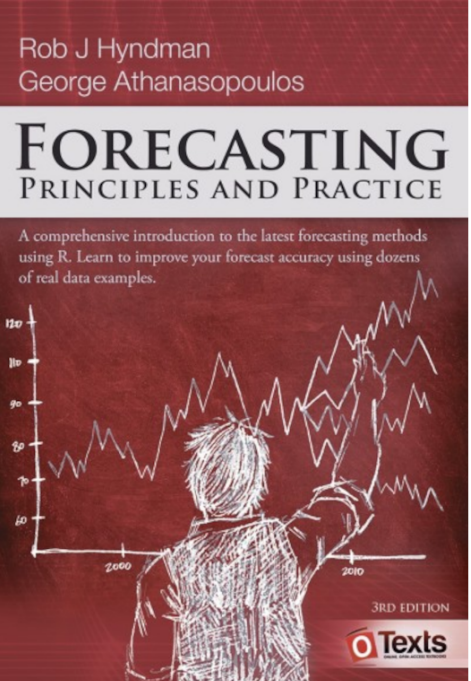


5. The forecaster's toolbox

5.10 Time series cross-validation

OTexts.org/fpp3/

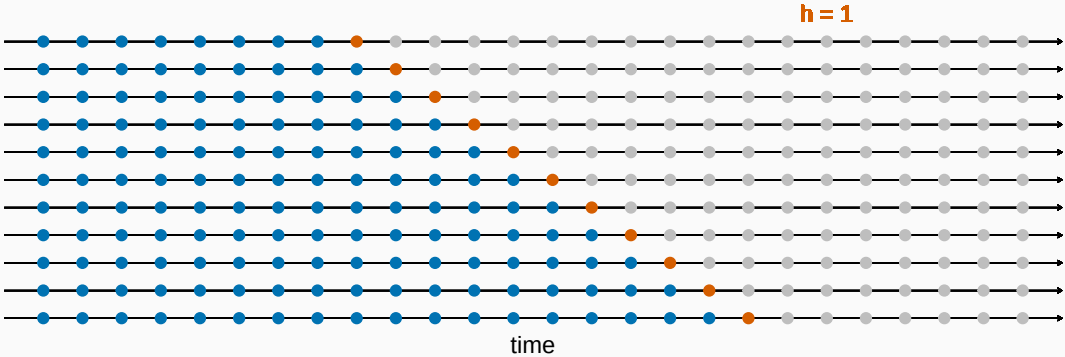
Time series cross-validation

Traditional evaluation

Time series cross-validation

Traditional evaluation

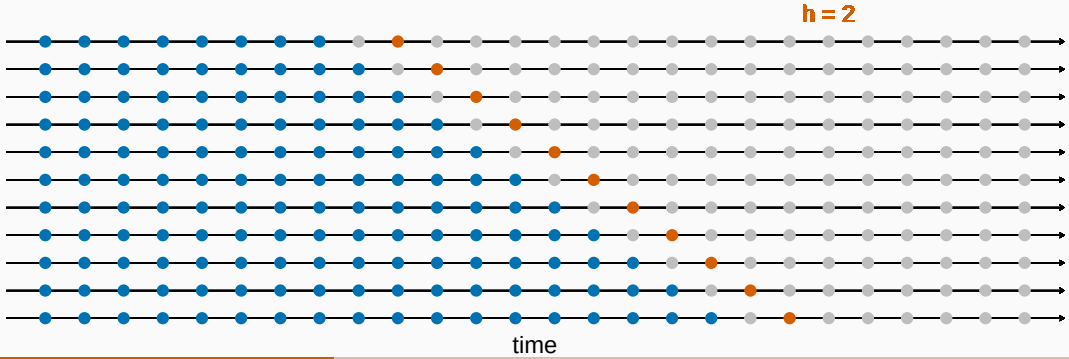
Time series cross-validation



Time series cross-validation

Traditional evaluation

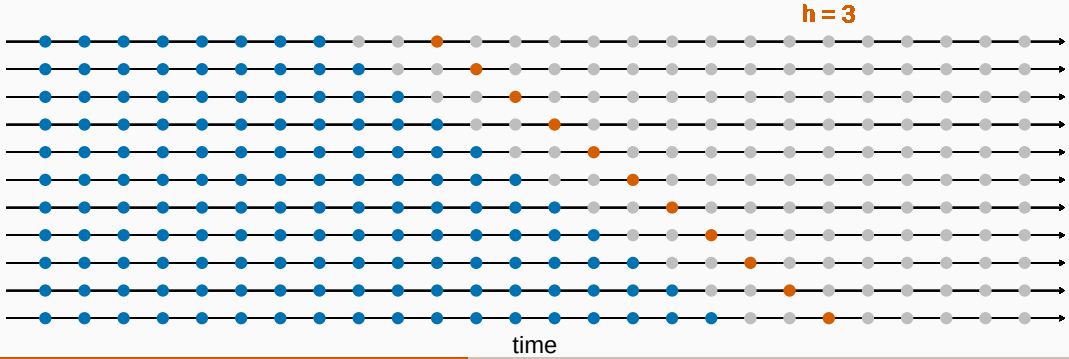
Time series cross-validation



Time series cross-validation

Traditional evaluation

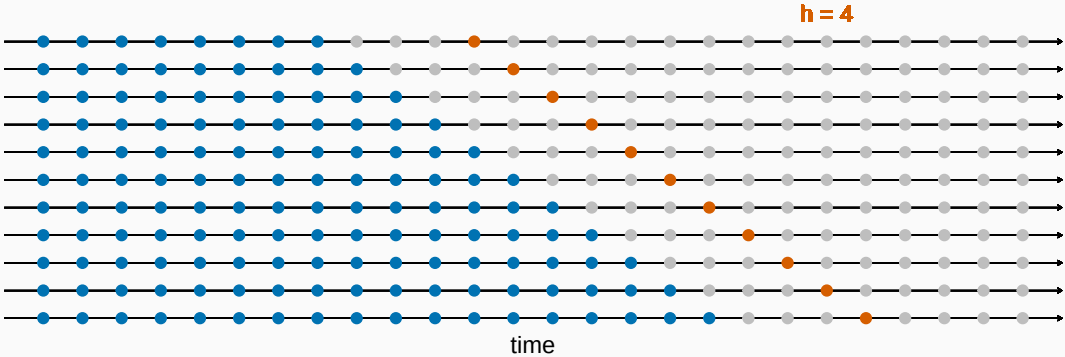
Time series cross-validation



Time series cross-validation

Traditional evaluation

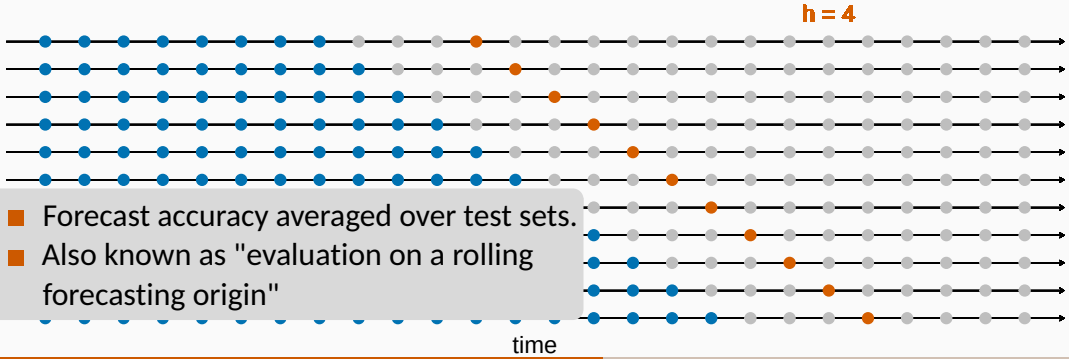
Time series cross-validation



Time series cross-validation

Traditional evaluation

Time series cross-validation



- Forecast accuracy averaged over test sets.
- Also known as "evaluation on a rolling forecasting origin"

Time series cross-validation

Stretch with a minimum length of 3, growing by 1 each step.

```
fb_stretch <- fb_stock |>
  stretch_tsibble(.init = 3, .step = 1) |>
  filter(.id != max(.id))
```

```
## # A tsibble: 790,650 x 4 [1]
## # Key:       .id [1,255]
##    Date       Close trading_day   .id
##    <date>     <dbl>       <int> <int>
## 1 2014-01-02  54.7            1     1
## 2 2014-01-03  54.6            2     1
## 3 2014-01-06  57.2            3     1
## 4 2014-01-02  54.7            1     2
## 5 2014-01-03  54.6            2     2
## 6 2014-01-06  57.2            3     2
## 7 2014-01-07  57.9            4     2
```

