

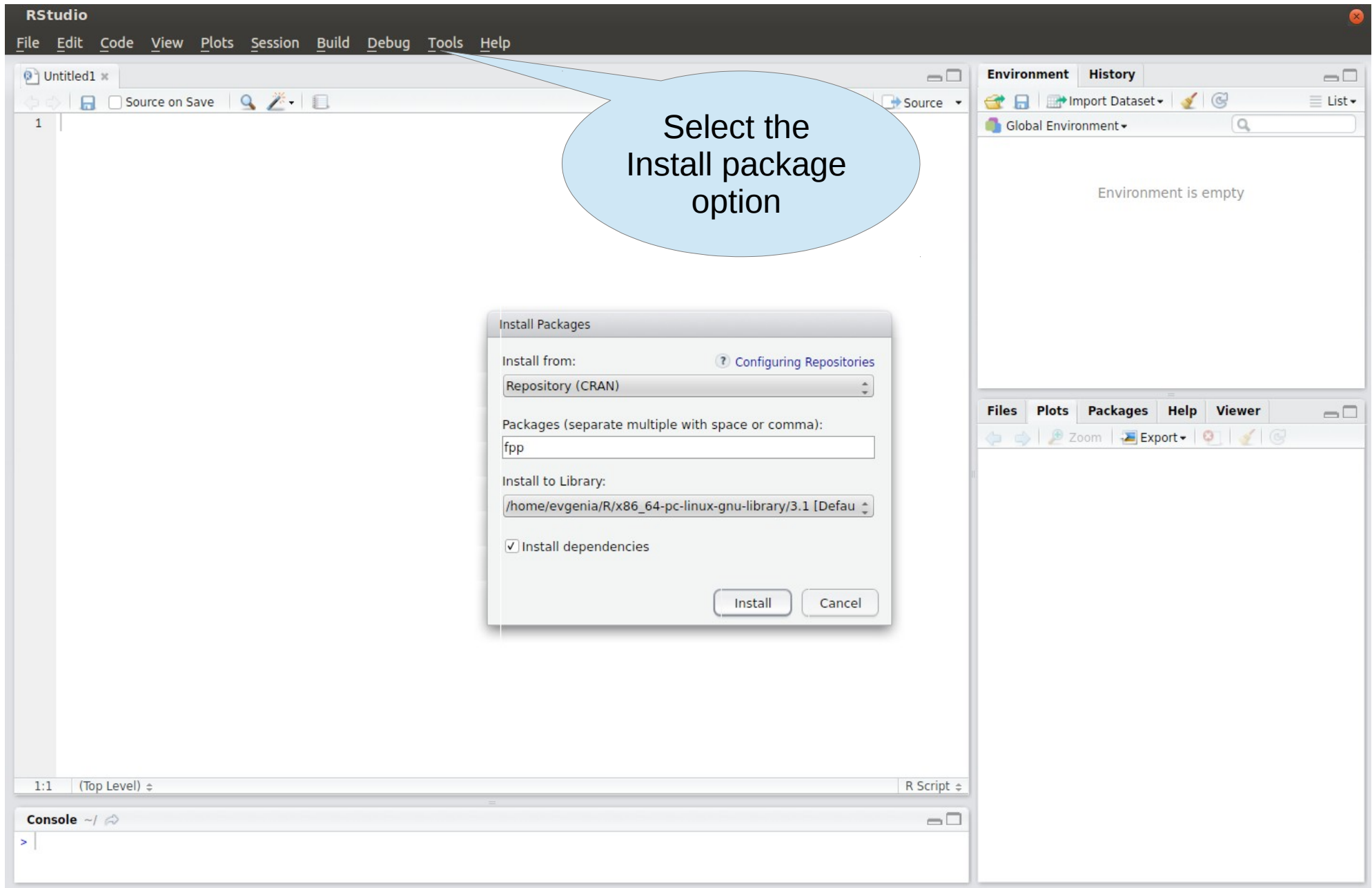
**Welcome
to
Dynamic Models for
Prediction**

First things first...

