Parameter estimation: Johnson&Johnson (AR attempt)

PRACTICAL TIME SERIES ANALYSIS

THISTLETON AND SADIGOV

Objectives

- To fit an AR(p) model to Quarterly earnings (dollars) per Johnson & Johnson share 1960–80.
- Use Yule-Walker equations in matrix form to estimate parameters of the fitted model

JohnsonJohnson {datasets}

- Quarterly earnings (dollars) per Johnson & Johnson share 1960–80.
- Quarterly time series
- Source: “astsa” package

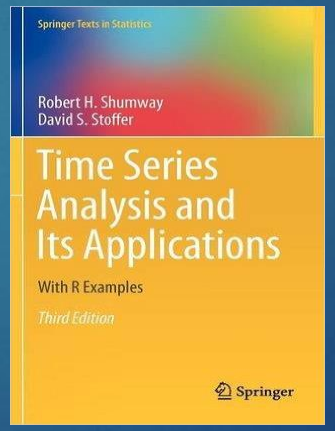
Shumway, R.H. and Stoffer, D.S. (2000)

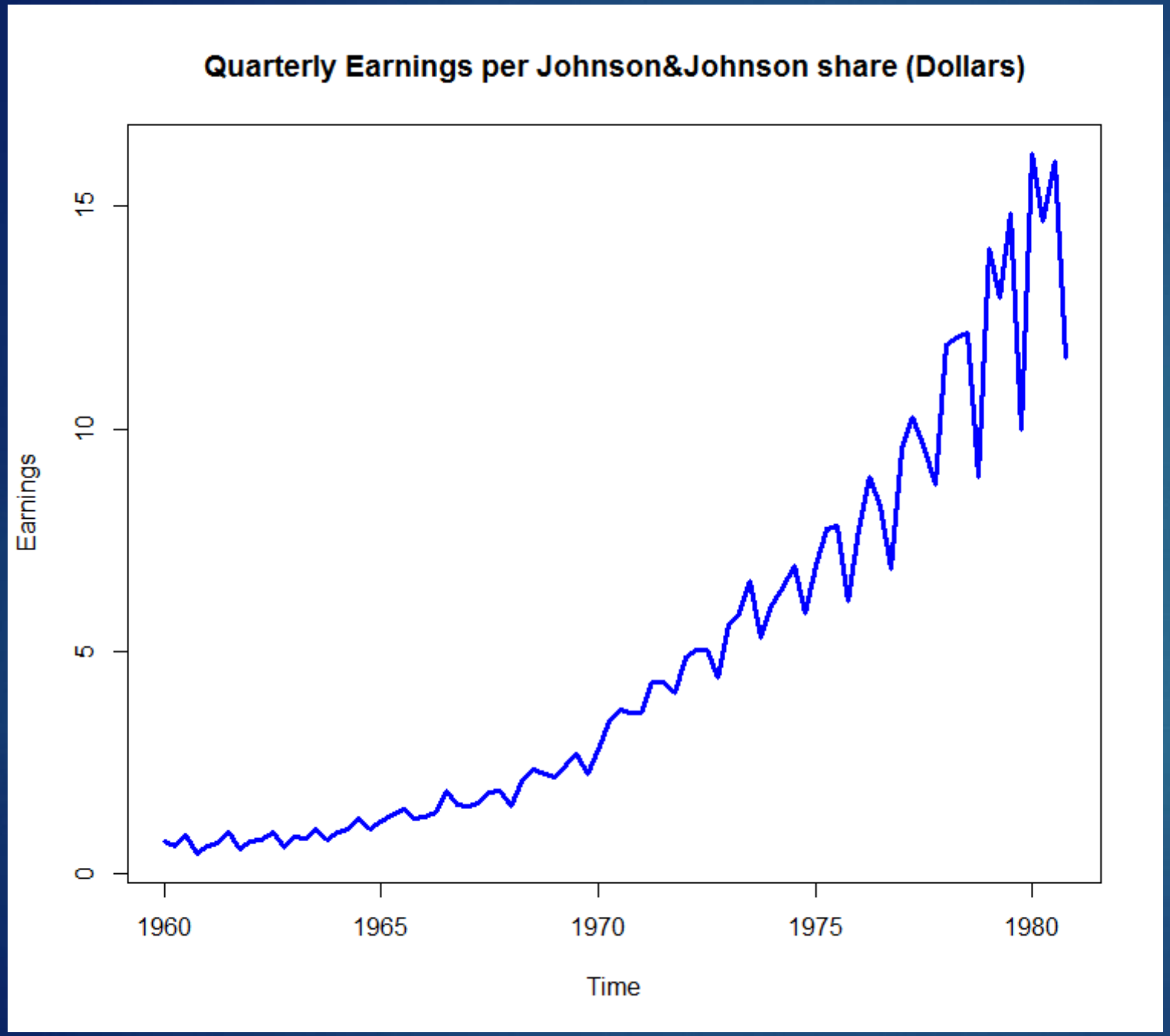
Time Series Analysis and its Applications

With R examples

Third Edition

Springer




Quarterly Earnings per Johnson&Johnson share (Dollars)
Earnings
0
5
10
15
1960
1965
1970
1975
1980
Time

