

Visualizing Patterns over Time

Statistics 4868/6610 Data Visualization

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Introduction

Today in the computer lab we will go over some examples of time series data using

- R
- tableau

Examples from the book

Recall that the data files and relate R code can be downloaded from the book's website. [Book](#)

We will look at some of the examples from [Chapter 4](#)

Hot Dog Eating, bargraphs with R

The Hot Dog Eating example gives a good idea how to work with R to make bargraphs.

Try the author's program **bars.R**

- Note the use of the *for loop* and the *if-then-else* statement to color specific bars in the graph
- Note the use of the time labeling.

Hot Dog Eating, bargraphs with tableau

Reproduce the graph from **bars.R** that is on page 96 using tableau.

First note that the *hot-dogs-contest-winners.csv* file is considered a Text File by tableau.

The Columns shelf will be **Year** and the Rows shelf will be **SUM(Dogs eaten)**.

To color code the years with a new recoded, drag **New record** to the Marks Color.

Hot Dog Eating, map movie with tableau

Now produce a map movie of the Hot Dog Eating data showing the changing country of origin by time.

Longitude is the Column

Latitude is the Row

And **Year** is the Pages

Hot Dog Eating, stacked bargraphs with R

The Hot Dog Eating example gives a good idea how to work with R to make bargraphs.

Try the author's program **stackedbars.R**

FlowingData subscribers, time plot with R

The FlowingData Subscribers example give a good idea of how to work with R to make time plots.

Try the author's program **scatter.R**

What does `type="h"` do in a `plot()` command?

What does the `points()` command do?

FlowingData subscribers, time plot with tableau

Now reproduce the graph from **scatter.R** that is on page 116 using tableau.

First note that the *flowingdata_subscribers.csv* file is considered a Text File by tableau.

The Columns shelf will be **DAY(Date)** and the Rows shelf will be **SUM(Subscribers)**.

Change the Marks to Bar and change the Size.

World Population, time plot with tableau

Reproduce the graph from **timeseries.R** that is on page 120 using tableau.

US Postage, step chart with R

The US Postage example gives a good idea how to work with R to make step charts.

A step chart is for data in time that changes at a specific time. US Postage rates change on specific dates.

Try the author's program **step.R**

US Postage, step chart with R

Reproduce the plots on page 126.

What does `type="s"` do in a `plot()` command?

What does the `points()` command do?

Smoothing Data with R

When looking at time series data it is common to examine time series plots for an underlying trend. The trend may linear or nonlinear or may be periodic.

The use of linear regression is common to see linear and nonlinear (quadratic, cubic, etc.) trends.

The use of LOESS is commonly used when the data is not periodic. LOESS is **locally weighted scatterplot smoothing**.

LOESS gives an easy way to smooth the data. Small slices are fitted with a low-degree polynomial, then the small curves are put together.

Unemployment Data, step chart with R

The Unemployment example gives a good idea how to work with R to smooth time series data using LOESS.

Try the author's program **loess.R**

Unemployment Data, step chart with R

What does the function `lines()` do?

What does the function `scatter.smooth()` do?

Recall Time Series Models

Basic models

- Additive model

$$Y_t = T_t + S_t + I_t$$

- Multiplicative model

$$Y_t = T_t * S_t * I_t$$

What would a **log** transformation do to the **multiplicative model**?