To have fun with R, we need to take a few steps:

- Download and Install R
- Download and Install RStudio

Install the fpp package



Load the package

The screenshot shows the RStudio interface. The main editor window displays the following R code:

```
1 library(fpp)
2 |
```

The Environment pane on the right shows "Global Environment" and "Environment is empty".

The Console pane at the bottom shows the following output:

```
> fpp
Error: object 'fpp' not found
>
> library(fpp)
> |
```

The Help pane on the right shows the "Help Pages" for the "fpp" package, listing various data sets and their descriptions:

- [fpp-package](#) Data for "Forecasting: principles and practice"
- [a10](#) Monthly anti-diabetic drug sales in Australia from 1992 to 2008.
- [ausair](#) Air Transport Passengers Australia
- [ausbeer](#) Quarterly Australian Beer production
- [austa](#) International visitors to Australia
- [austourists](#) International Tourists to Australia: Total visitor nights.
- [cafe](#) Quarterly expenditure on eating out in Australia
- [credit](#) Credit ratings on personal loans from an Australian bank

Jumping into the code...

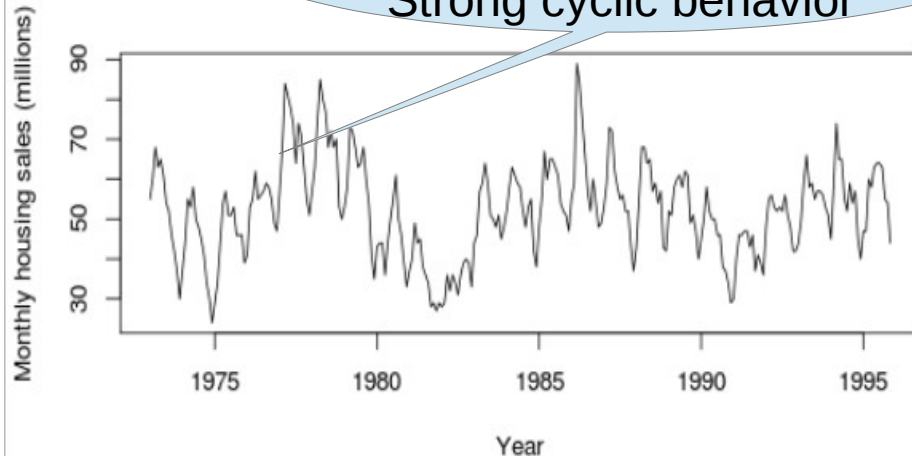


**WE'RE
BACK!**

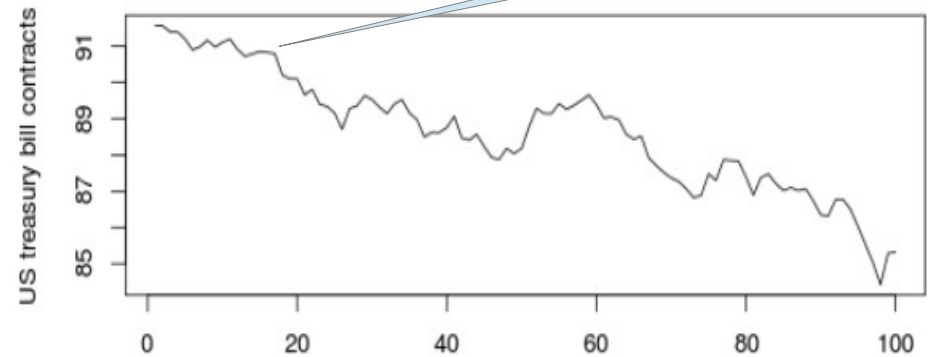
Time series decomposition

Can you identify that pattern?

