DEVELOPMENT OF AUSTRALIAN IMPORTS FROM JAPAN DURING THE SECOND HALF OF THE TWENTIETH CENTURY

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Introduction

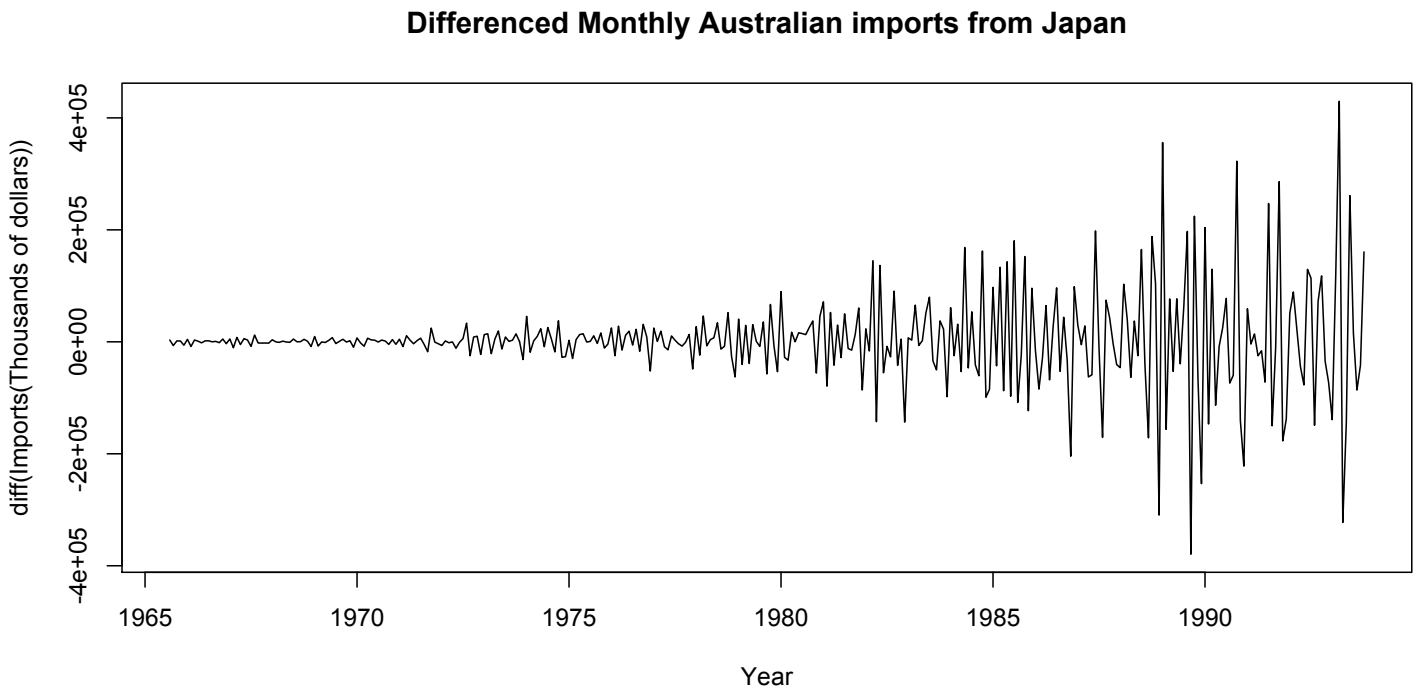
Graph of the time series