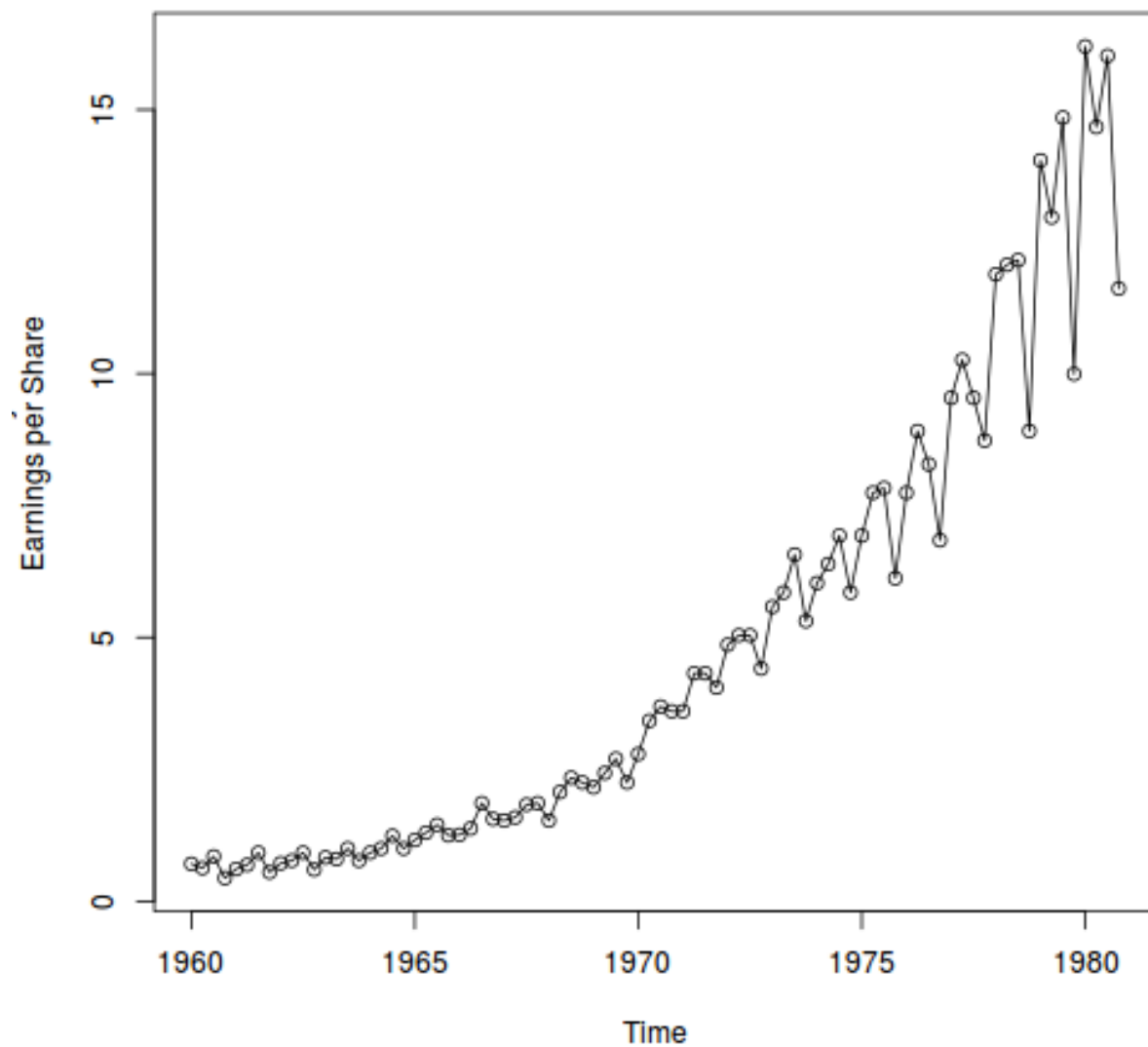
In R

```
decompose( )
```

Johnson & Johnson stock price with R

```
