# Project NFP

Sam Choi, Eric Xu

ARIMA

We will use the Box-Jenkins method to build an ARIMA model for the seasonally adjusted NFP data transformed using first order differencing.

Model identification

```
PAYEMS <- read.csv(file = "PAYEMS.csv", header = TRUE, sep = ",")
nfp_sa_ts_2010_2018 <- ts(PAYEMS[853:951, ][2])
SA_diff <- diff(nfp_sa_ts_2010_2018, lag = 1, differences = 1)

SA_mean <- mean(SA_diff, na.rm = TRUE)
centered_SA_diff <- SA_diff - SA_mean
plot.ts(centered_SA_diff, main = "Centered SA Diffs, 2010-2018", xlab = "Months (since January 2010)", )
```
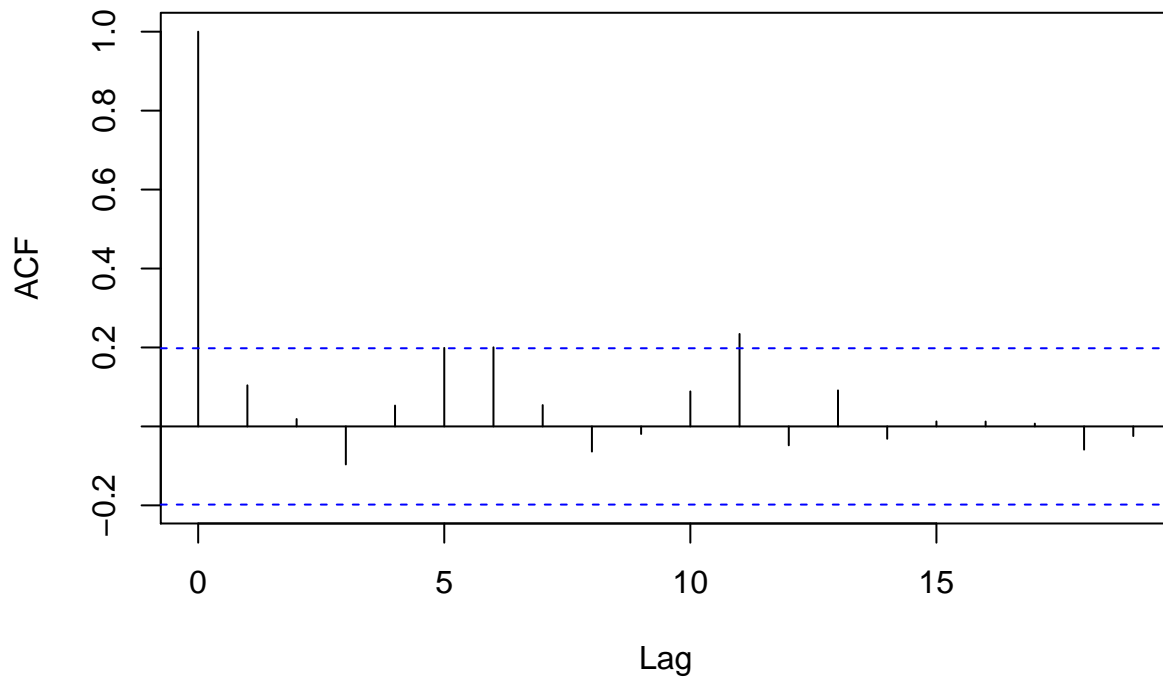
Centered SA Diffs, 2010–2018
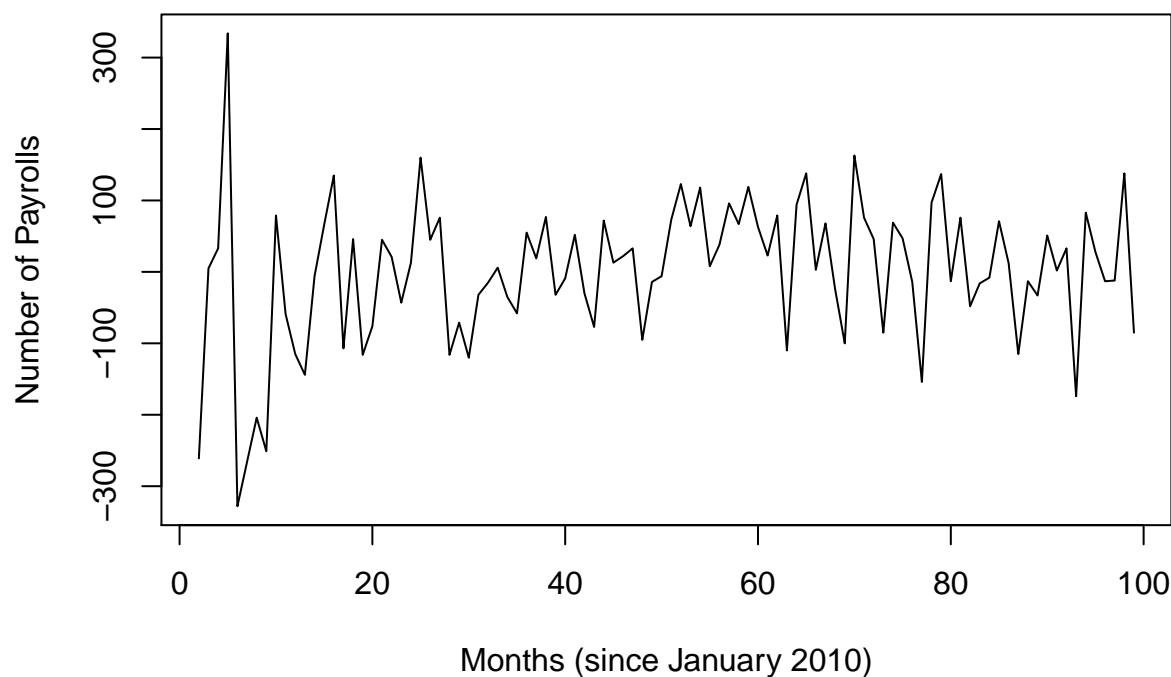
The time series appears stationary with a mean of approximately 188. No apparent trends.

```
acf(centered_SA_diff, main = "ACF Plot of SA Differences 2010-2018")
```
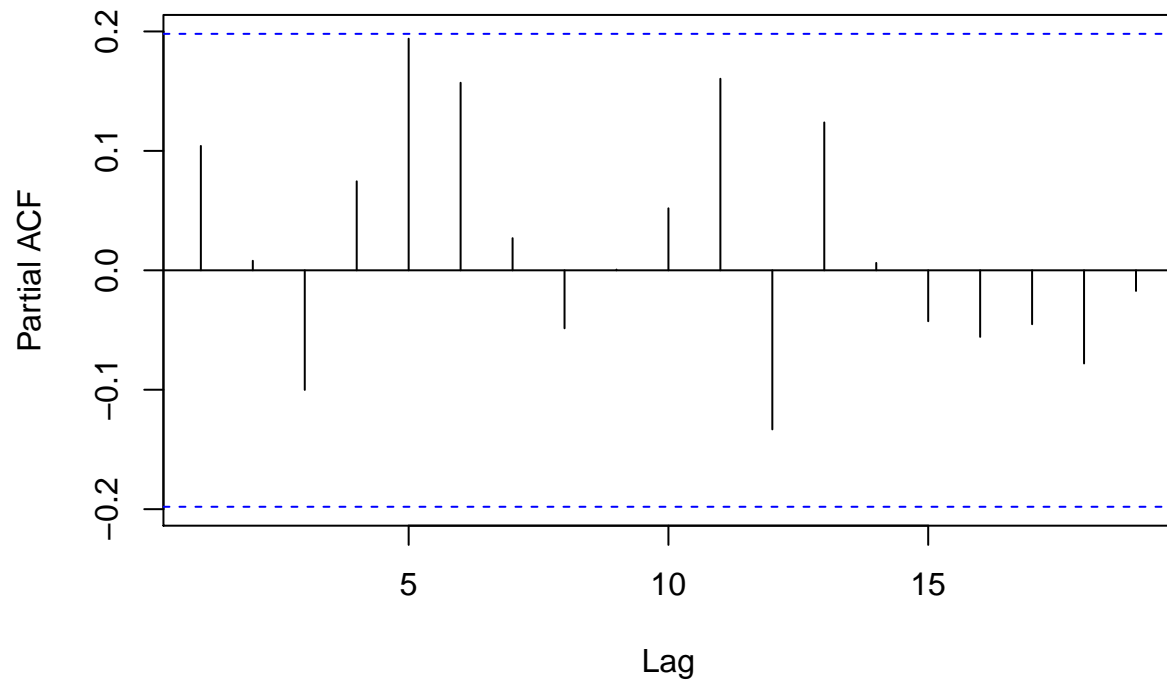
ACF Plot of SA Differences 2010–2018

