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FORECASTING
PRINCIPLES AND PRACTICE

A comprehensive introduction to the latest forecasting methods using R. Learn to improve your forecast accuracy using dozens of real data examples.

3RD EDITION

OTexts

5. The forecaster's toolbox

5.7 Forecasting with decomposition

OTexts.org/fpp3/

Forecasting and decomposition

$$y_t = \hat{S}_t + \hat{A}_t$$

- $\hat{A}_t$ is seasonally adjusted component
- $\hat{S}_t$ is seasonal component.

- Forecast $\hat{S}_t$ using SNAIVE.
- Forecast $\hat{A}_t$ using non-seasonal time series method.
- Combine forecasts of $\hat{S}_t$ and $\hat{A}_t$ to get forecasts of original data.

US Retail Employment

```
us_retail_employment <- us_employment |>
  filter(year(Month) >= 1990, Title == "Retail Trade") |>
  select(-Series_ID)
us_retail_employment

## # A tsibble: 357 x 3 [1M]
##       Month Title        Employed
##       <mth> <chr>           <dbl>
##  1 1990 Jan Retail Trade   13256.
##  2 1990 Feb Retail Trade   12966.
##  3 1990 Mar Retail Trade   12938.
##  4 1990 Apr Retail Trade   13012.
##  5 1990 May Retail Trade   13108.
##  6 1990 Jun Retail Trade   13183.
##  7 1990 Jul Retail Trade   13170.
##  8 1990 Aug Retail Trade   13160.
## 9 1990 Sep Retail Trade   13113.
```

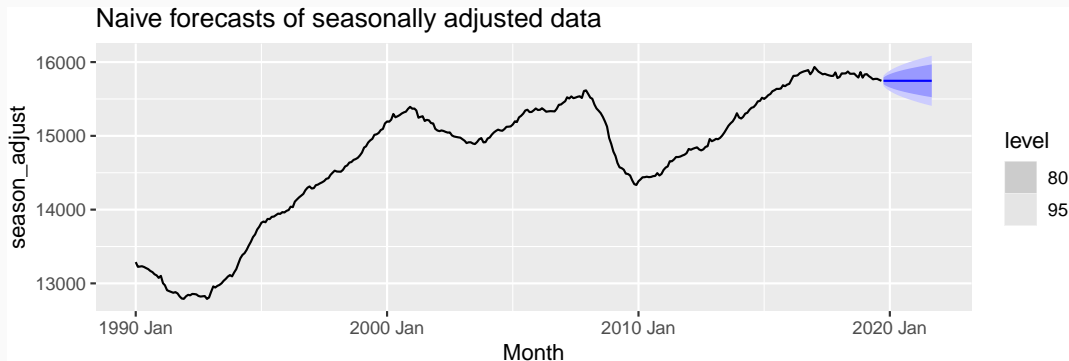# US Retail Employment

```
dcmp <- us_retail_employment |>
  model(STL(Employed)) |>
  components() |>
  select(-.model)
dcmp
```

```
## # A tsibble: 357 x 6 [1M]
##        Month Employed   trend season_year remainder season_adjust
##        <mth>    <dbl>   <dbl>       <dbl>     <dbl>         <dbl>
##  1 1990 Jan    13256.  13288.       -33.0     0.836        13289.
##  2 1990 Feb    12966.  13269.      -258.    -44.6          13224.
##  3 1990 Mar    12938.  13250.      -290.    -22.1          13228.
##  4 1990 Apr    13012.  13231.      -220.      1.05         13232.
##  5 1990 May    13108.  13211.      -114.     11.3          13223.
##  6 1990 Jun    13183.  13192.       -24.3    15.5          13207.
##  7 1990 Jul    13170.  13172.       -23.2    21.6          13193.
##  8 1990 Aug    13160.  13151.        -9.52   17.8          13169.
```
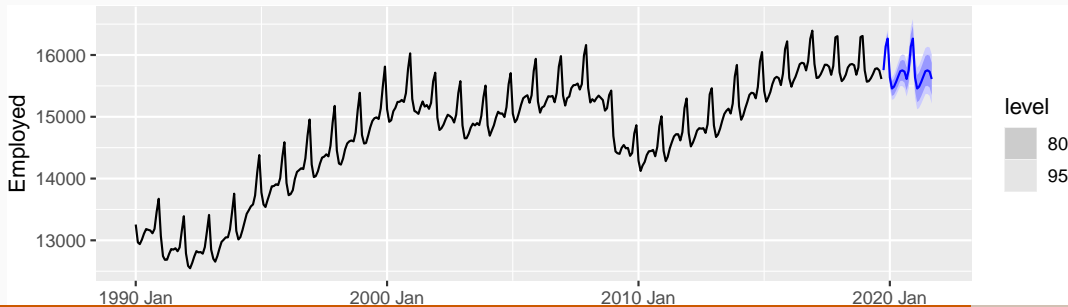
US Retail Employment

```
dcmp |>
  model(NAIVE(season_adjust)) |>
  forecast() |>
  autoplot(dcmp) +
  labs(title = "Naive forecasts of seasonally adjusted data")
```


Naive forecasts of seasonally adjusted data

US Retail Employment

```
us_retail_employment |>
  model(stlf = decomposition_model(
    STL(Employed ~ trend(window = 7), robust = TRUE),
    NAIVE(season_adjust)
  )) |>
  forecast() |>
  autoplot(us_retail_employment)
```

Decomposition models

`decomposition_model()` creates a decomposition model

- You must provide a method for forecasting the `season_adjust` series.
- A seasonal naive method is used by default for the `seasonal` components.
- The variances from both the seasonally adjusted and seasonal forecasts are combined.