BBA315
BUSINESS FORECASTING

UNIT OUTLINE
SEMESTER 1, 2006

Lecture: Monday, 10:00am – 12:00pm, W5A T2
or Monday, 4.00pm–6.00pm, E7B T5

Unit Convenor: Julian de Meyrick

Prerequisites: Admission to BBA or BCom-Mktg or BIntBus;
STAT170 or STAT171; any 100-level COMP or ISYS unit; 40cp

Students in this unit should read the Unit Outline carefully at the beginning of the semester. It contains important information about the unit. If anything in it is unclear, please consult the Unit Convenor.
BBA315 is a 3 credit point unit.
As much as businesses are involved in activities in the present, they are also involved in planning for the future. The planning process requires strategic input from managers, budgeting, evaluation of the business's current position, evaluation of the environment both internal and external, and prediction of future circumstances that will impact on the business. Forecasting is an important component of the planning process. Prediction of key variables such as sales and/or market share, external variables such as input prices, interest rates, exchange rates and economic activity are incorporated with strategic input to develop forecasts for key performance indicators of the business. These forecasts are used both as a direction for the business and benchmarks against which actual performance can be compared.

This unit explores business forecasting by considering the planning process of the organisation, the environment in which business forecasts are made, prediction of key variables using qualitative and quantitative information and the practical considerations of forecast implementation. Quantitative predictions will generally make use of spreadsheets and simple statistical procedures that can be easily applied in the business environment.

**Teaching Staff**

**Convenor:** Graham Gale

**Email:** graham_gale@optusnet.com.au

**Consultation:** Mondays 2pm to 4pm by appointment (please email beforehand)

**Classes**

**Lecture Time:**
Monday 10-12 pm, W5AT2
or Monday 4-6 pm, E7BT5

**Tutorial Times:**
Monday 9am E4B214,
Monday 12pm E4B118 or E4B214,
Monday 1pm E4B118,
Monday 2pm E4B118,
Monday 6pm E4B214
Prescribed Unit Materials


Recommended Reading

Additional Texts


Unit Web Page

All announcements and resources (including lecture slides) will be available on the web site. Please consult it at least once a day.

http://online.mq.edu.au/public/BBA315/

Learning Outcomes

The learning outcomes of this unit are:

- an understanding of the need for, and uses of, forecasting in a business context
- an understanding of simple quantitative forecasting techniques used in business
- application of simple forecasting techniques using EXCEL and simple statistical programs
- an understanding of qualitative forecasting techniques in a business environment.

In addition to the discipline-based learning objectives, all academic programs at Macquarie seek to develop students’ generic skills in a range of areas. Students should develop skills in the following:

- working in teams
- taking responsibility for the students own learning
## Teaching and Learning Strategy

This unit is taught using lectures and tutorials. Students are expected to read in advance of lectures, and participate in tutorials.