The ACF is always insignificant.

```
pacf(centered_SA_diff, main = "PACF Plot of SA Differences 2010-2018")
```

PACF Plot of SA Differences 2010–2018

```
PAYNSA <- read.csv(file = "PAYNSA.csv", header = TRUE, sep = ",")
nfp_nsa_ts <- ts(PAYNSA[853:951,][2])
NSA_diff <- diff(nfp_nsa_ts, lag = 1, differences = 1)

NSA_mean <- mean(NSA_diff, na.rm = TRUE)
centered_NSA_diff <- NSA_diff - NSA_mean
plot.ts(centered_NSA_diff, main = "Centered NSA Diffs, 2010-2018", xlab = "Months (since January 2010)"
```
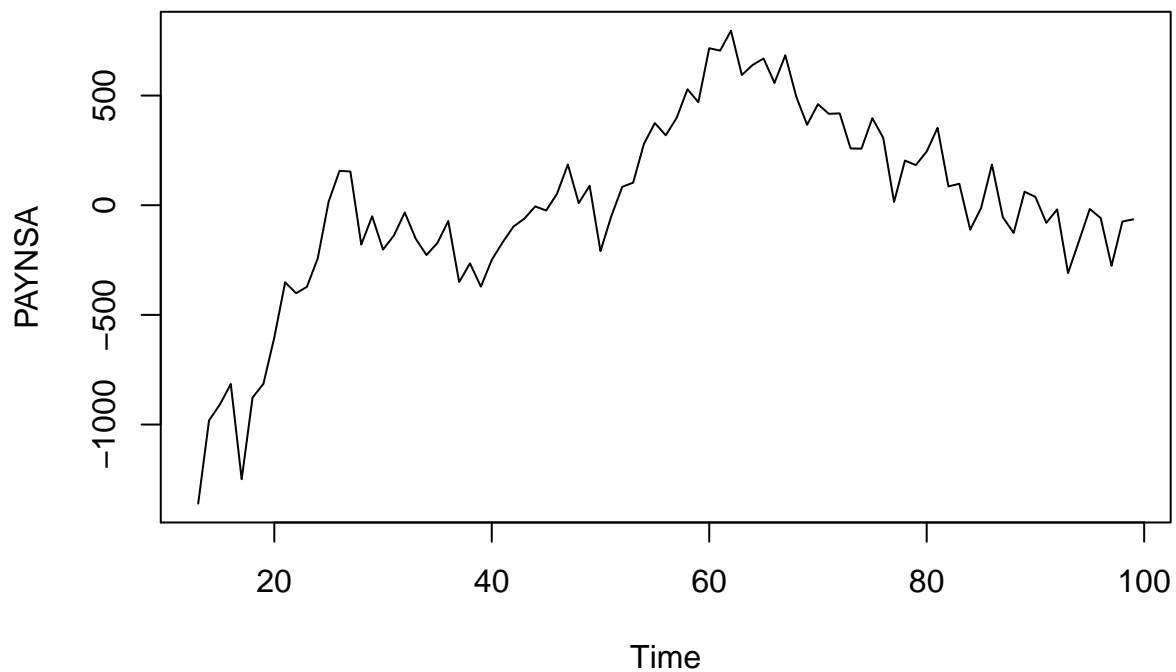
Centered NSA Diffs, 2010–2018

