

Time Series Analysis

Lecture 2

Regression With Time Series, An Introduction to
Exploratory Time Series Data Analysis and Time Series
Smoothing

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Time Series Regression: Example 2

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- One could regress one time series on another. For a pure illustration purpose, we use the Southern Oscillation Index (SOI) and Recruitment series as an example. This dataset is used in a few examples in Chapters 1 and 2 in our textbook.
- For instance, it is shown in Chapter 1 that the lag values of SOI are correlated to the current value of Recruitment. One model we can entertain is the following simple mode:

$$R_t = \beta_1 + \beta_2 S_{t-6} + w_t,$$

(Handwritten red annotations: a double arrow points to R_t , a bracket underlines S_{t-6} , and an arrow points to S_t above the equation.)

where R_t denotes the Recruitment for month t and S_{t-6} denotes the SOI six months prior.

- The estimated model is

$$\hat{R}_t = 65.79 - 44.28_{(2.78)} S_{t-6}$$

(Handwritten red bracket around the equation.)

with $\hat{\sigma}_w = 22.5$ on 445 degrees of freedom.

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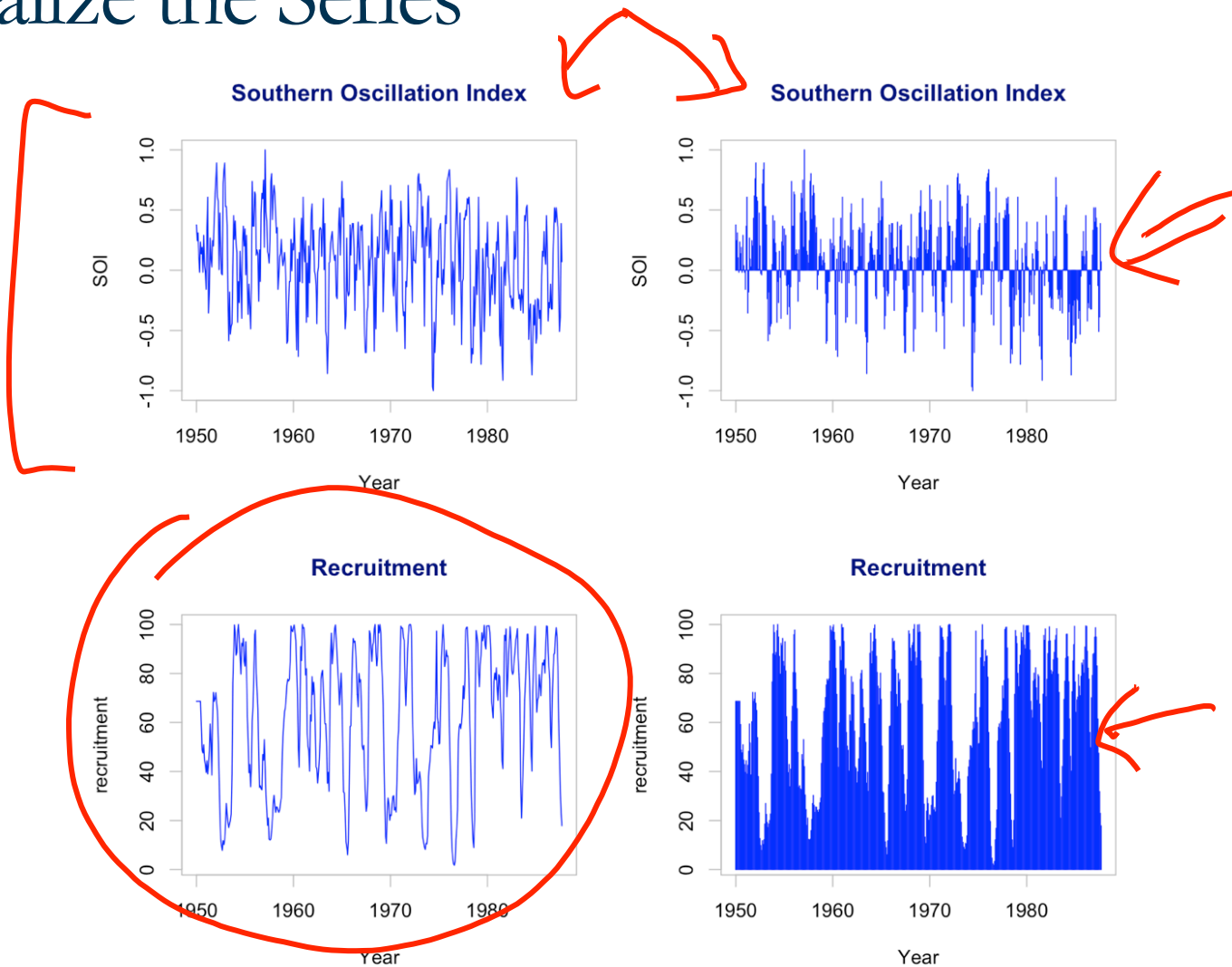
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Visualize the Series



Estimate a Model With Lag SOI

```
> str(rec)
Time-Series [1:453] from 1950 to 1988: 68.6 68.6 68.6 68.6 68.6 ...
> str(soi)
Time-Series [1:453] from 1950 to 1988: 0.377 0.246 0.311 0.104 -0.016
```

```
# time index alignment
fish = ts.intersect(rec, soil6=lag(soi,-6))
summary(fitz <- lm(rec ~ soil6, data=fish, na.action = NULL))
```

$$\hat{R}_t = 65.79 - 44.28_{(2.78)} S_{t-6}$$

```
Call:
lm(formula = rec ~ soil6, data = fish, na.action = NULL)

Residuals:
    Min       1Q   Median       3Q      Max
-65.187 -18.234   0.354  16.580  55.790

Coefficients:
              Estimate Std. Error t value Pr(>|t|)
(Intercept)   65.790     1.088    60.47  <2e-16 ***
soil6        -44.283     2.781   -15.92  <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 22.5 on 445 degrees of freedom
Multiple R-squared:  0.3629,    Adjusted R-squared:  0.3615
F-statistic: 253.5 on 1 and 445 DF,  p-value: < 2.2e-16
```

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