- overall increasing trend
- large fluctuations after 1980

Stationary and Transformation

First difference of the raw data

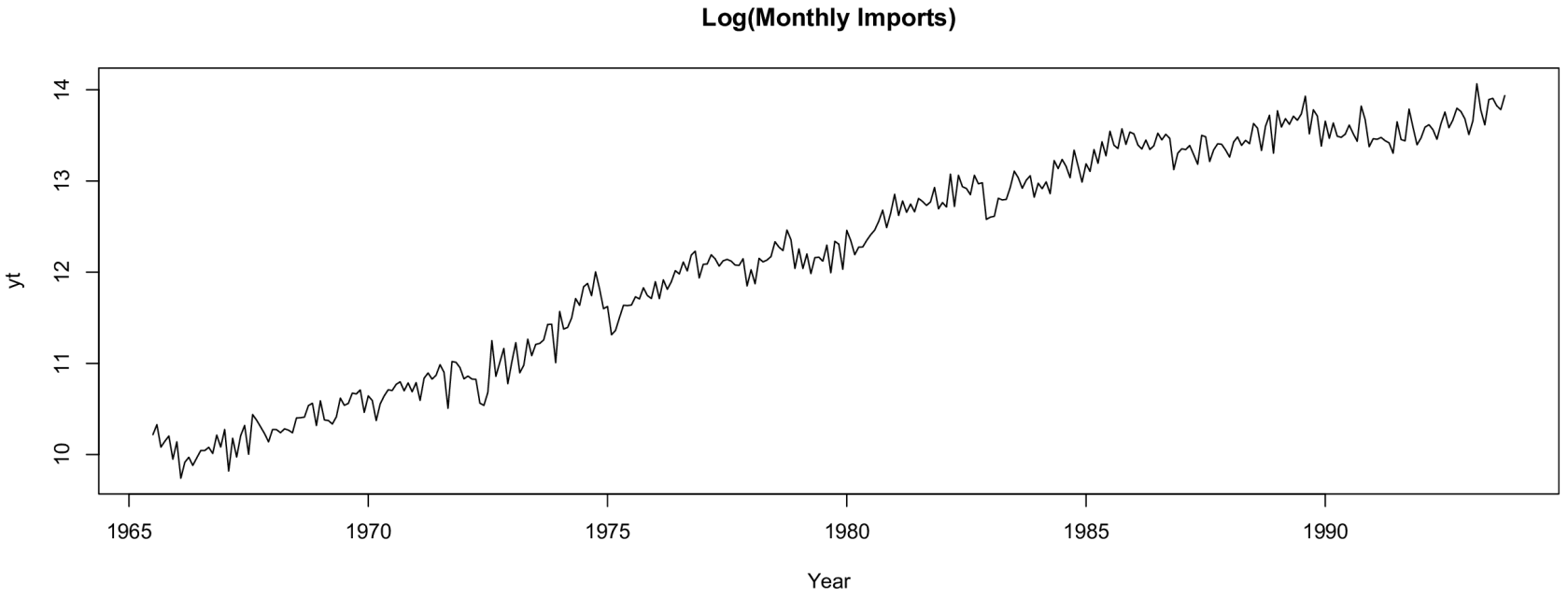
- Variance not constant
- Not stationary