Months (since January 2010)
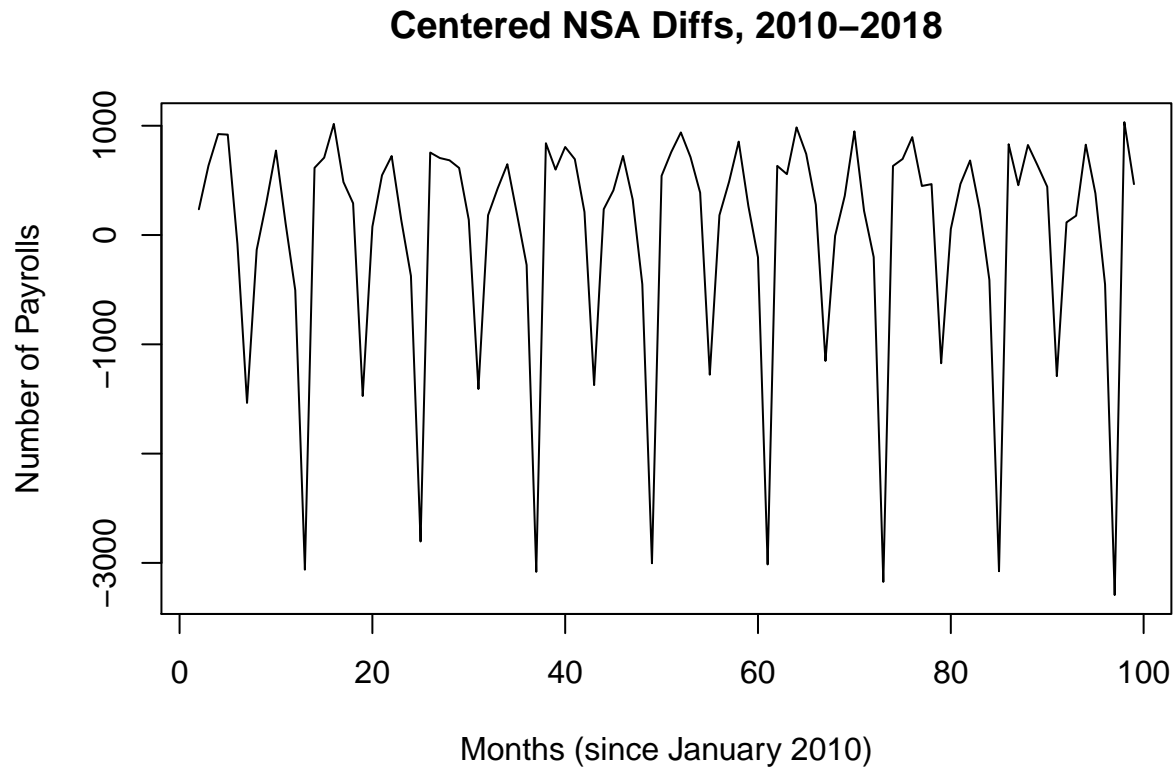
```
NSA_sdiff <- diff(nfp_nsa_ts, lag = 12, differences = 1)
NSA_smean <- mean(NSA_sdiff)
centered_NSA_sdiff <- NSA_sdiff - NSA_smean
plot.ts(centered_NSA_sdiff)
```