library(astsa)

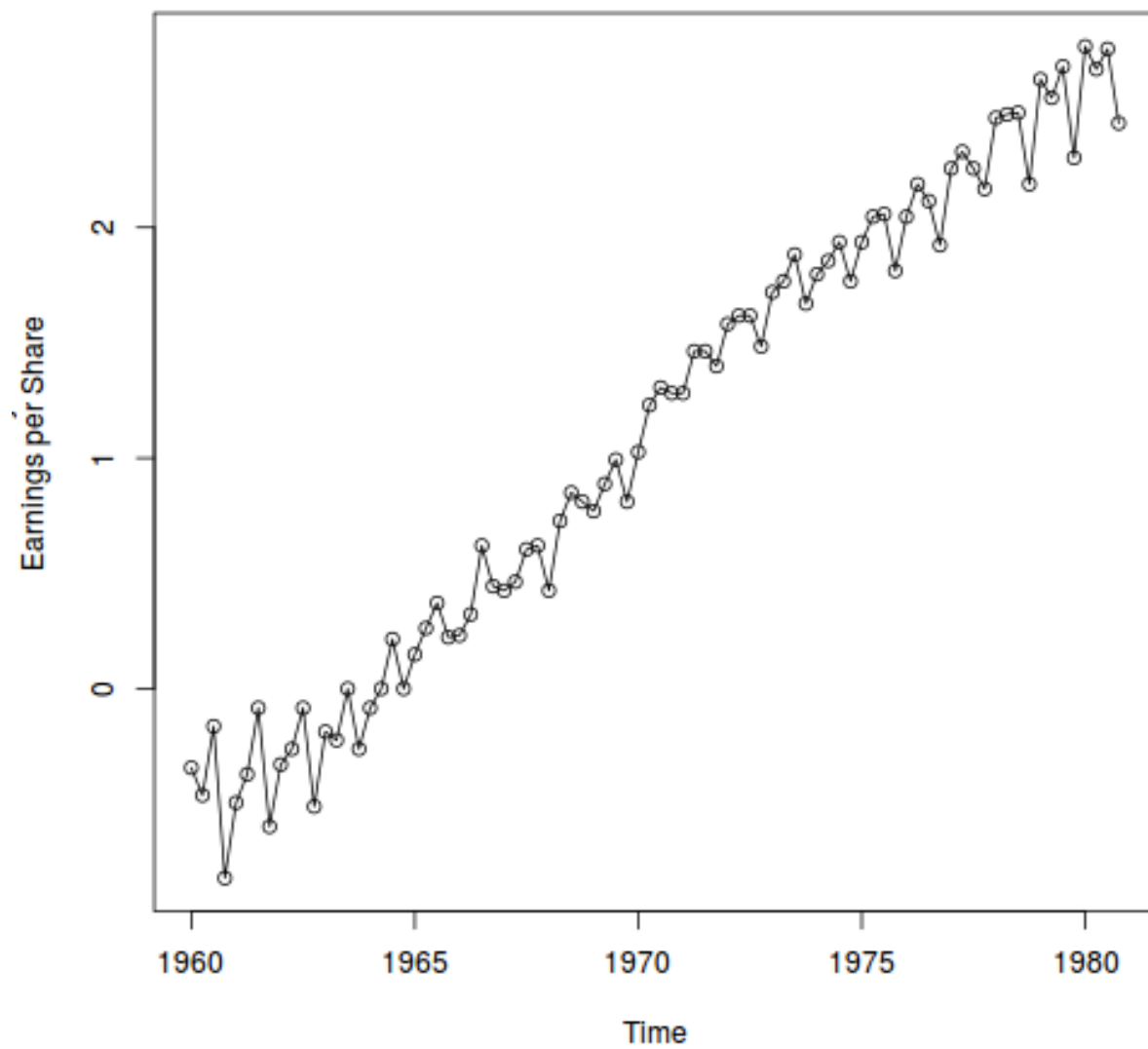
plot(jj, type="o", ylab="Quarterly
      Earnings per Share")
```