### Lecture Program: 2006

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Topics Covered</th>
<th>Other Information</th>
</tr>
</thead>
</table>
| 1    | 27 February | - Outline the forthcoming series of lectures and tutorials and advise the basis on which students will be judged.  
<pre><code>   |            | - The meaning of forecasting. The philosophy of forecasting.                   | Chapter 1 of text                                       |
</code></pre>
<p>|      |            | - Exploring the way it is used by business organisations today.                | Session 1 Lecture Slides                                |
|      |            | - Organisations, planning and budgeting.                                      |                                                        |
| 2    | 6 March    | - The forecast environment.                                                   | Chapter 2 &amp; 3 of Text                                   |
|      |            | - Evaluation of forecasting tasks.                                            | Session 2 Lecture Slides                                |
|      |            | - Definition of time series.                                                  |                                                        |
|      |            | - Sources of data for prediction.                                            |                                                        |
|      |            | - Errors of prediction. Costs of errors.                                     |                                                        |
| 3    | 13 March   | - Simple predictor models-                                                    | Chapter 4 of text                                       |
|      |            | - Naïve, Moving averages, Simple Exponential Smoothing.                       | Session 3 Lecture Slides                                |
|      |            |                                                                                | Tutorial 1 - Introduction                               |
|      |            |                                                                                | Quantitative Prediction                                 |
| 4    | 20 March   | - Prediction of trends, Holts smoothing model, Trend extrapolation.           | Chapter 5 of text                                       |
|      |            | - Descasionalising data                                                       | Session 4 Lecture Slides                                |
|      |            |                                                                                | Tutorial 2 - Elementary smoothing                       |
| 5    | 27 March   | - Seasonal models.                                                            | Chapter 5 of text                                       |
|      |            | - Cycles, predicting cycles. Leading indicators-business indicators          | Session 5 Lecture Slides                                |
|      |            | - Decomposition                                                               |                                                        |
|      |            | - Winters Smoothing Model                                                     |                                                        |
| 6    | 3 April    | - Regression models.                                                          | Chapter 6 &amp; 7 of the text                              |
|      |            | - Ways to Evaluate Models                                                     | Session 6 Lecture Slides                                |
|      |            |                                                                                | Workbook collection ERIC by 2pm 04/04                   |</p>
<table>
<thead>
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<th>Week</th>
<th>Date</th>
<th>Topics</th>
</tr>
</thead>
</table>
| 7    | 10 April | - Regression Modeling in Practice  
- Ways to build models. |
| 8    | 1 May   | - Box-Jenkins (ARIMA) methods |
|      |         | Chapter 9 of the text  
Session 8 Lecture Slides |
|      |         | Mid semester test between 12 and 1 pm - will cover all material weeks 1-7 inclusive |
| 9    | 8 May   | - Judgmental methods- management, sales force forecasts.  
- Formal surveys and market research based assessments.  
- Individual subjective probability assessments.  
- The role of judgmental prediction in the organisation |
|      |         | Chapter 10 of the text  
Session 9 Lecture Slides  
Tutorial 4 - Regression, Leading indicators |
| 10   | 15 May  | - Scenario development methods  
- DELPHI approaches  
- Cross impact matrices  
- Analogy methods |
|      |         | Chapter 10 of the text  
Session 10 Lecture Slides |
| 11   | 22 May  | - Using all the information to forecast.  
- Actions based on forecasts.  
- Combining Forecasts |
|      |         | Chapter 11 of the text  
Session 11 Lecture Slides  
Workbook collection ERIC by 2pm 23/05 |
| 12   | 29 May  | - Putting it all together.  
- Forecasting in practice.  
- Case studies of forecasting.  
- Evaluation of Forecast performance in general. The future of forecasting |
| 13   | 5 June  | - Revision & Consultation |
|      |         | Revision Lecture Slides |
Assessment

Raw marks in this unit will be allocated on the following basis -

- Workbook 20%
- Mid-semester test 30%
- Final Examination 50%

Workbook

There will be exercises assigned almost every week relating to forecasting and/or the material in the course. Questions from the text and elsewhere will form the basis of these exercises. Students are expected to attempt these exercises and keep a workbook of their attempts and answers. The workbook will be collected twice during the semester at times indicated on the class schedule. The workbooks should be handed in to ERIC before the time indicated. There will be no provision for late submission under any circumstances. The purpose of the workbooks is to ensure that students work steadily through the unit and allow for feedback on student progress.

(Note: you will NOT be judged on the quantity of computer output nor strictly on the correctness of answers. The logic and justification of your answers with evidence will be of paramount importance. Presentation of answers and output will also be regarded).

Students are advised to buy an exercise book or maintain a folder with the relevant answers and related and necessary output as questions will build output and results from earlier questions. Working together on computing and exercises can be beneficial, however students should ensure that all work reported in the workbook relating to answers and conclusions is their own. There will be heavy penalties for plagiarism (zero marks for this assessment component at a minimum).

Mid-semester test

There will be one mid-semester test to be held in tutorials on the Monday May 1st in your tutorial time. Students must attend the tutorial time to which they have been allocated at enrolment. Failure to do so without prior permission may result in loss of marks for the test. The test will cover all material from weeks 1-7 inclusive and will consist of multiple choice questions.