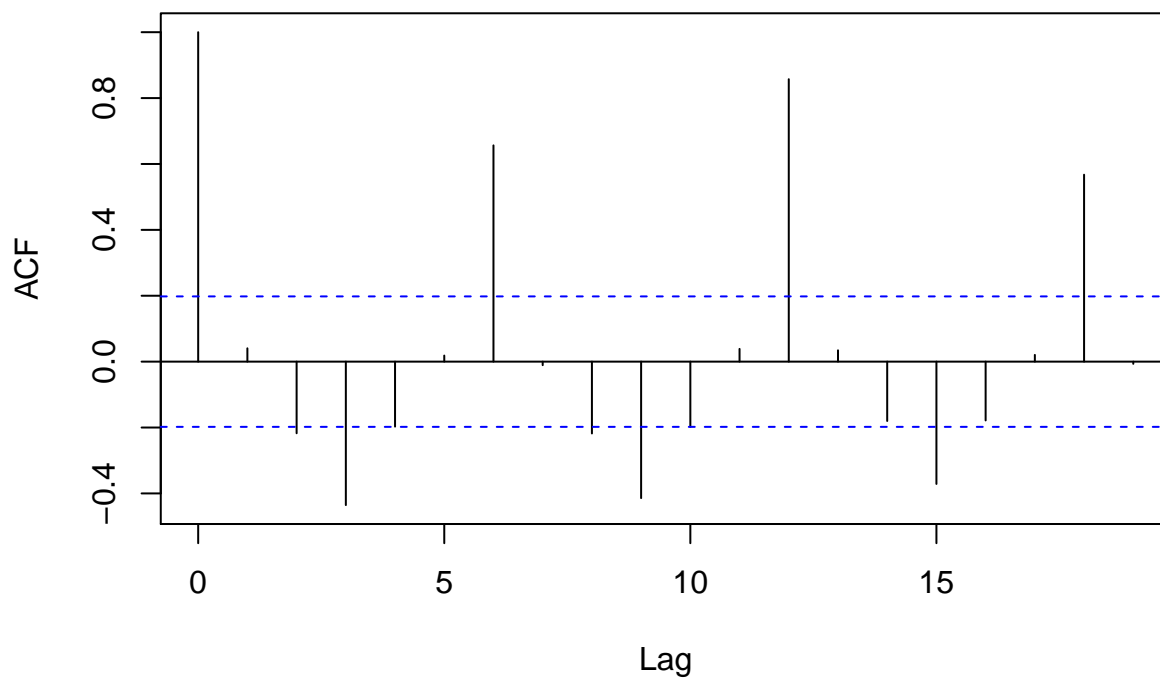
The time series appears stationary with a mean of approximately 188. No apparent trends.
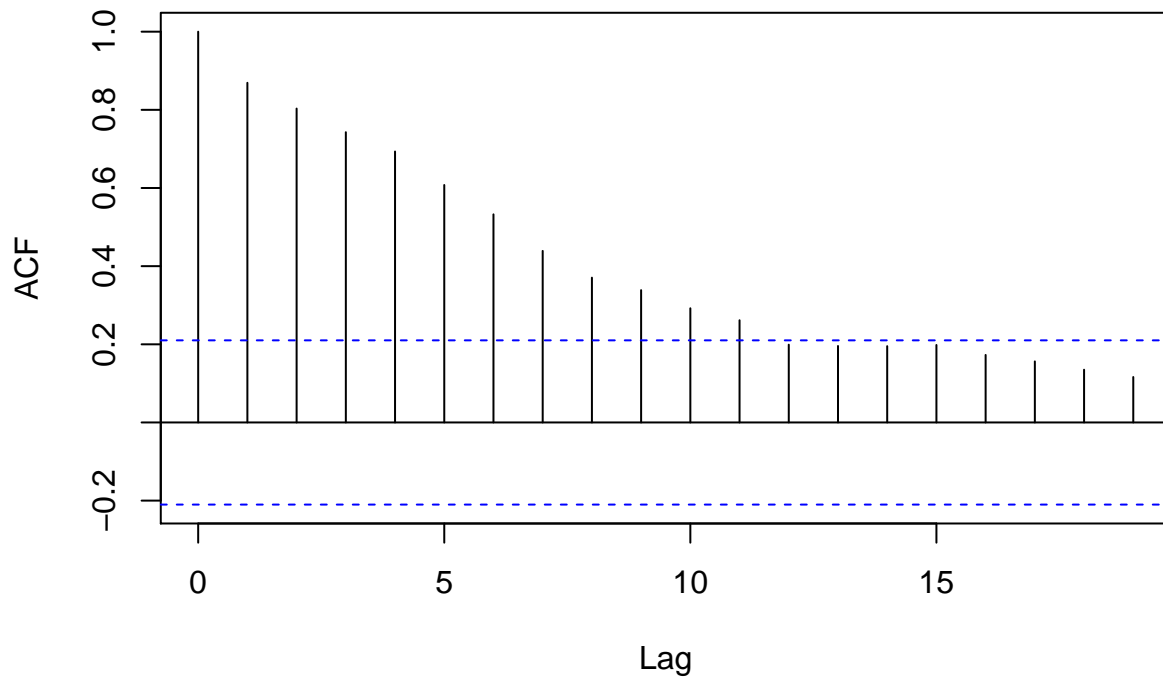
```
acf(centered_NSA_diff, main = "ACF Plot of SA Differences 2010-2018")
```