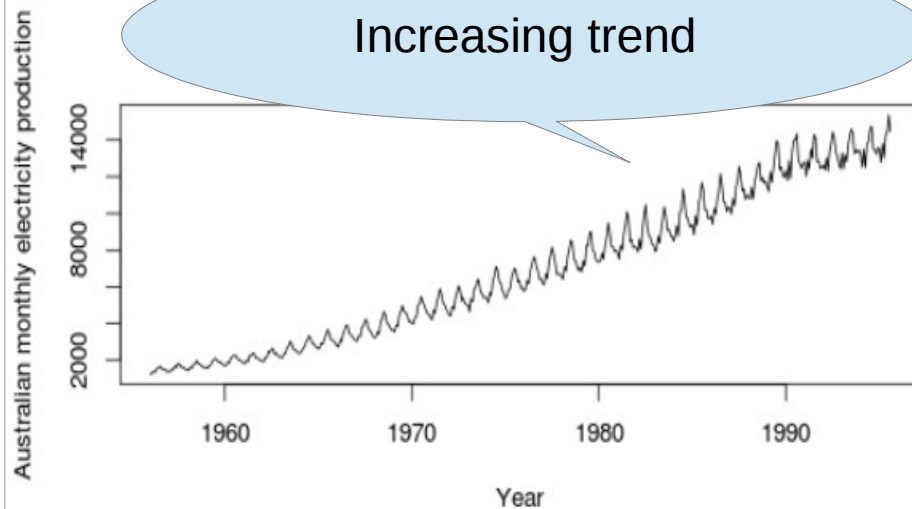
Strong seasonality
+
Strong cyclic behavior



