Forecasting in R
Forecasting by combination
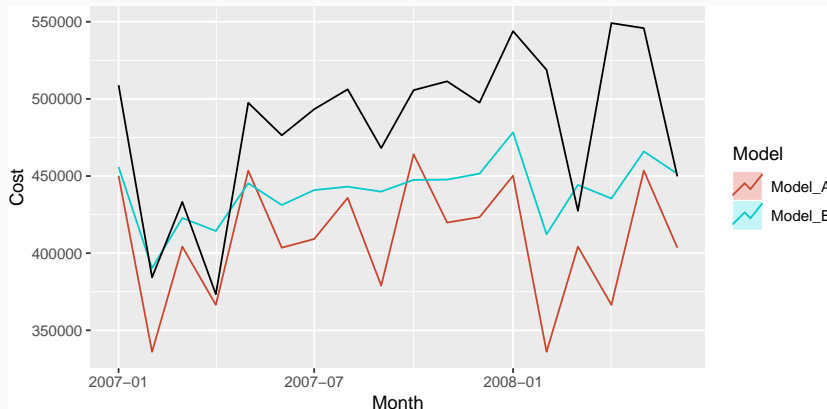
Bahman Rostami-Tabar

Outline

Outline

Learning outcomes

1. Describe why combining forecasts is helpful
2. Explain when combining forecasts might improve accuracy
3. Produce forecasts by combining forecasting models
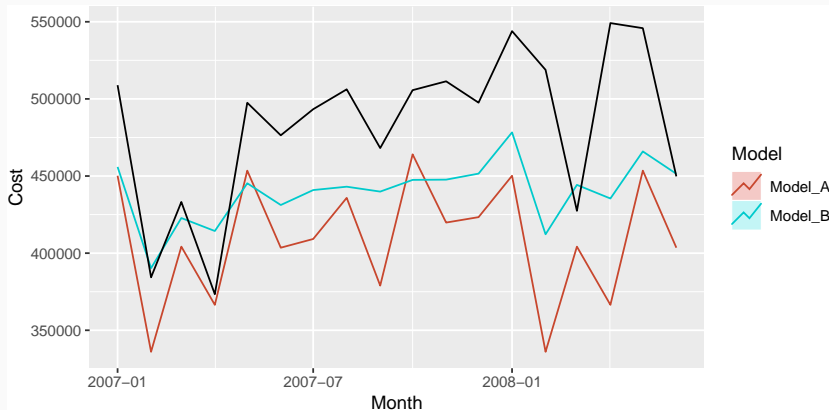4. Check wether forecast combination improves accuracy
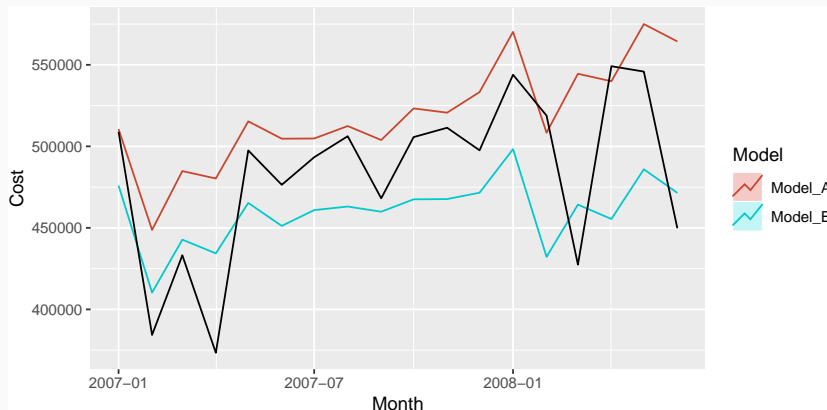
Outline

Combining forecasts
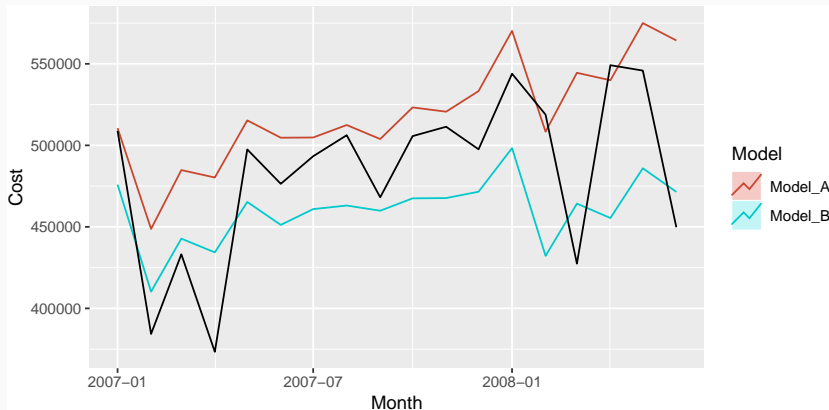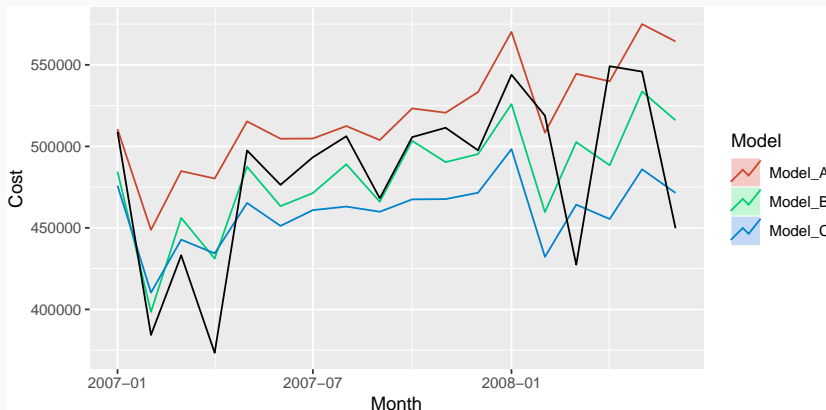
Combining forecasts

What will be the performance of the combination of the two models?

