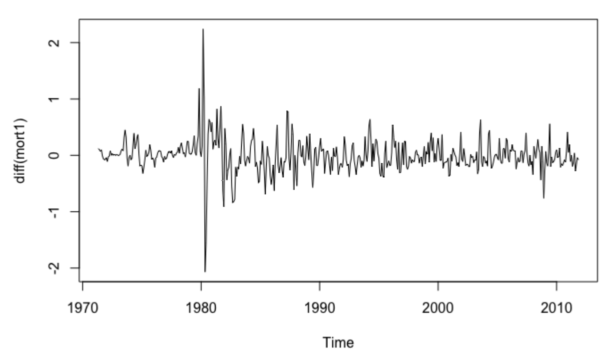
To analyze this dataset, we will have to transform it to a stationary time series. And from there we will be analyze the ARIMA models through its sample ACF and PACF, perform parameter estimations for residuals to be i.i.d normal, and build a time series model that under lag 1 differencing as part of our variables for Federal Funds rate and see its effect on monthly mortgage rates.

Results:

(c) Monthly Mortgage Rate Stationarity

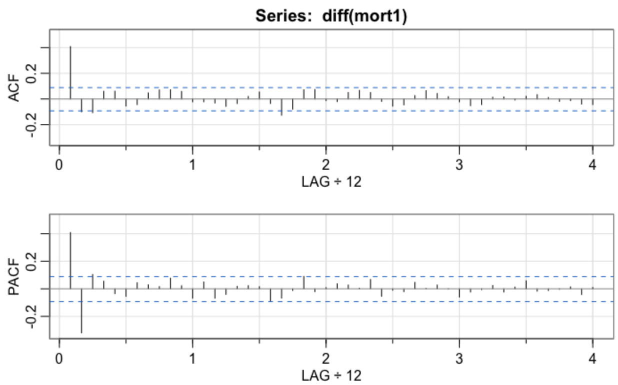
```
mort = subset(mortgage,select = -c(year,month,day,ffr))
mort1 = ts(mort, frequency = 12, start=c(1971,4))
ts.plot(mort1)
ts.plot(diff(mort1))
```



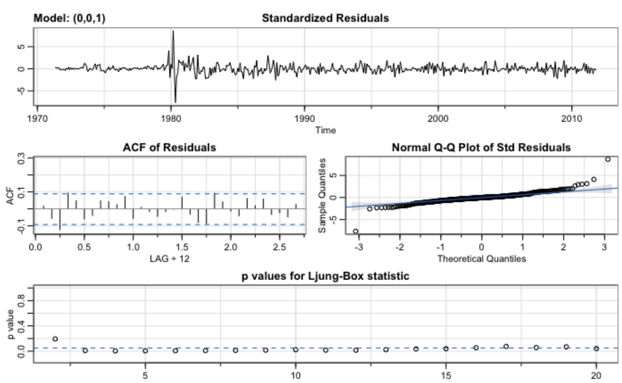

Because the variation in Monthly Mortgage Rate fluctuates in proportion to the time, a differencing transformation could remove the nonstationarity observable in the variance as a function of time. The transformation yt = diff xt stabilizes the variance over the series

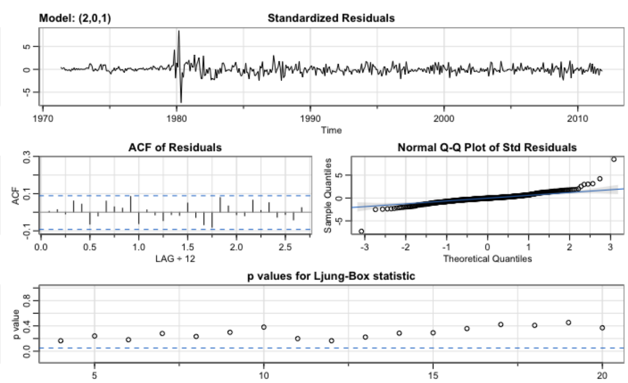
(d) Sample ACF and PACF
acf2(diff(mort1))




The sample ACF and PACF, confirm the tendency of ∇ diff(xt) to behave as a first-order moving average process as the ACF has only a significant peak at lag one and the PACF decreases exponentially.