Johnson & Johnson stock price with R

```
library(astsa)

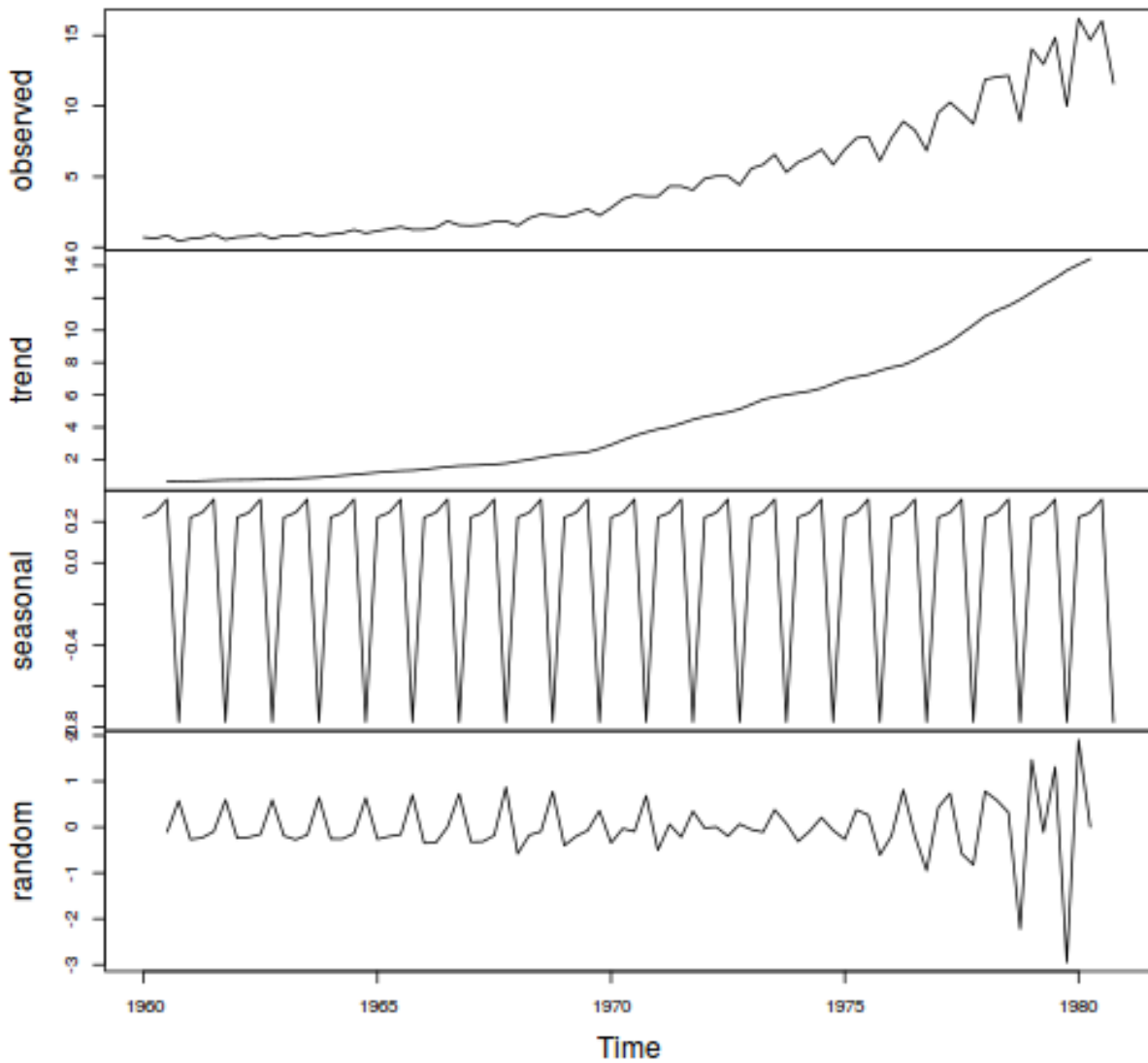
plot(log(jj), type="o", ylab="Quarterly  
Earnings per Share")
```