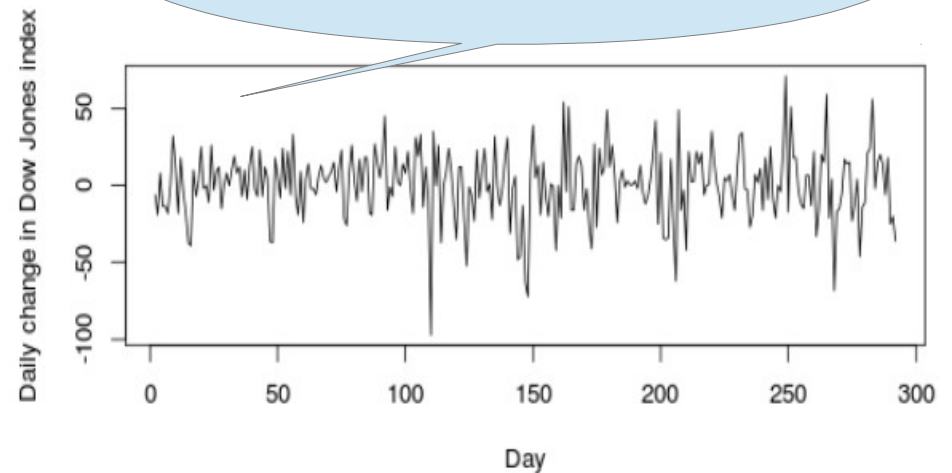
Downward trend



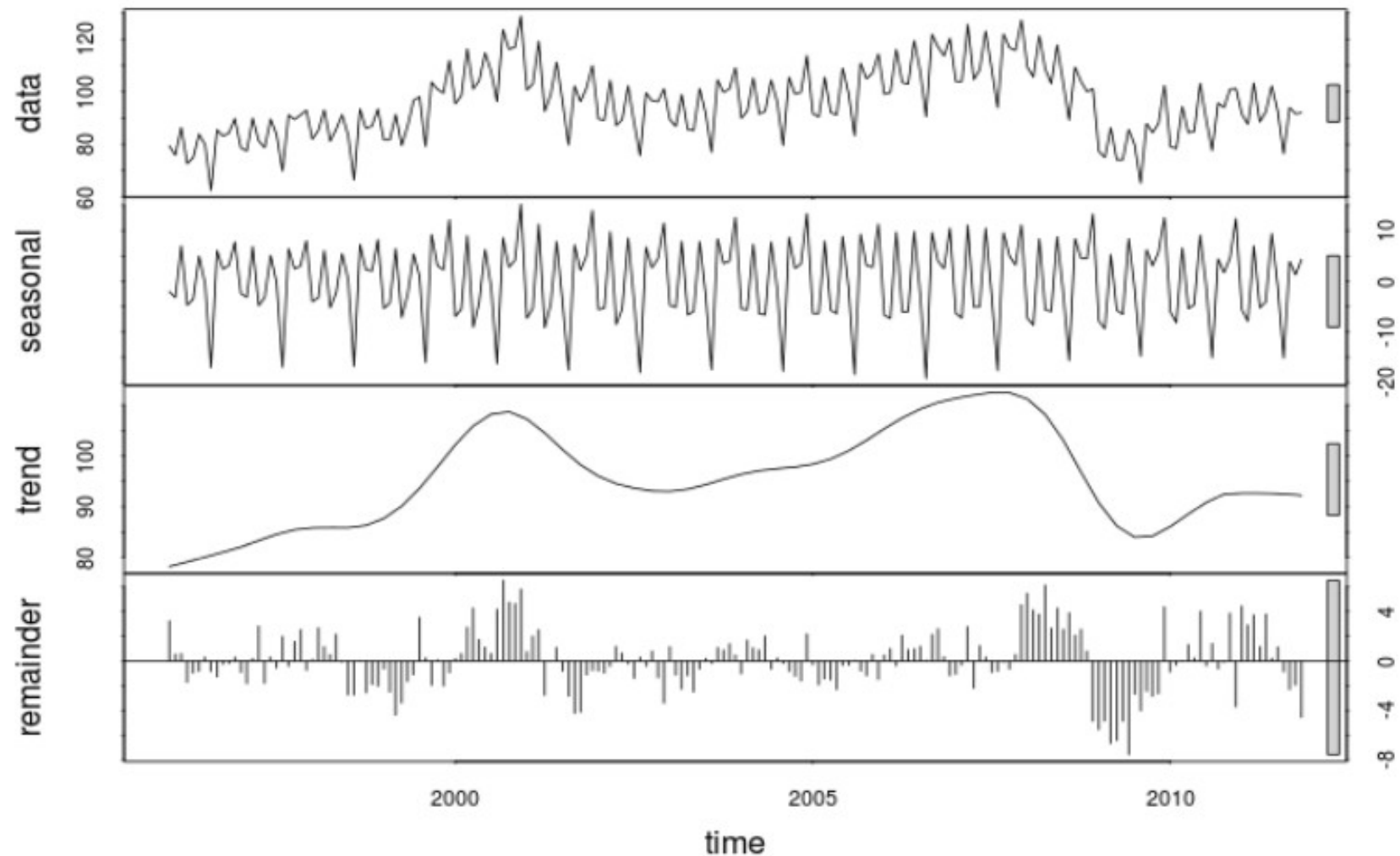
Increasing trend



Random



Additive decomposition of data



Examples

Example 1

- Use the Dow Jones index (data set dowjones) to do the following
 - a) Produce a time plot of the series
 - b) Produce forecasts using the drift method and plot them
 - c) Show that the graphed forecasts are identical to extending the line drawn between the first and last observation
 - d) Try some of the other benchmark functions to forecast the same data set. Which do you think is best? Why?

Example 2

For the data set *bricksq*:

(a) Split the data into two parts using

```
bricks1 <- window(bricksq, end = 1987.99)
```

```
bricks2 <- window(bricksq, start = 1988)
```

(b) Check that your data have been split appropriately by producing the following plot

```
plot(bricksq)
```

```
lines(bricks1, col="red")
```

```
lines(bricks2, col="blue")
```

Example 2 (Continuing)

(c) Calculate forecasts using each of the four benchmarks methods applied to `bricks1`

(d) Compare the accuracy of your forecasts against the actual values stored in *bricks2*. For example:

```
bricks1mean <- meanf(bricks1)
```

```
accuracy(bricks1mean,bricks2)
```

(e) Which method does best? Why?

Example 2 (Continuing)

(f) For the best method, compute the residuals and plot them. For example

```
res <- residuals(bricks1drift)
```

```
plot(res)
```

```
hist(res, breaks="FD")
```

Do the residuals appear to be uncorrelated and normally distributed?

Example 3

- A) From Example 2, use the preferred forecasting method you identified for the bricksq time series and apply it to the full data set.
- B) Compute the residuals and plot their ACF. Do the residuals appear to be white noise? What did your forecasting method miss?
- C) Do a Ljung-Box test on the residuals. What do the results mean?

Example 4

Use the `seasonplot` and `monthplot` functions to explore the seasonal patterns in the following time series:

`bricksq, writing, fancy`

- (a) What can you say about the seasonal patterns?
- (b) Can you identify any unusual years?