Combining forecasts

Combining forecasts

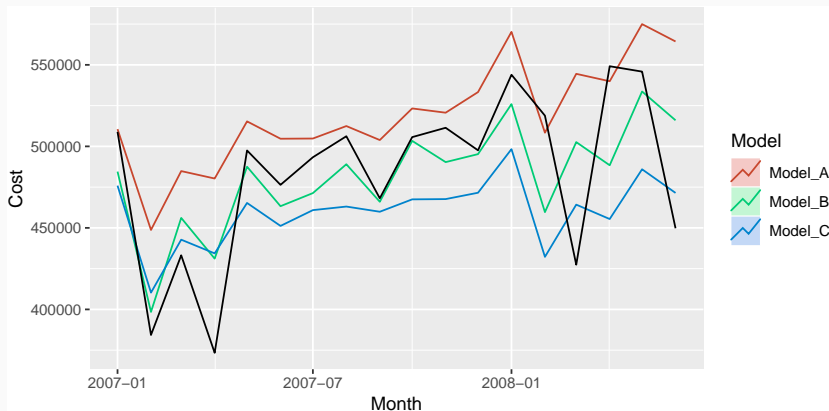

What will be the performance of the combination of the two models?

Combining forecasts

Combining forecasts

What will be the performance of the combination of the three models?

Combining forecasts

- Is there merit to averaging (combining) different forecasts?
- Or is it better to focus on selecting the best forecast?

Data uncertainty, model uncertainty, parameters uncertainty

Benefits of Combining forecasts

- Combining has been considered widely to be beneficial for forecasting.
- Averaging statistical approaches leads to improvements in accuracy.
- Combining also results in lower levels of uncertainty, by reducing the variance of the forecasting errors.
- Simple approaches are considered to be robust and perform reasonably well relative to more complex methods.
- However, many recent studies have examined sophisticated weight selection processes for combining forecasts.

Outline

11

Forecast ensembles

```
tourism_all <-  tourism %>%
  filter(Region == "Spa Country") %>
  index_by(Quarter) %>% summarise(Trips=sum(Trips))
train <- tourism_all %>%  filter(year(Quarter) <= 2014)

fit <- train %>%
  model(
    ets = ETS(Trips),
    arima = ARIMA(Trips),
    snaive = SNAIVE(Trips)
  ) %>%
  mutate(mixed = (ets + arima + snaive) / 3)
```

- Ensemble forecast `mixed` is a simple average of the three fitted models.

Forecast ensembles

```
fc <- fit %>% forecast(h="3 years")
fc %>% autoplot(tourism_all, level=NULL)
```
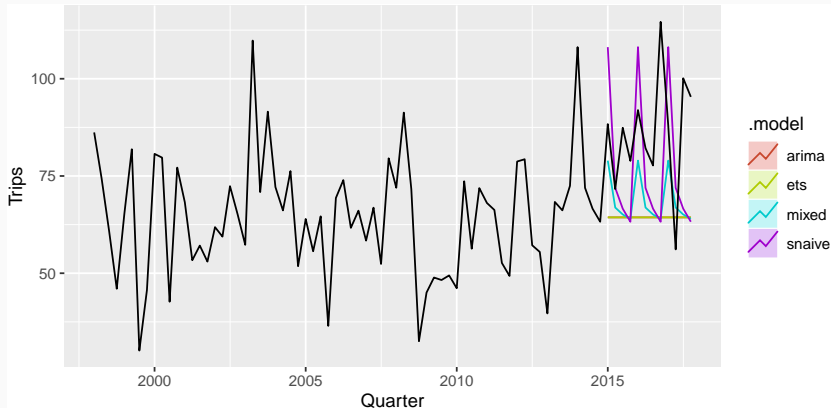

- forecast() will produce distributional forecasts taking into account the correlations between the forecast errors of the component

Forecast ensembles

```r
accuracy(fc, tourism_all) %>%
  group_by(.model) %>%
  summarise(
    RMSE = mean(RMSE),
    MAE = mean(MAE),
    MASE = mean(MASE)
  ) %>%
  arrange(RMSE)
```

```
## # A tibble: 4 x 4
##    .model  RMSE   MAE  MASE
##    <chr>  <dbl> <dbl> <dbl>
## 1 mixed   23.0  19.1  1.13
## 2 snaive  24.2  20.6  1.21
## 3 ets     25.8  23.0  1.36
## 4 arima   25.8  23.0  1.36
```

Outline

15

- Train ETS and Arima models on train data
- Create an ensemble daily A&E forecast using ETS and ARIMA
- Calculate forecast accuracy
- Does the mix model improve accuracy?