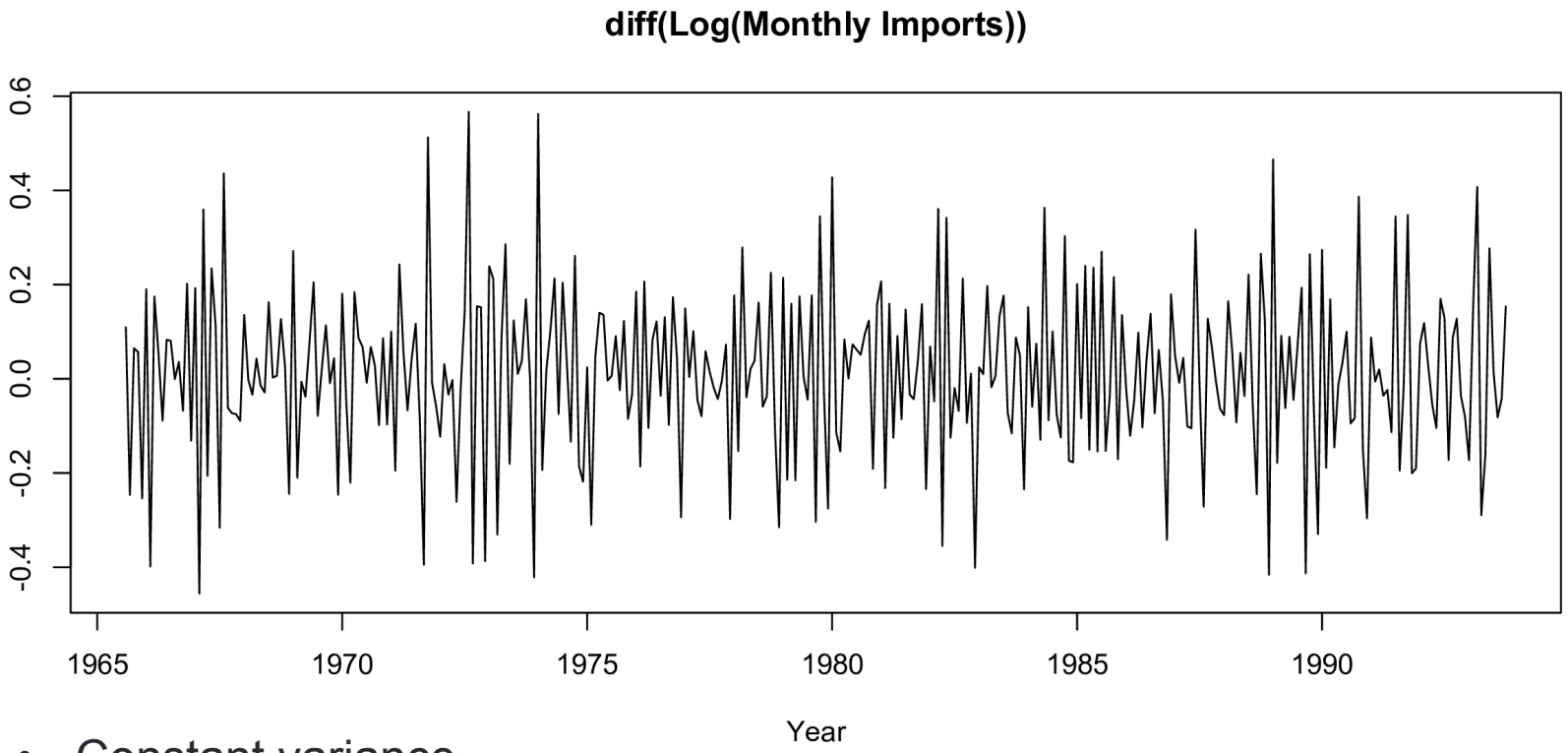
Stationary and Transformation

After Log-transformation

- an overall linear increasing trend
- Not stationary.



