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

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Assignment 1: forecast the following series

1. Google closing stock price on 21 March 2025 [Data].
2. Maximum temperature at Melbourne airport on 11 April 2025 [Data].
3. The difference in points (Collingwood minus Essendon) scored in the AFL match between Collingwood and Essendon for the Anzac Day clash. 25 April 2025 [Data].
4. The seasonally adjusted estimate of total employment for April 2025 in ('000). ABS CAT 6202, to be released around mid May 2025 [Data].
5. Google closing stock price on 23 May 2025 [Data].

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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Stock price forecasting (Q1 and Q5)

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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 ETS(A,A,A).

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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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- 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.

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- 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).

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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
  - Beijing, France, June 29- July 2, 2025.
  - Montreal, Canada 2026, Paphos, Cyprus 2027.
  - 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*
  - *Foresight* (the practitioner's journal)
  - 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

Student Evaluation of Teaching and Units

- See link in `https://edstem.org/au/courses/21006/discussion/2687478`

or

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