Final Examination

The final examination will be held during the normal first semester examination period in June. Students are advised to check the relevant noticeboards at around approximately week 7 or 8 to find out the time and location of the final examination. The final examination will be a three hour examination which may consist of multiple choice, True or False questions and/or short answer questions. All material in the unit is examinable. Further details about the final examination will be given later in the semester. You must perform satisfactorily the final exam to pass the unit.
In the examination components of the unit, most complex formulae will be provided however students will be expected to memorise simpler formulae. Statistical tables will be provided. All examinations are closed book. Students will also be required to perform calculations requiring a calculator so they should bring one to all examinations.

**Raw Mark and Grade Meanings**

To assist students to interpret the meaning of the raw mark on assignments the following information is provided:

**Range of Marks**

(max 10)

<table>
<thead>
<tr>
<th>Mark</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>0 - 4</td>
<td>Work is below the required standard. A major effort should be made to improve the quality of the work.</td>
</tr>
<tr>
<td>4.5</td>
<td>A marginal effort, has important weaknesses which require further attention.</td>
</tr>
<tr>
<td>4.5 - 6.5</td>
<td>A sound level of work with no major shortcomings. Meets the expected level of work at this unit level.</td>
</tr>
<tr>
<td>7 - 8</td>
<td>Displays academic excellence in some areas, but with limitations in scope and ability to sustain a position.</td>
</tr>
<tr>
<td>8.5 - 10</td>
<td>Work is among the highest quality produced by students at the level of this unit.</td>
</tr>
</tbody>
</table>

**Final Grades:**

The final mark and grade awarded to students will be assessed on the following criteria:

HD. Denotes performance which meets all unit objectives in such an exceptional way and with such marked excellence that it deserves the highest level of recognition.

D. Denotes performance which clearly deserves a very high level of recognition as an excellent achievement in the subject.

CR. Denotes performance which is substantially better than would normally be expected of competent students in the unit.

P. Denotes performance which satisfies unit objectives.

PC. Denotes performance which meets unit objectives only marginally, and which is therefore unlikely to be adequate preparation for further study in the area.

F. Denotes performance which does not meet unit objectives.
The raw mark will not necessarily be exactly the same as the final mark awarded. Raw marks may be scaled according to normal statistical procedures.

***Note that the total raw mark a student has achieved will not necessarily be indicative of the grade the student obtains. At the final tabulation stage, consideration will be given to individual student performance in all aspects of assessment but especially in the examination components and the above criteria for a grade will apply. Student raw marks may then be adjusted to reflect the grade awarded***

#All students are required to perform satisfactorily in the final examination to obtain a passing grade for the unit. The combined performance of the student in the examination components of the course will be a prime determinant of the student’s final grade in this unit. In the case that a student has not achieved a satisfactory performance in the examination components, then the final mark awarded will be indicative of that examination performance i.e. marks in other assessment tasks will be weighted differently in the final mark.

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**Formal Examination Procedures**

**The University examination period in First Half Year 2006 is from 14 June to 30 June.**

You are expected to present yourself for examination at the time and place designated in the University Examination Timetable. The timetable will be available in Draft form approximately eight weeks before the commencement of the examinations and in Final form approximately four weeks before the commencement of the examinations. [http://www.timetables.mq.edu.au/exam](http://www.timetables.mq.edu.au/exam)

The only exception to not sitting an examination at the designated time is because of documented illness or unavoidable disruption. In these circumstances you may wish to consider applying for Special Consideration. Information about unavoidable disruption and the special consideration process is available at [http://www.reg.mq.edu.au/Forms/APSCon.pdf](http://www.reg.mq.edu.au/Forms/APSCon.pdf)

If a Supplementary Examination is granted as a result of the Special Consideration process the examination will be scheduled after the conclusion of the official examination period.

You are advised that it is Macquarie University policy not to set early examinations for individuals or groups of students. All students are expected to ensure that they are available until the end of the teaching semester, that is the final day of the official examination period.
The University defines plagiarism in its rules: "Plagiarism involves using the work of another person and presenting it as one's own." Plagiarism is a serious breach of the University's rules and carries significant penalties. You must read the University's practices and procedures on plagiarism. These can be found in the Handbook of Undergraduate Studies or on the web at: http://www.student.mq.edu.au/plagiarism/.