Stationary and Transformation



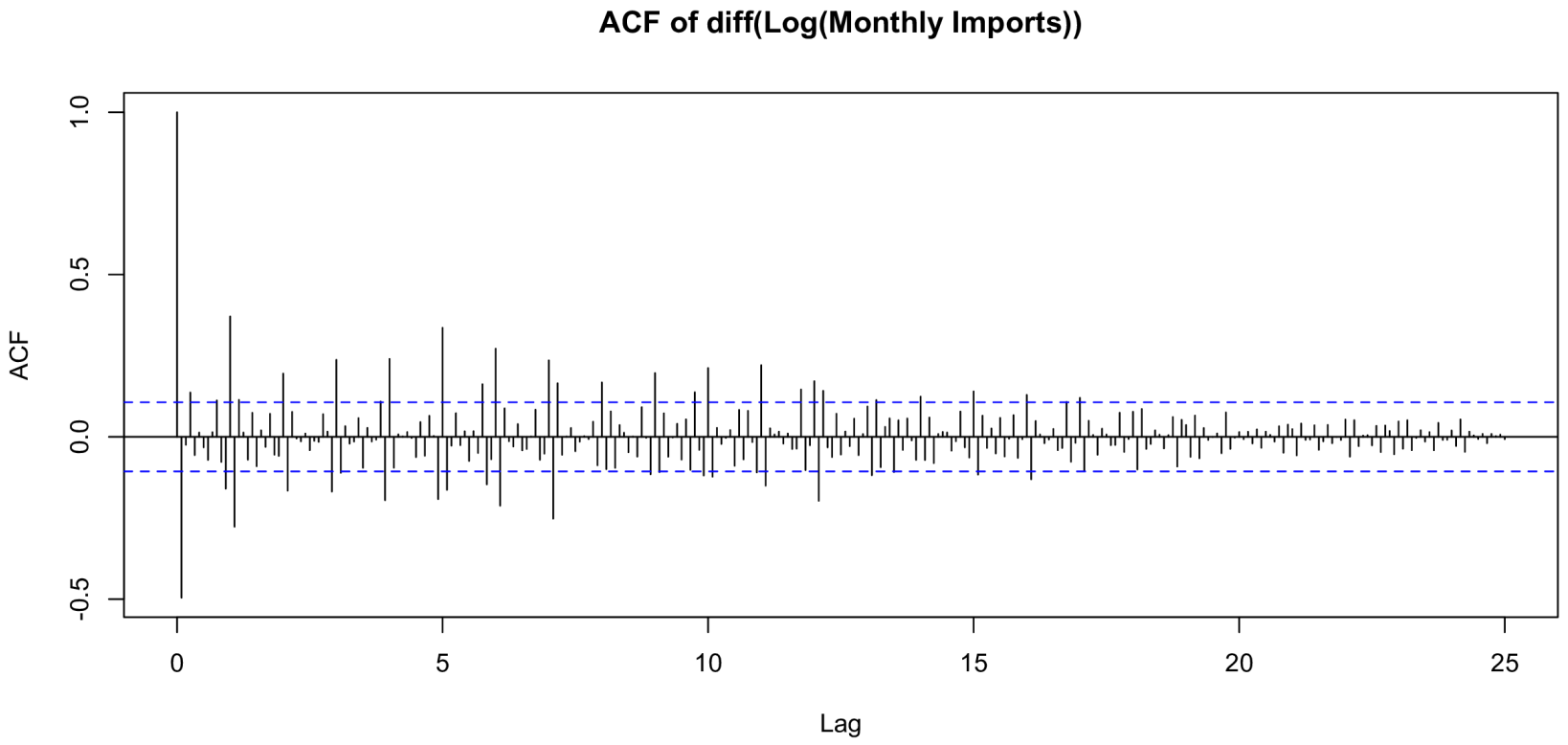
- Constant variance

Var(firsthalf) = 0.03240124
Var(secondhalf) = 0.03170778
Sqrt(secondhalf/firsthalf) = 0.9892411