Johnson & Johnson stock price, decompose with R

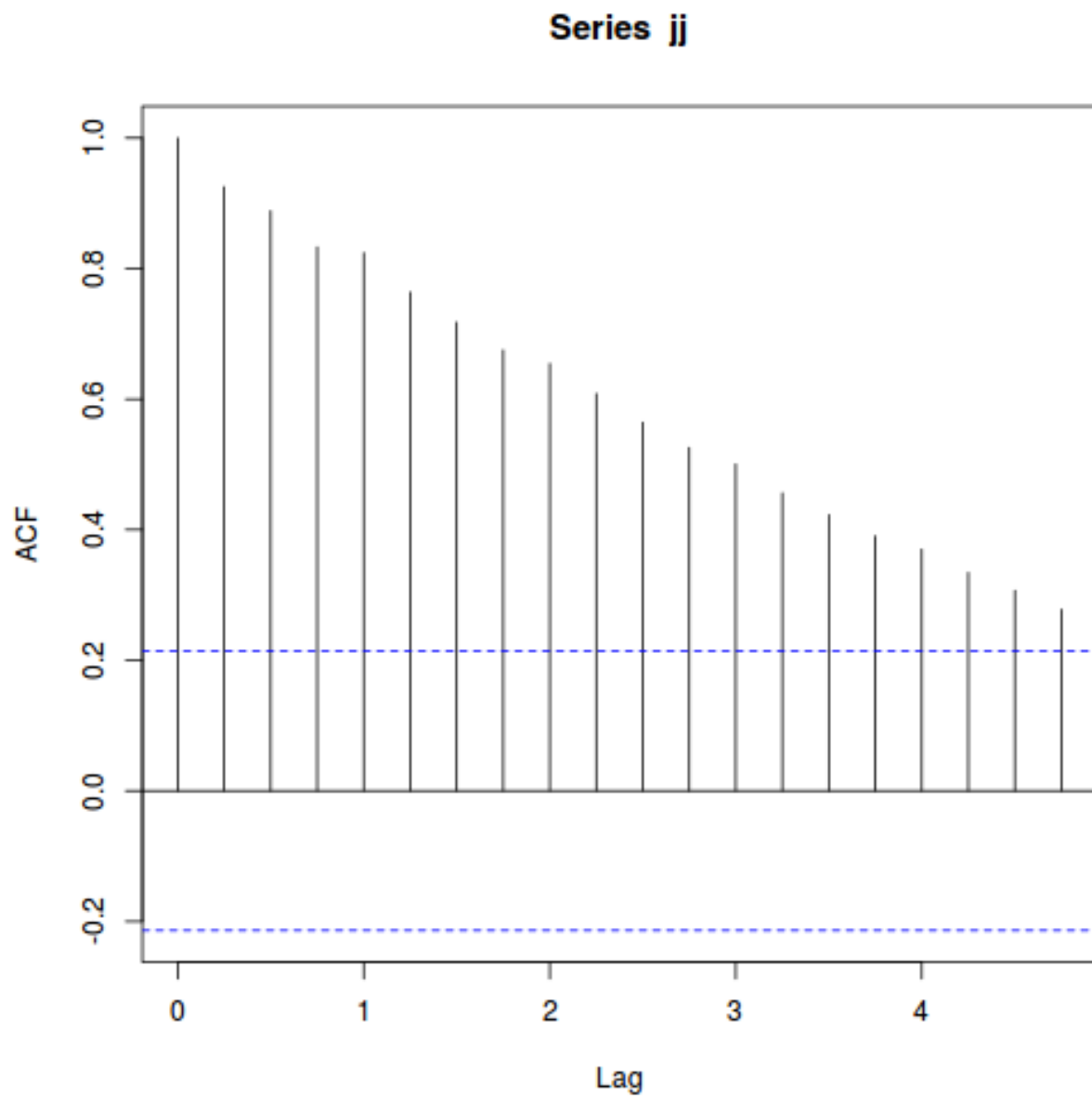
```
plot(decompose(jj))
```

Decomposition of additive time series



Johnson & Johnson stock price, ACF with R

```
acf(jj)
```



Johnson & Johnson stock price, PCF with R

```
pacf(jj)
```

Series jj