The policies and procedures explain what plagiarism is, how to avoid it, the procedures that will be taken in cases of suspected plagiarism, and the penalties if you are found guilty. Penalties may include a deduction of marks, failure in the unit, and/or referral to the University Discipline Committee.

Academic Senate has a set of guidelines on the distribution of grades across the range from fail to high distinction. Your final result will include one of these grades plus a standardised numerical grade (SNG).

On occasion your raw mark for a unit (i.e., the total of your marks for each assessment item) may not be the same as the SNG which you receive. Under the Senate guidelines, results may be scaled to ensure that there is a degree of comparability across the university, so that units with the same past performances of their students should achieve similar results.

It is important that you realise that the policy does not require that a minimum number of students are to be failed in any unit. In fact it does something like the opposite, in requiring examiners to explain their actions if more than 20% of students fail in a unit.

The process of scaling does not change the order of marks among students. A student who receives a higher raw mark than another will also receive a higher final scaled mark.

For an explanation of the policy see

http://www.mq.edu.au senate/MQUonly/Issues/Guidelines2003.doc or
http://www.mq.edu.au senate/MQUonly/Issues/detailedguidelines.doc

Macquarie University provides a range of Academic Student Support Services. Details of these services can accessed at http://www.student.mq.edu.au.
Tutorial 1 (13th March)

Introduction to the data environment and computer applications

The tasks that are set below should be used as examples to show you the data and computing environment. Feel free to browse and do some exploring at any stage of the process. You should however attempt to complete the sheet early in the course preferably in the tutorial. The notes will be a good companion to have with you during tutorials.

Task 1

Open up the **DX Data for Windows** option by using the menu hierarchy. *(Use START< Programs< Student Lab Programs< Economics)*

Check out the Databases on offer.

You may have to change the directories in DX (Use the Options > Directories on the toolbar to obtain the Databases, Workfiles and Template directories. Modify the given directories and browse through the available drives to find appropriate Dxdata directories).

Open up the **ABS Time Series** database. Check out the range of options.

a. Go to **K: Business Surveys** and find a measure of company profits (original) for the following broad industries- Property and Business Services, Other Services, Retail Trade and Construction Check out the company profit options available (any option will do). Which option did you use? What was the frequency of collection and length of available data? *(Toggle across using the arrow keys)*. View a graph of each of the industry company profits separately and comment on the type of components visible in each time series. *(Use the View option on the Toolbar to view the Data and then a Graph of the data.)*

b.  

i. Suppose we wish to obtain data for production in certain parts of the retail industry. The data that we seek is data for the dollar amount spent on grocery and supermarket purchases in monthly or quarterly periods. Find appropriate data on the database. *(You will need to go to another category in the ABS Time Series)* What was the frequency of collection and length of available data?

ii. Having found the data above for **Retail Turnover:Food retailing:Supermarkets & groceries** use the **View** option on the Toolbar to view the Data and then a **Graph** of the data. Comment on the nature of the graph.

iii. Suppose we do not wish to utilise the entire time series but some relevant section of the time series. Dx allows the user to alter the timeframe to be used in the active window. Use **Options** on the Toolbar to alter the timeframe to;

   1. the last 60 observations
   2. Data from Jan-90 to Dec-98
Return to the window marked “ABS Time Series Statistics” ensuring that you have the variable Retail Turnover: Food retailing: Supermarkets & groceries highlighted

Use the Series option on the Toolbar to create three new series which represent:

1. The natural logarithms of the retail variable
2. The % change in the retail variable (period on period)!!! (What is the difference between period on period and year on year change?)
3. Yearly aggregated retail sales

Dx will create a workfile for manipulations of data series. Be careful that you create the correct variables. Search the Series menu for the correct transformations. Before you do the second transformation make sure the highlight is on the original time series

i. View the data for all the above series together. (Highlight all variables in your workfile together and then View)

ii. Copy the data to the clipboard. (Make sure that you have the Data in the active window otherwise you will copy only the time series headings). Open up EXCEL by using the Microsoft Office menu options. Paste the data into EXCEL.

