STA 137 Final Project

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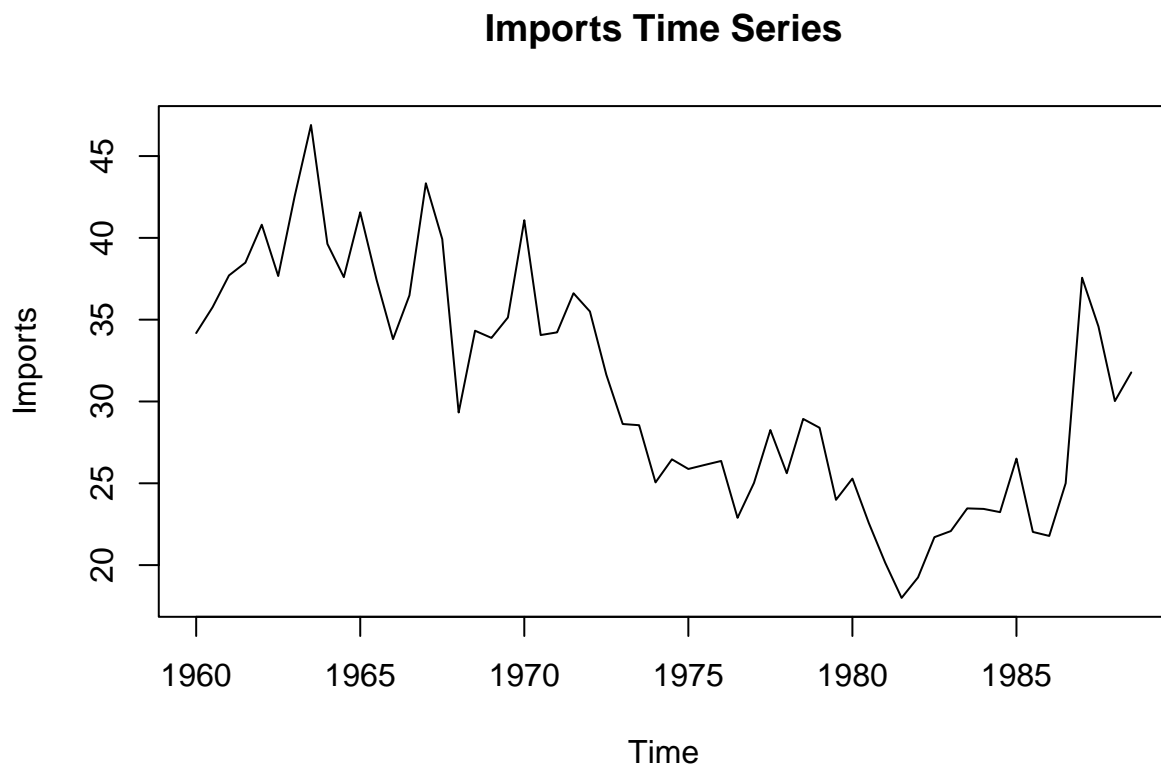## Col Removal