ACF Plot of SA Differences 2010–2018


```
acf(centered_NSA_sdiff, main = "ACF Plot of SA Differences 2010-2018")
```
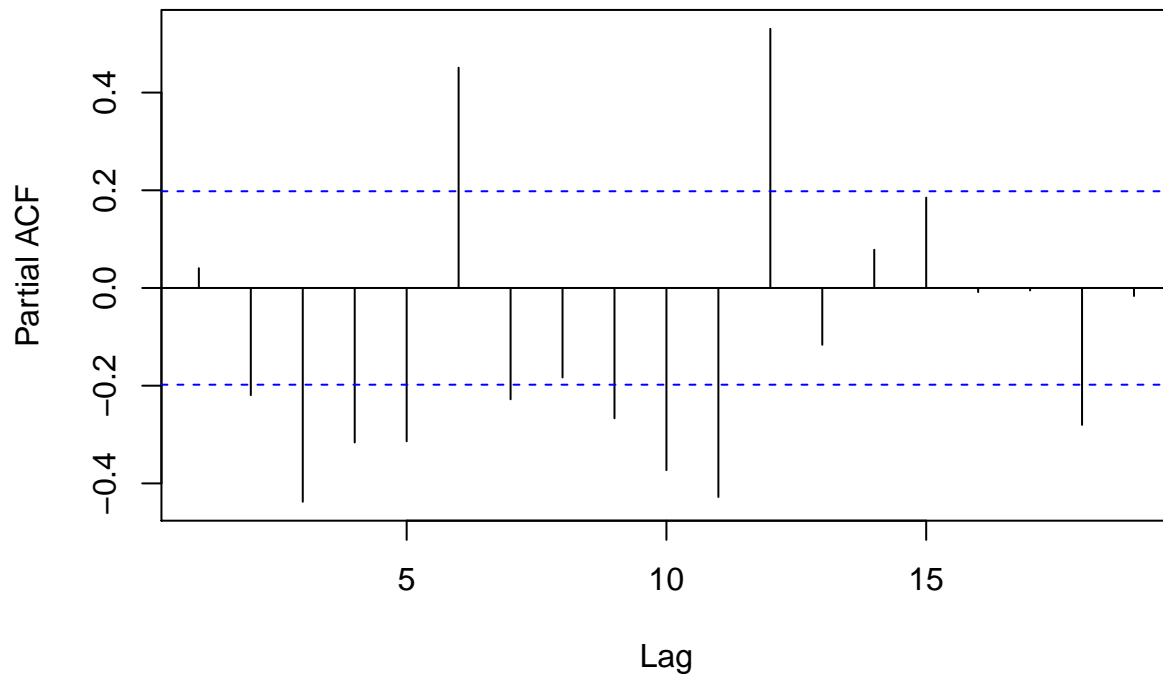
ACF Plot of SA Differences 2010–2018

