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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.



7. Time series regression models

7.6 Forecasting with regression

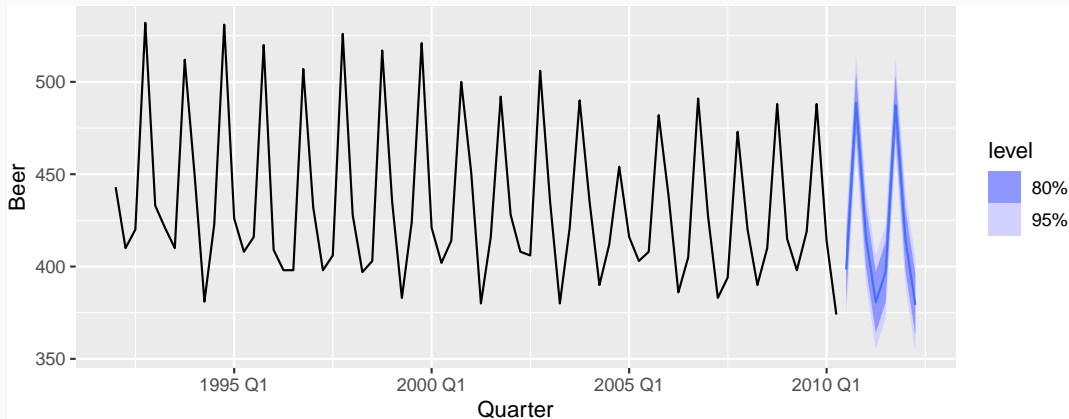
OTexts.org/fpp3/

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

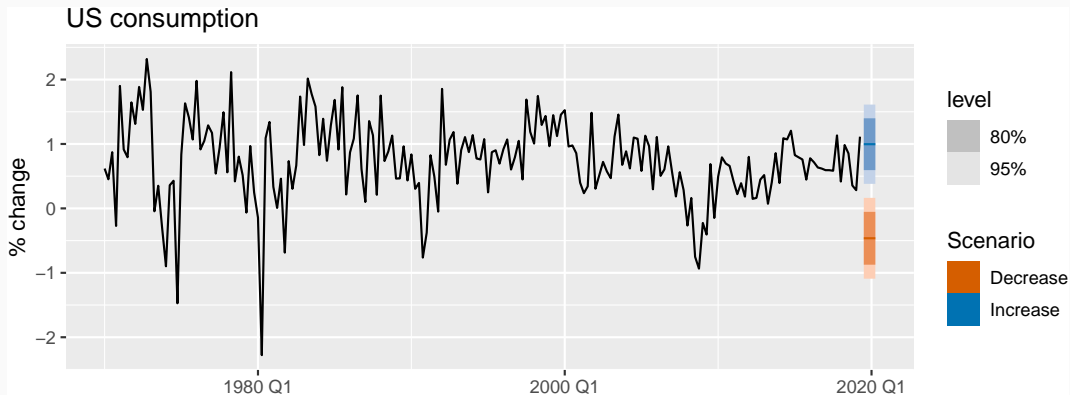
```
fit_consBest <- us_change |>
  model(
    TSLM(Consumption ~ Income + Savings + Unemployment)
  )

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 .