- Stationary needed to be verify

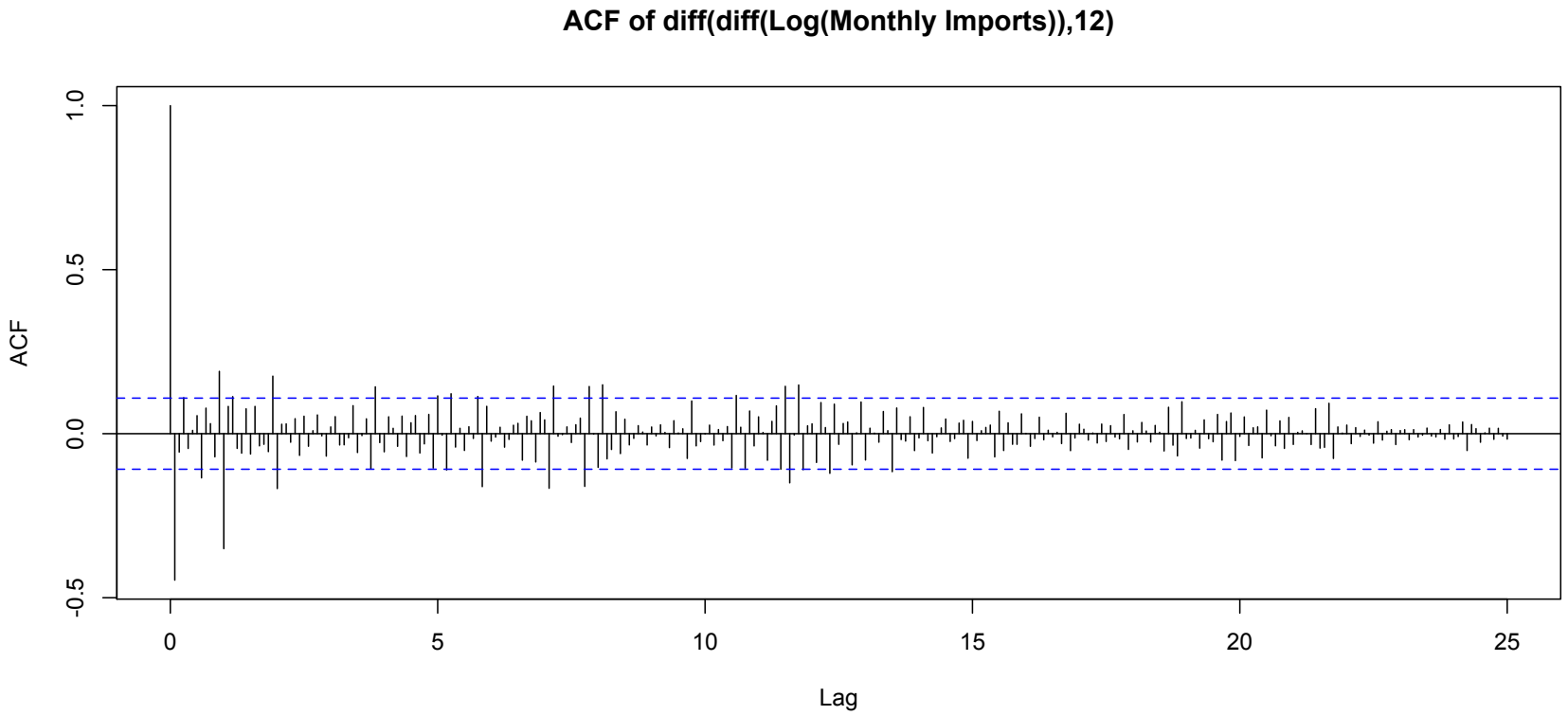
Seasonality

- Peaks at seasonal lags
- Seasonal lags decreasing slowly

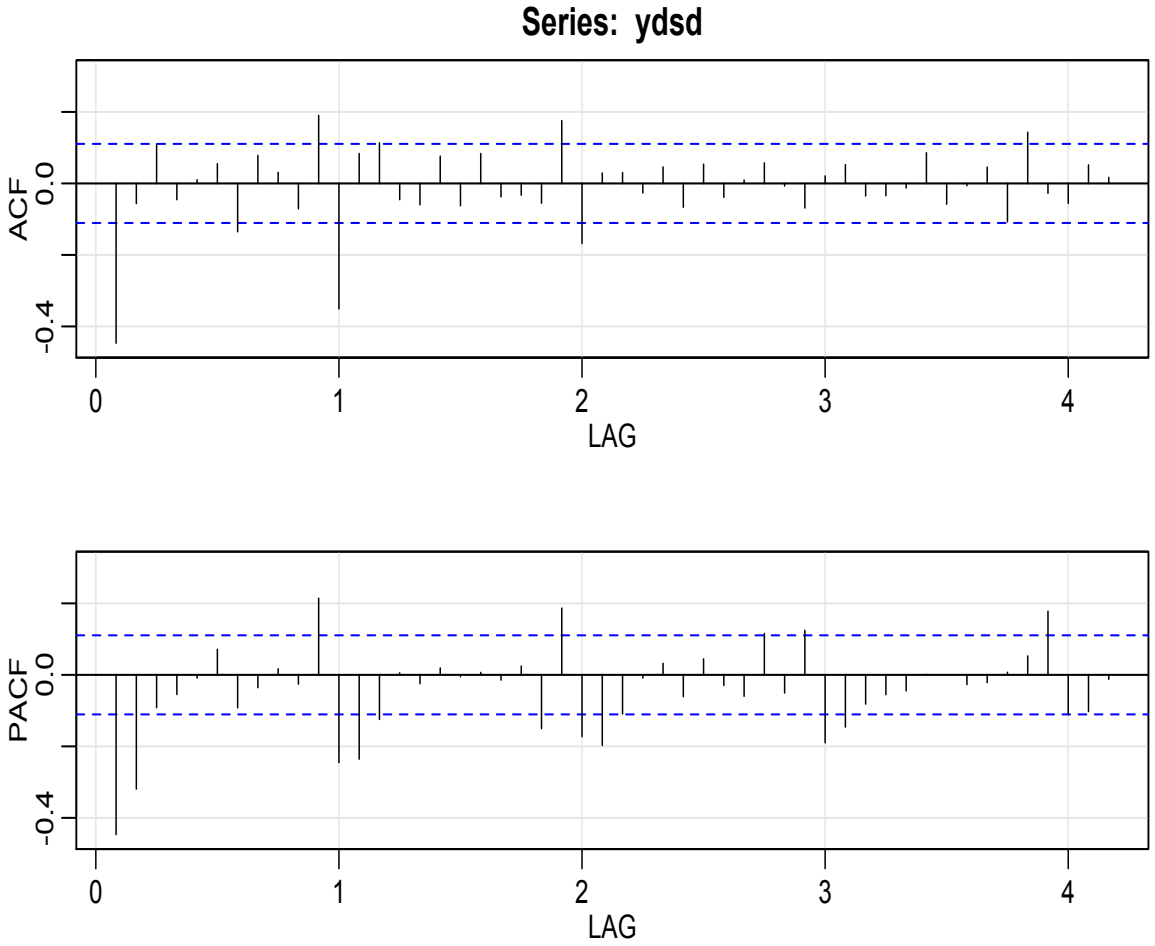


Stationary

- ACF only significant at lag 0, 1.
- ACF decreasing exponentially fast



Fitting Model



Seasonal lag

- ACF cuts off after lag 1s
- PACF cuts off after lag 3s

Within seasonal lag

- ACF cuts off after lag 1
- PACF cuts off after lag 2

Fitting Model

Table 3.1. Behavior of the ACF and PACF for ARMA Models

	AR(p)	MA(q)	ARMA(p, q)
ACF	Tails off	Cuts off after lag q	Tails off
PACF	Cuts off after lag p	Tails off	Tails off

- AR(2)
- MA(1)
- ARMA(2,1)

Table 3.3. Behavior of the ACF and PACF for Pure SARMA Models

	AR(P)$_s$	MA(Q)$_s$	ARMA(P, Q)$_s$
ACF*	Tails off at lags ks, $k = 1, 2, \ldots,$	Cuts off after lag Qs	Tails off at lags ks
PACF*	Cuts off after lag Ps	Tails off at lags ks $k = 1, 2, \ldots,$	Tails off at lags ks

*The values at nonseasonal lags $h \neq ks$, for $k = 1, 2, \ldots,$ are zero.