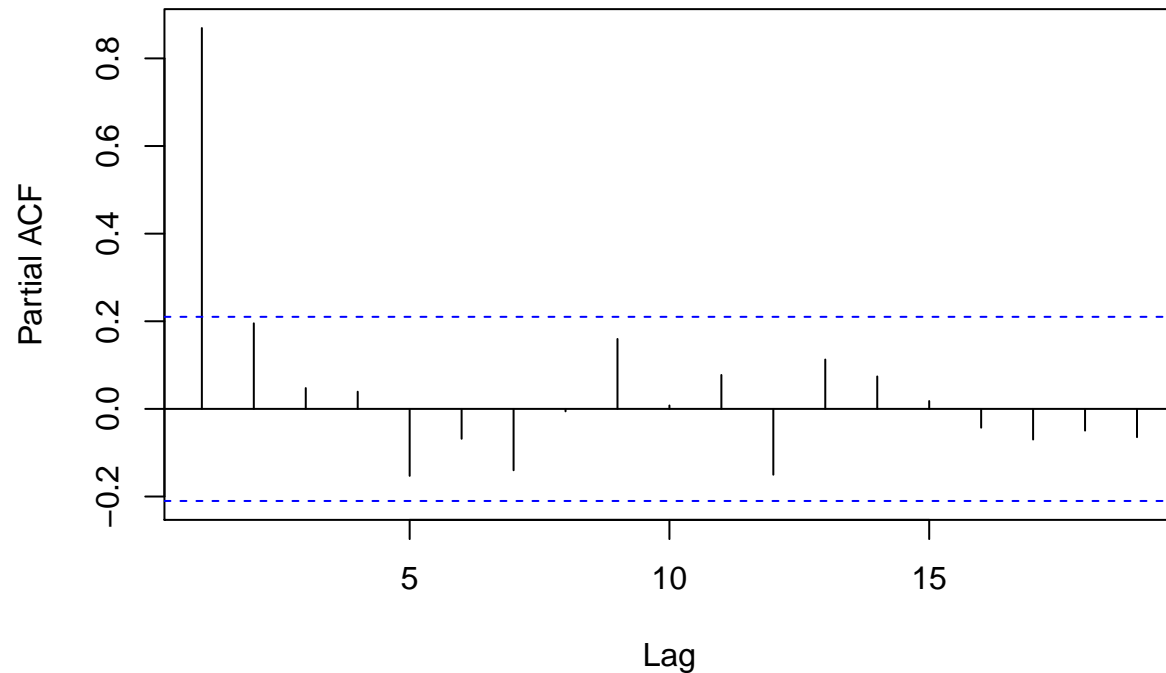

The ACF is always insignificant.

```
pacf(centered_NSA_diff, main = "PACF Plot of SA Differences 2010-2018")
```

PACF Plot of SA Differences 2010–2018

```r
pacf(centered_NSA_sdiff, main = "PACF Plot of SA Differences 2010-2018")
```

PACF Plot of SA Differences 2010–2018

Appears to be ARMA(1, 0)

Parameter Estimation and Model Diagnostics

```r
sarima(centered_NSA_diff, 1, 0, 0, D = 1, S = 12)
```

```
## initial  value 5.040918
## iter   2 value 5.011460
## iter   3 value 5.011304
## iter   4 value 5.011213
## iter   5 value 5.011210
## iter   6 value 5.011209
## iter   6 value 5.011209
## final  value 5.011209
## converged
## initial  value 5.037980
## iter   2 value 5.037862
## iter   3 value 5.037676
## iter   4 value 5.037676
## iter   4 value 5.037676
## iter   4 value 5.037676
## final  value 5.037676
## converged
```