Transformation

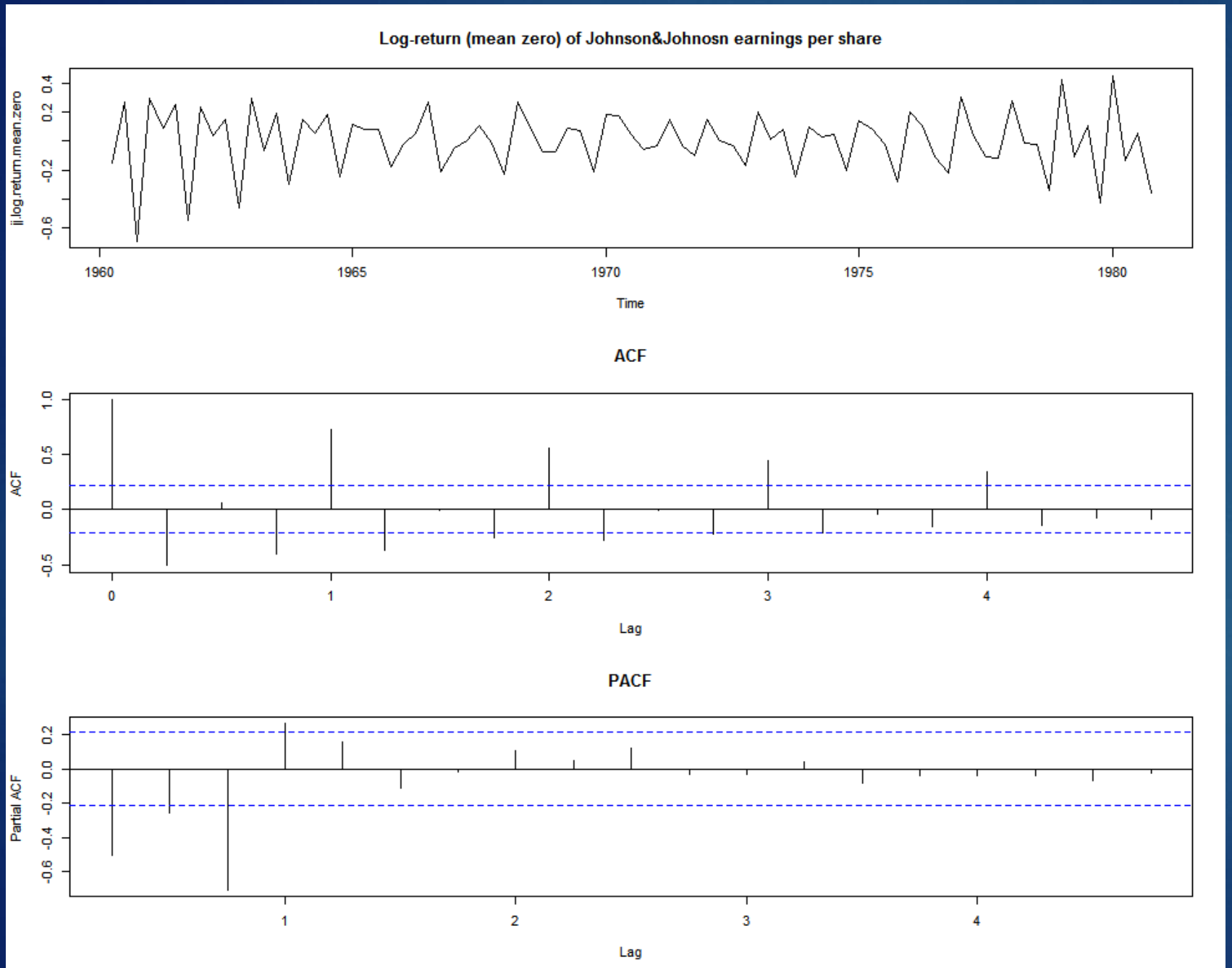
Log-return a time series $\{X_t\}$

is defined as

$$r_t = \log\left(\frac{X_t}{X_{t-1}}\right) = \log(X_t) - \log(X_{t-1})$$

In R,

$$diff(\log(\quad))$$


Log-return (mean zero) of Johnson&Johnosn earnings per share
jj.log.return.mean.zero
-0.6
-0.2
0.2
0.4
1960
1965
1970
1975
1980
Time
ACF
ACF
-0.5
0.0
0.5
1.0
0
1
2
3
4
Lag
PACF
Partial ACF
-0.6
-0.4
-0.2
0.0
0.2
1
2
3
4
Lag

The parsimony principle

- Choose ‘simplest explanation that fits the evidence’
- Simplest of competing theories is to be preferred
- PACF $\Longrightarrow$ AR(4)
- Yule-Walker equations in matrix form

$p = 4$

Fitted model is

$$r_t = 0.079781 - 0.6293492\, r_{t-1} - 0.5171526\, r_{t-2} - 0.4883374\, r_{t-3} + 0.2651266\, r_{t-4} + Z_t$$

$$Z_t \sim Normal\,(0, 0.01419242)$$

where

$$r_t = \log\left(\frac{X_t}{X_{t-1}}\right)$$

What We've Learned

- Fitting an AR(p=4) model to log-return of Johnson & Johnson quarterly earnings from 'astsa' package using Yule-Walker equations in matrix form