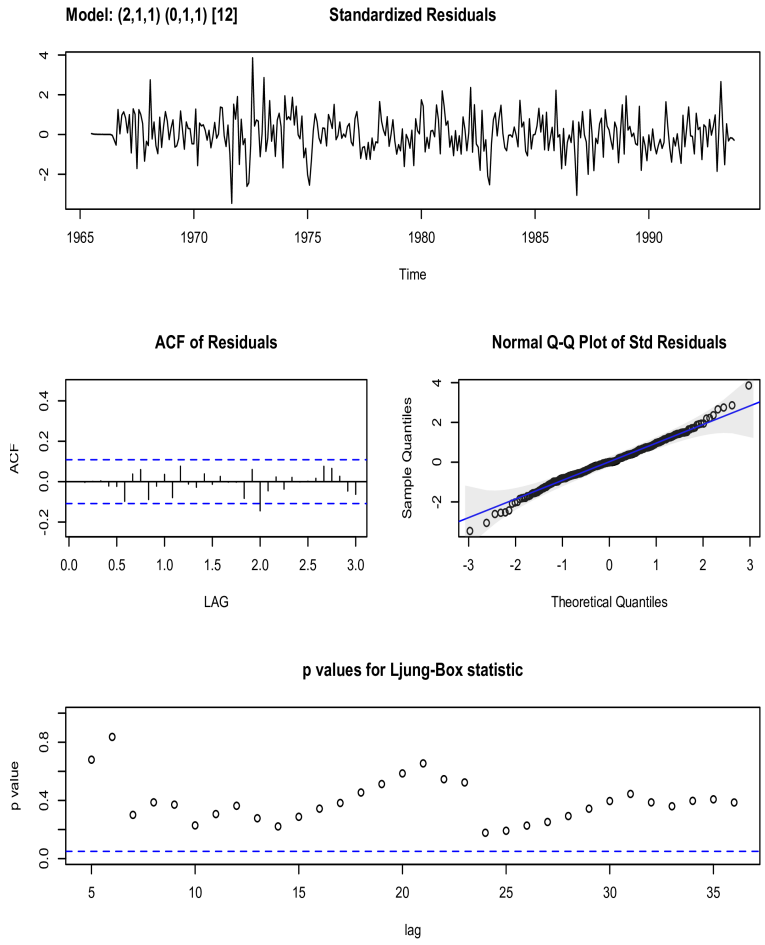
- SAR(3)
- SAR(1)
- SARMA(3,1)

Fitting Model

Model	Sig. of coefficient	AIC	AICc
$ARIMA(0,1,1) \times (0,1,1)_{12}$	all highest order coefficient are significant	-3.087501	-3.081409
$ARIMA(0,1,1) \times (3,1,0)_{12}$	all highest order coef. are sig.	-2.943235	-2.936824
$ARIMA(0,1,1) \times (3,1,1)_{12}$	SAR(3) is not significant	-3.110061	-3.103437
$ARIMA(2,1,0) \times (0,1,1)_{12}$	all highest order coef. are sig.	-3.091594	-3.085361
$ARIMA(2,1,0) \times (3,1,0)_{12}$	all highest order coef. are sig.	-2.949414	-2.94279
$ARIMA(2,1,0) \times (3,1,1)_{12}$	SAR(3) is not significant	-3.111903	-3.105028
$ARIMA(2,1,1) \times (0,1,1)_{12}$	all highest order coef. are sig.	-3.099141	-3.09273
$ARIMA(2,1,1) \times (3,1,0)_{12}$	all highest order coef. are sig.	-2.954684	-2.947809
$ARIMA(2,1,1) \times (3,1,1)_{12}$	SAR(3) is not significant	-3.119653	-3.112491