Model: (1,0,0) (0,1,0) [12]   Standardized Residuals

ACF of Residuals

Normal Q–Q Plot of Std Residuals

p values for Ljung–Box statistic
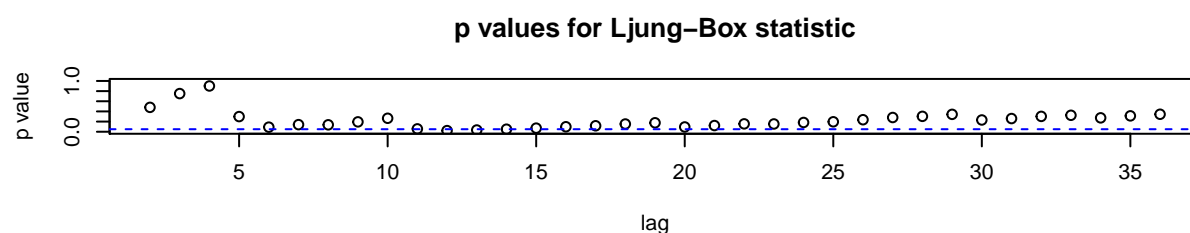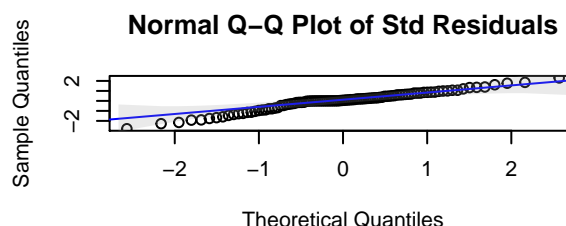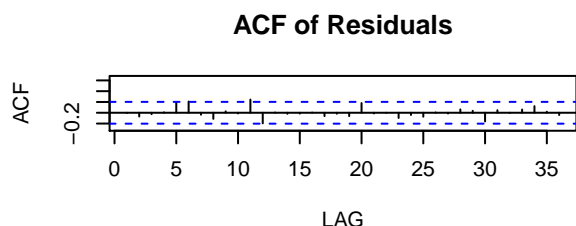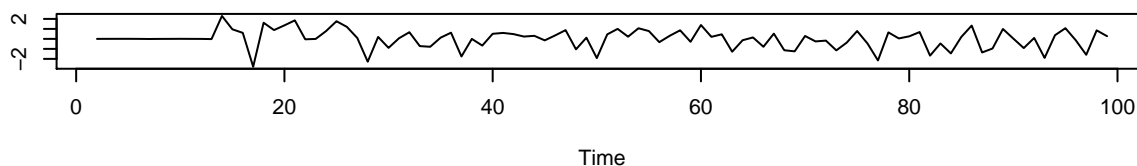

```
## $fit
##
## Call:
## stats::arima(x = xdata, order = c(p, d, q), seasonal = list(order = c(P, D,
##      Q), period = S), xreg = constant, optim.control = list(trace = trc, REPORT = 1,
##      reltol = tol))
##
## Coefficients:
##           ar1  constant
##       -0.2434    1.1874
## s.e.   0.1074    1.1162
##
## sigma^2 estimated as 23733:  log likelihood = -555.27,  aic = 1116.54
##
## $degrees_of_freedom
## [1] 84
##
## $ttable
##         Estimate      SE t.value p.value
## ar1      -0.2434 0.1074 -2.2664  0.0260
## constant  1.1874 1.1162  1.0638  0.2905
##
## $AIC
## [1] 11.11546
##
## $AICc
## [1] 11.13847
##
```

7

```
## $BIC
## [1] 10.16821
```

Model Selection