Keep Year, Imports, and Imports columns

```r
finalPro_data <- finalPro_data[, c("Year", "Imports")]
```
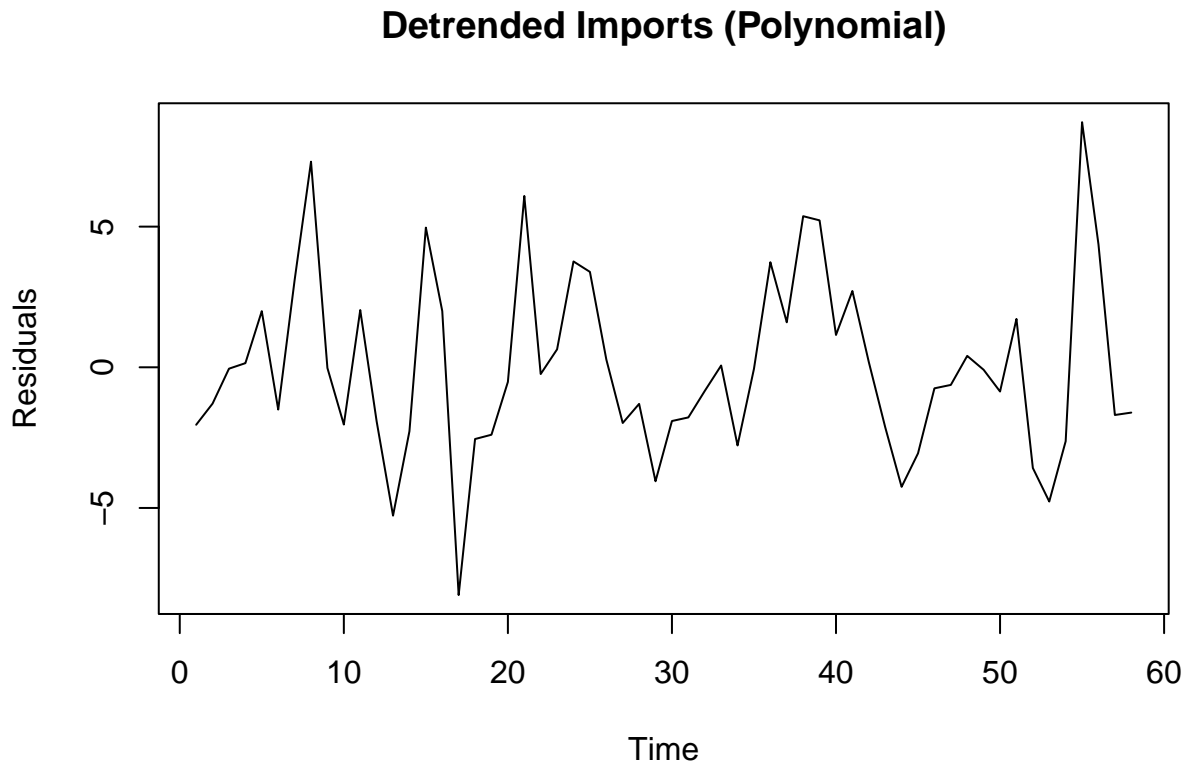
Plot Time Series

```r
# Plot Imports
imports_ts <- ts(finalPro_data$Imports, start = 1960, frequency = 2)

ts.plot(imports_ts, main="Imports Time Series", ylab="Imports")
```



```r
# Apply Polynomial Detrending
time_index <- 1:length(imports_ts)
poly_trend_model <- lm(imports_ts ~ poly(time_index, 3))  # 3rd-degree polynomial trend
detrended_imports <- residuals(poly_trend_model)
```

```
# Plot Detrended Imports
ts.plot(detrended_imports, main = "Detrended Imports (Polynomial)", ylab = "Residuals")
```

Detrended Imports (Polynomial)

Summary:

- Imports time series has U shape curve, this shows this is non-stationary
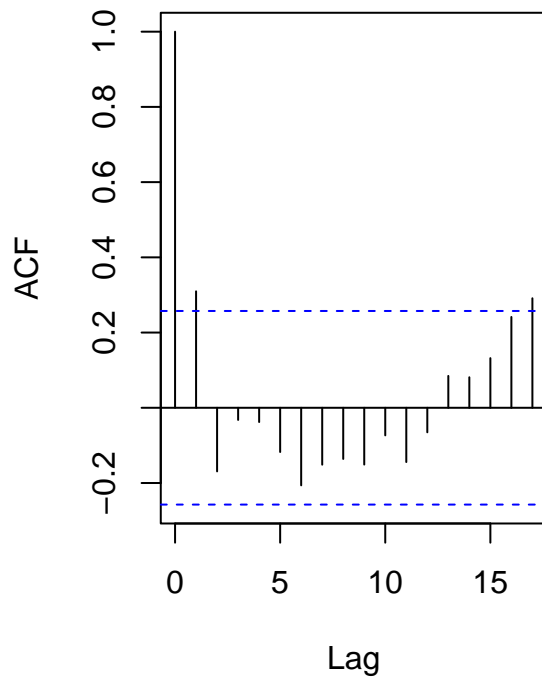- It has peaks around every 10 year: 1980, 1990, 2010