(e) ARIMA Model
sarima(diff(mort1), p=0, d=0, q=1, no.constant=TRUE)
**sarima(diff(mort1), p=2, d=0, q=1, no.constant=TRUE)**
sarima(diff(mort1), p=2, d=0, q=1, no.constant=TRUE)$fit



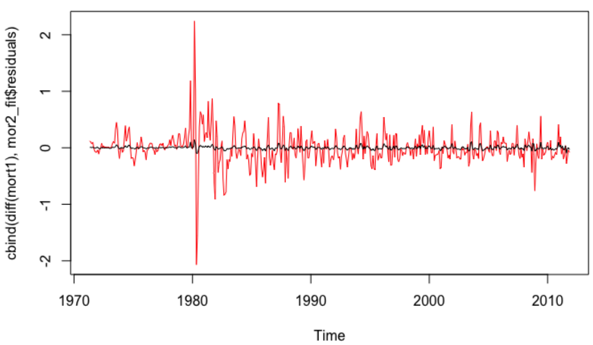

For ARIMA(0,0,1),there appears to be a small amount of autocorrelation left in the residuals and the Q-tests are all significant. To adjust for this problem, we fit an ARIMA(2, 0, 1) to the differenced data and obtained the estimates.
the AR term is significant. The Q-statistic p-values for this model are also displayed and it appears this model fits the data well.

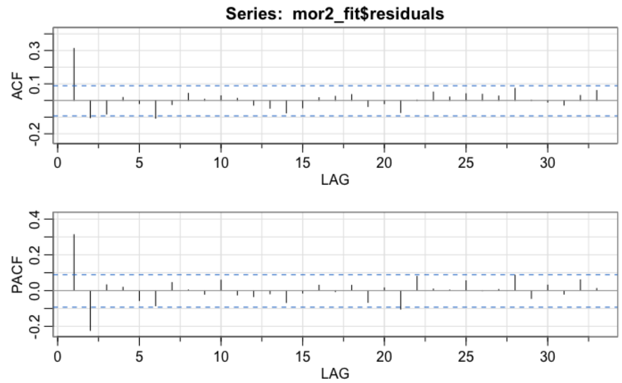
(f) Lag-1 ffr
mor = subset(mortgage,select = -c(year,month,day))
mor1 = ts(mor, frequency = 12, start=c(1971,4))

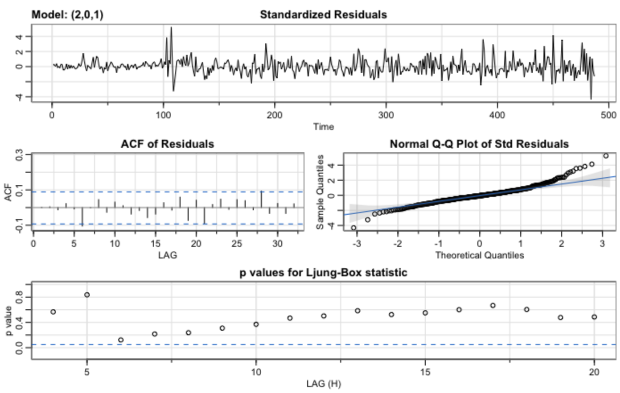
lm(diff(morg) ~ diff(lag(ffr,-1)), data = mor1)

mor2_fit = lm(formula = diff(log(morg)) ~ diff(log(lag(ffr, -1))), data = mor1)
plot.ts(cbind(diff(mort1), mor2_fit$residuals), plot.type = 'single', col=c('red', 1))

```
acf2(mor2_fit$residuals)
sarima(mor2_fit$residuals, p=2, d=0, q=1, no.constant=TRUE)
```




- The sample ACF and PACF, confirm the tendency of ∇ diff(log((xt))) to behave as a first-order moving average process as the ACF has only a significant peak at lag one and the PACF decreases exponentially.
- The AR term is significant. The Q-statistic p-values for this model are also displayed and it appears this model fits the data well.
- From the graph, we can see there is some correlation between monthly mortgage rate and federal funds rate. Lag 1 differencing of the Federal funds rate proves that Mortgage rate depends on the Federal Funds rate.