Time series cross-validation

Estimate RW w/ drift models for each window.

```
fit_cv <- fb_stretch |>
  model(RW(Close ~ drift()))
```

```
## # A mable: 1,255 x 3
## # Key:     .id, Symbol [1,255]
##      .id Symbol `RW(Close ~ drift())`
##    <int> <chr>                 <model>
## 1      1 FB             <RW w/ drift>
## 2      2 FB             <RW w/ drift>
## 3      3 FB             <RW w/ drift>
## 4      4 FB             <RW w/ drift>
## # i 1,251 more rows
```

Time series cross-validation

Produce one step ahead forecasts from all models.

```
fc_cv <- fit_cv |>
  forecast(h = 1)
```

```
## # A fable: 1,255 x 5 [1]
## # Key:     .id, Symbol [1,255]
##     .id Symbol trading_day      Close .mean
##   <int> <chr>        <dbl>     <dist> <dbl>
## 1     1 FB               4 N(58, 5.8)  58.4
## 2     2 FB               5 N(59, 2.7)  59.0
## 3     3 FB               6 N(59, 1.9)  59.1
## 4     4 FB               7 N(58, 2.2)  57.7
## # i 1,251 more rows
```

Time series cross-validation

```
# Cross-validated
fc_cv |> accuracy(fb_stock)
# Training set
fb_stock |>
  model(RW(Close ~ drift())) |>
  accuracy()
```

	RMSE	MAE	MAPE
Cross-validation	2.418	1.469	1.266
Training	2.414	1.465	1.261

A good way to choose the best forecasting model is to find the model with the smallest RMSE computed using time series cross-validation.