Transform

We tried log and Box-Cox, but neither stabilized the variance.

```
# Fit a basic linear model for demonstration
model_imports_bc <- lm(detrended_imports ~ time(detrended_imports))
resid_imports_bc <- residuals(model_imports_bc)

# Plot ACF and PACF of residuals
par(mfrow = c(1, 2))  # Side-by-side plots
acf(resid_imports_bc, main = "ACF of Residuals")
pacf(resid_imports_bc, main = "PACF of Residuals")
```

ACF of Residuals

PACF of Residuals
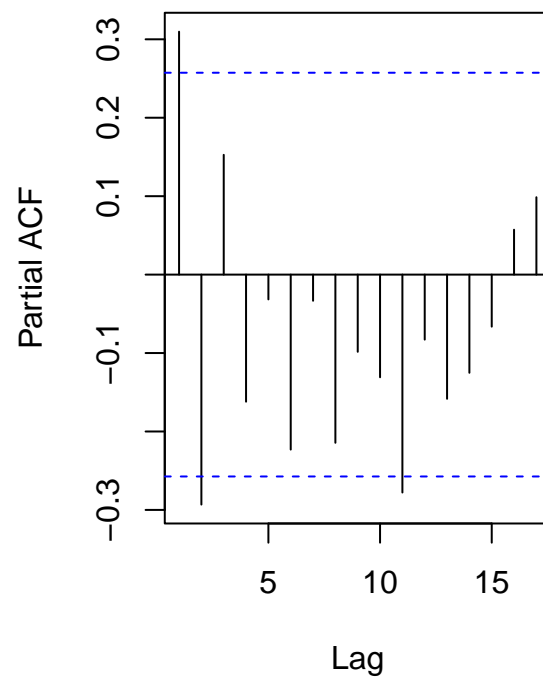

```r
par(mfrow = c(1, 1))  # Reset layout
```

```r
# Portmanteau (Box-Pierce) test for white noise
portmanteau_result <- Box.test(resid_imports_bc, lag = 10, type = "Box-Pierce")
print(portmanteau_result)
```

```
##
##  Box-Pierce test
##
## data:  resid_imports_bc
## X-squared = 14.672, df = 10, p-value = 0.1445
```
