MONASH University

MONASH BUSINESS SCHOOL

ETF3231/5231: Business forecasting

Week 12: Revision

https://bf.numbat.space/

AACSB ACCREDITED EQUIS ACCREDITED ASSOCIATION AMBA ACCREDITED

Outline

1. Assignment 1
2. Review of topics covered
3. Exam

Student Evaluation of Teaching and Units

- See link in Moodle

or

- `https://www.monash.edu/ups/setu`

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Assignment 1: forecast the following series

1. Google closing stock price on 20 March 2024.
2. Maximum temperature at Melbourne airport on 10 April 2024.
3. The difference in points (Collingwood minus Essendon) scored in the AFL match between Collingwood and Essendon for the Anzac Day clash. 25 April 2024.
4. The seasonally adjusted estimate of total employment for April 2024 in ('000). ABS CAT 6202, to be released around mid May 2024.
5. Google closing stock price on 22 May 2024.

For each of these, give a point forecast and an 80% prediction interval.

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Prize: $AU100 Amazon gift voucher

Forecasting competition: scoring

y = actual, $\hat{y}$ = point forecast, $[\hat{\ell}, \hat{u}]$ = prediction interval

Point forecasts:

$$\text{Absolute Error} = |y - \hat{y}|$$

- Rank results for all students in class
- Add ranks across all five items

Prediction intervals:

$$\text{Interval Score} = (\hat{u} - \hat{\ell}) + 10(\hat{\ell} - y)_+ + 10(y - \hat{u})_+$$

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and the winner is. . .

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Congratulations: Tony

Assignment 1

Stock price forecasting (Q1 and Q5)

- Hard to beat naïve forecast
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Maximum temperature at Melbourne airport (Q2)

- Weather is relatively stationary over similar time of year and recent years.
- So take mean and var of max temp in April over last 10 years.

Assignment 1

Difference in points in AFL match (Q3)

- Teams vary in strength from year to year.
- Could look at distribution of for-against points from last few years across all games for each team. Assume distributions independent.

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Seasonally adjusted estimate of total employment (Q4)

- Probably locally trended.
- Perhaps use drift method based on average monthly change in last 2 years.

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Topics

- Introduction to forecasting and R (1, Appendix)
- Time series graphics (2)
- Time series decomposition (3, 4)
- The forecasters' toolbox (5)
- Exponential smoothing (8)
- ARIMA models (9)
- Multiple regression (7)
- Dynamic regression models (10)

1. Introduction to forecasting and R

- Time series data and `tsibble` objects.
- What makes things hard/easy to forecast.

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Exam preparation

- Reading R code.
- Interpreting R output.

2. Time series graphics

- Time plots
- Seasonal plots
- Seasonal subseries plots
- Lag plots
- ACF
- White noise

3: Time series decomposition

- Describing a time series: seasonality, trend, cycles, changing variance, unusual features
- Transformations (and adjustments)
- Difference between seasonality and cyclicity
- Moving averages
- Classical and STL (advantages/disadvantages)
- Interpreting a decomposition
- Seasonal adjustment
- Forecasting and decomposition

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- Problem of over-fitting.
- Out-of-sample accuracy. Training/test sets.
- Measures of forecast accuracy: MAE, MSE, RMSE, MAPE, MASE, RMSSE.
- Time series cross-validation.

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- Measures of forecast accuracy: MAE, MSE, RMSE, MAPE, MASE, RMSSE.
- Time series cross-validation.
- One-step prediction intervals based on RMSE from residuals.

8: Exponential smoothing

- Simple exponential smoothing.
- Holt's local trend method.
- Damped trend methods.
- Holt-Winters seasonal method (additive and multiplicative versions).
- ETS state space formulation.

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- Interpretation of output in R.
- Computing forecasts by setting future ε_t to 0.
- Assumptions for prediction intervals.
- You have access to formula in the exam.

9: ARIMA models

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  - Transformations
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- ACF, PACF. Model identification.
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- ACF, PACF. Model identification.
- ARIMA models, Seasonal ARIMA models
- Order selection and goodness of fit (AICc)
- Interpretation of output in R.

9: ARIMA models (cont'd)

- Backshift operator notation.
- Expanding out an ARIMA model for forecasting.
- Finding point forecasts for given ARIMA process.

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- Assumptions for prediction intervals.
- One-step prediction intervals based on RMSE.
- Effect of (p,q) and (c,d) on forecasts.
- ARIMA vs ETS.

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- (Matrix formulation.)

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- Stochastic vs deterministic trends.
- Forecasting for dynamic regression models with ARIMA errors.

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- Closed book
- Calculator
- 1 A4 double-sided sheet of notes
- 5 working sheets
- 2 hours 10 mins + (30 mins to upload images).

Preparing for the exam

- Exams from 2021–2023 on website.
- Solutions to follow soon.

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- Exercises. Make sure you have done them all (especially the last two topics - revise the lecture examples)!

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- Identify your weak points and practice them.
- Write your own summary of the material.
- Practice explaining the material to a class-mate.

Help available

- See us during the consultation times (for details refer to the website).
- Discuss on the Ed Discussion forum. I/we will monitor but will not answer every post. This is mostly for you to use between yourselves.

Useful resources for forecasters

Organization:

- International Institute of Forecasters.

Annual Conference:

- International Symposium on Forecasting
  - Dijon, France, June 30- July 3, 2024.
  - Student members ($45).

Journals:

- International Journal of Forecasting
- Foresight (the practitioner's journal)

Links to all of the above at **`www.forecasters.org`**

IIF Best Student Award

- https://forecasters.org/programs/research-awards/students/
- US$100
- A certificate of achievement from the IIF
- One year free membership of the Institute with all attendant benefits. Subscriptions to:
  - the International Journal of Forecasting
  - the practitioner journal: Foresight
  - The Oracle newsletter

Discounts on conference and workshop fees, and links to a worldwide community of forecasters in many disciplines.

Happy forecasting

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Please fill in your SETUs