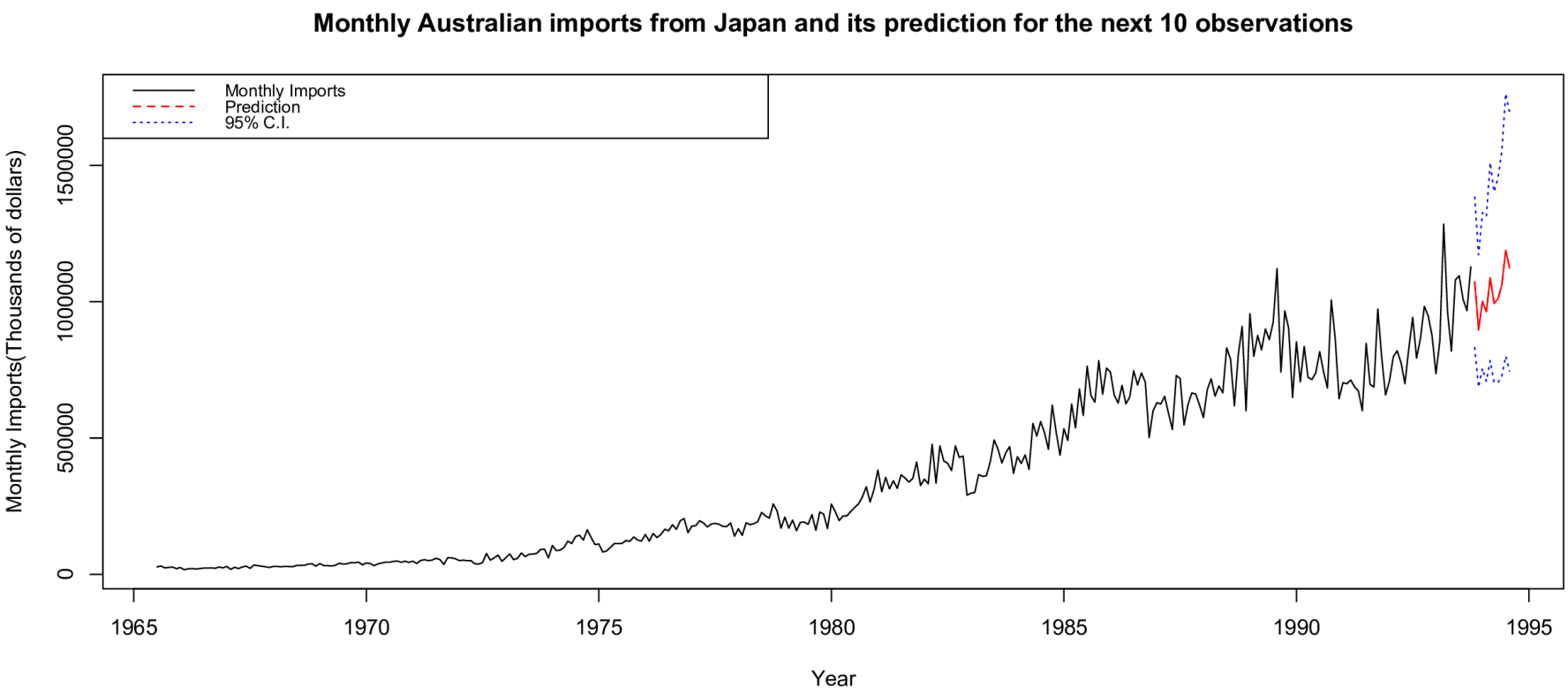
- Compare AIC and AICc
- Over fitting Problem

Fitting Model




```
Call:
stats::arima(x = xdata, order = c(p, d, q), seasonal = list(order = c(P, D,
    Q), period = S), include.mean = !no.constant, optim.control = list(trace = trc,
    REPORT = 1, reltol = tol))

Coefficients:
          ar1      ar2      ma1     sma1
      -0.3829  -0.2447  -0.2922  -0.8892
s.e.   0.1371   0.0874   0.1397   0.0339

sigma^2 estimated as 0.0162:  log likelihood = 200.41,  aic = -390.81

$degrees_of_freedom
[1] 336

$ttable
     Estimate     SE  t.value p.value
ar1   -0.3829 0.1371  -2.7924  0.0055
ar2   -0.2447 0.0874  -2.7996  0.0054
ma1   -0.2922 0.1397  -2.0913  0.0372
sma1  -0.8892 0.0339 -26.1968  0.0000
```

Prediction on Future



Conclusion

- Stationarity and transformation
- Seasonality
- Fitted model
- Model choice and test diagnostics

Reference

- Anderson, S. (Photographer). (2014, July 8). Economic and defence ties are set to be strengthened by Australia's “new special relationship” with Japan as both countries' leaders signed a free trade agreement [digital image]. Retrieved from http://www.sbs.com.au/news/article/2014/07/08/economic-and-defence-ties-be-boosted-special-relationship-japan

- [Digital image]. Retrieved from http://dfat.gov.au/trade/agreements/jaepa/news/Pages/guide-to-using-jaepa-to-export-and-import-goods.aspx