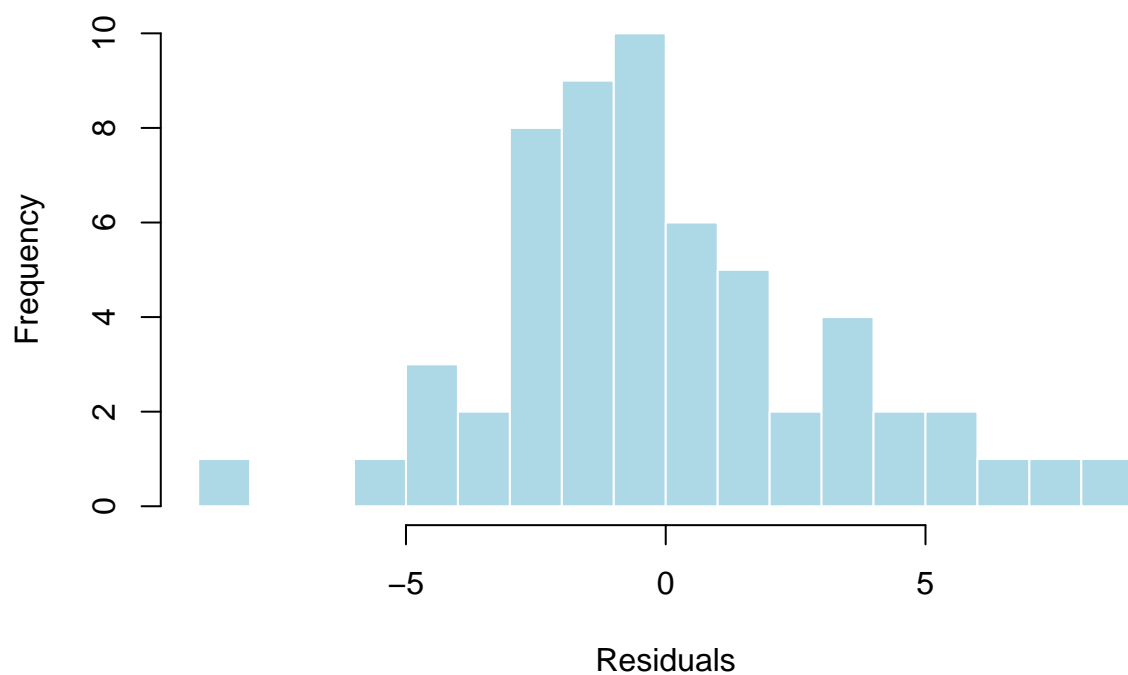
Assess Normality

```r
# Assess Normality of Residuals

# Histogram
hist(resid_imports_bc, breaks = 15, main = "Histogram of Residuals", xlab = "Residuals", col = "lightblu
```
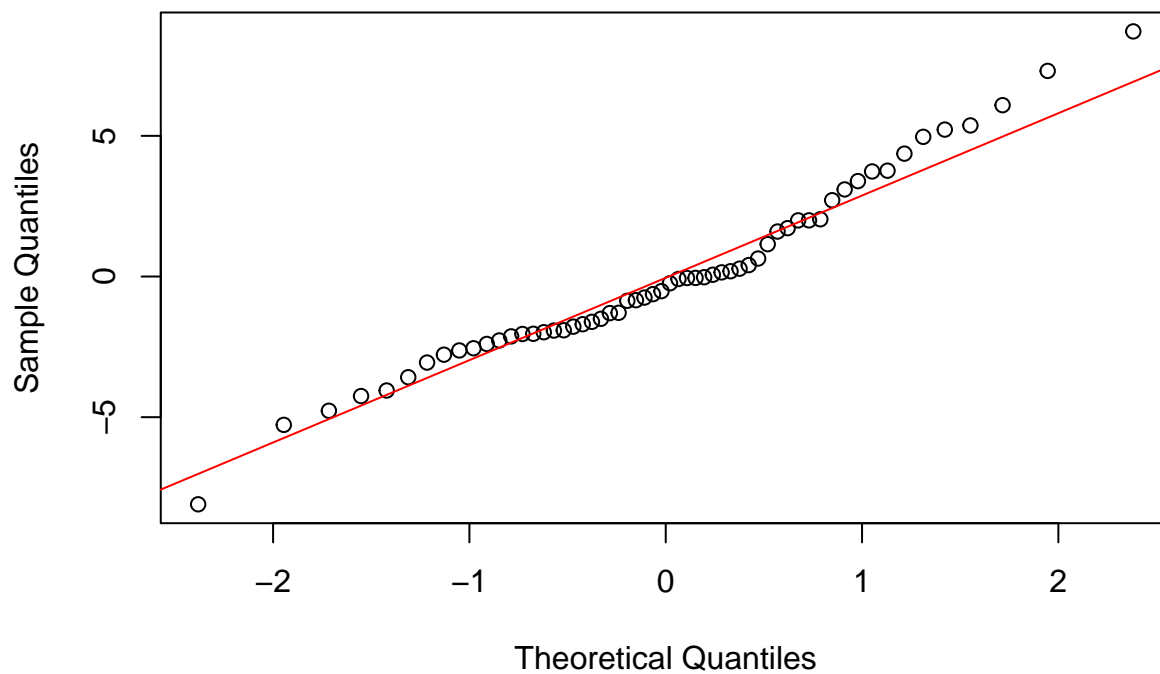
Histogram of Residuals


```r
# Q-Q Plot
qqnorm(resid_imports_bc, main = "Q-Q Plot of Residuals")
qqline(resid_imports_bc, col = "red")
```

Q–Q Plot of Residuals


```r
# Shapiro-Wilk Test
shapiro_test <- shapiro.test(resid_imports_bc)
```

```
print(shapiro_test)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  resid_imports_bc
## W = 0.97142, p-value = 0.1869
```

```
# Save detrended imports data to CSV
write.csv(data.frame(Year = finalPro_data$Year, Detrended_Imports = detrended_imports),
          "detrended_imports.csv", row.names = FALSE)
```