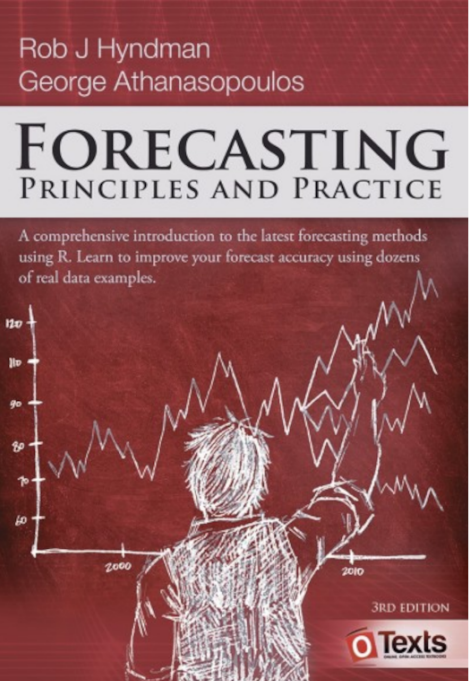


7. Time series regression models

7.6 Forecasting with regression

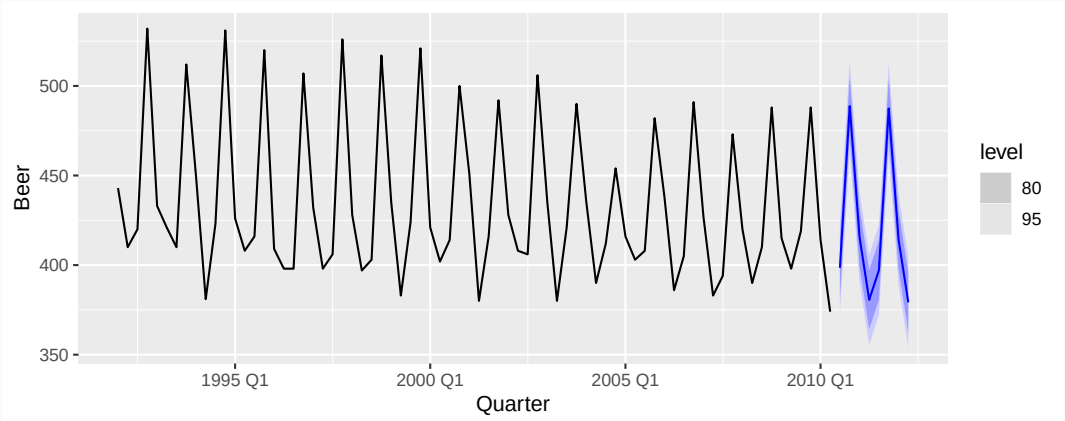
OTexts.org/fpp3/

Ex-ante versus ex-post forecasts

- Ex ante forecasts are made using only information available in advance.
  - require forecasts of predictors
- Ex post forecasts are made using later information on the predictors.
  - useful for studying behaviour of forecasting models.
- trend, seasonal and calendar variables are all known in advance, so these don't need to be forecast.

Beer production

```
recent_production <- aus_production |> filter(year(Quarter) >= 1992)
recent_production |> model(TSLM(Beer ~ trend() + season())) |>
   forecast() |> autoplot(recent_production)
```



Scenario based forecasting

- Assumes possible scenarios for the predictor variables
- Prediction intervals for scenario based forecasts do not include the uncertainty associated with the future values of the predictor variables.

US Consumption

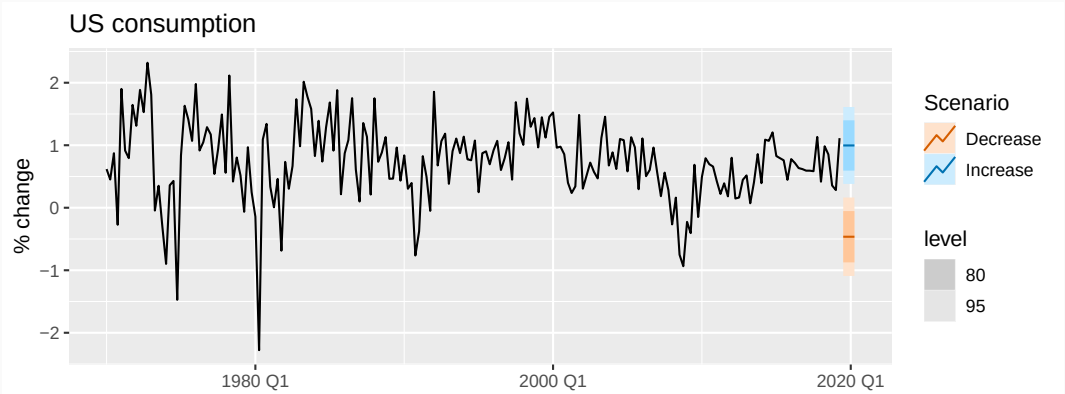
```
fit_consBest <- us_change |>
  model(
    TSLM(Consumption ~ Income + Savings + Unemployment)
  )

future_scenarios <- scenarios(
  Increase = new_data(us_change, 4) |>
    mutate(Income = 1, Savings = 0.5, Unemployment = 0),
  Decrease = new_data(us_change, 4) |>
    mutate(Income = -1, Savings = -0.5, Unemployment = 0),
  names_to = "Scenario"
)

fc <- forecast(fit_consBest, new_data = future_scenarios)
```

US Consumption

```
us_change |> autoplot(Consumption) +
  labs(y = "% change in US consumption") +
  autolayer(fc) +
  labs(title = "US consumption", y = "% change")
```



Building a predictive regression model

- If getting forecasts of predictors is difficult, you can use lagged predictors instead.

$$y_{t+h} = \beta_0 + \beta_1 x_{1,t} + \cdots + \beta_k x_{k,t} + \varepsilon_{t+h}$$

- A different model for each forecast horizon h.