iii. Use EXCEL to make separate time series plots of the original retail sales variable, the logarithm of the retail sales variable, the % change of the retail sales variable and the yearly aggregated retail variable. (Use the chart wizard in EXCEL and the line chart option. You can also use the scatter plot option if the dates are included in the data region). Ensure that the charts you create allow the user to identify the main characteristics of the data.

iv. Comment on the characteristics of each of the time series. Compare the aggregated retail sales variable with the disaggregated variable. What differences do you see? Why would one aggregate data?

Task 2

a. Open up MINITAB. (MINITAB is found on the Student Programs>Statistics menu)

b. Using the Copy/Paste option in EXCEL paste the above variables with headings into the data window of MINITAB. (Be careful here to paste only the data and headings to the Data window in MINITAB. Make sure the data window is the active window before you paste)

c. Use the Statistics>Time Series> menu to create a time series plot of the logarithm of retail sales and the percentage change in retail sales. Explore the options for modifying the time series plots.
Tutorial 2 (20th March)
(The notes will be a good companion to have with you during all tutorials)

Task 1

a. Open up the data Aus:Total Establishments: Employment in the category T of the ABS Time Series Statistics in Dx

b. Comment on the nature of the data. What is the frequency of collection, the units of measurement and the length of the series?

c. 
   i. Open up EXCEL. Create a naive forecast of the above series using EXCEL. (This period’s forecast is last period’s actual data. Refer to your notes). Calculate the errors of your forecast method for every forecast made. (Use the spreadsheet to do this). What are your one period and two period ahead forecasts?

   ii. Use the errors to calculate the MAE (Mean Absolute Error), MSE (Mean Square Error), RMSE and MAPE (Mean Absolute % Error) for the naive forecast.

   iii. Create a three period moving average forecast for the % change in retail variable. Calculate the MAE and MAPE for this forecast method. Compare the results of the naive method with the three period moving average. Which forecast method seems preferable? What are your one period and two period ahead forecasts?

d. For the employment series create a simple exponential smoothing (SES) forecast for the entire series with alpha values of 0.2 and 0.7. Determine the errors of forecast with each method by calculating the MAE, MSE and MAPE. What are your one period and two period ahead forecasts?

e. Compare the performance of the SES models with the above smoothing models. Which forecast method is preferable?

f. Use the SOLVER sub routine in EXCEL to determine the optimal value of alpha if minimisation of MSE is required.

Task 2

a. Open up MINITAB. (*MINITAB is found on the Student Programs<Statistics menu*)

b. Paste the original data series from EXCEL with heading into MINITAB.

c. Use the Stat > Time Series options to create a three period moving average for the employment variable. Generate forecasts for the next three periods. (Use the forecast option in the dialog box.) What do you observe about the forecasts?

d. Discard the % change in Retail data. Open up the worksheet TRACK15.MTW on the MTTBWIN\DATA directory. (You will need to search for this on the EFS02 directory. Open the file as a WORKSHEET not a PROJECT.) Plot the data. Comment on the nature of the data. Use the Stat > Time Series option to estimate a simple exponential smoothing model for the data. (Use $\alpha = 0.5$) Generate a forecast for the next period.
Tutorial 3 (10th April)

Smoothing and Decomposition

Task 1

From the Dx Econ Data retrieve the variable Lending and Credit Aggregates :credit: Housing in the database RBA Bulletin.

a. Plot the data. Comment on the nature of the data. What factors influence the nature of the data?

b. Copy data for the last 60 observations into EXCEL. (including the dates)

c. Use the spreadsheet to create a HOLT smoothing model by reproducing the formulae below in the adjacent columns to the data. (You will need to think carefully about what you are doing!!)

\[
\begin{align*}
1. \quad L_t &= \alpha X_t + (1-\alpha) (L_{t-1} + T_{t-1}) \\
2. \quad T_t &= \beta (L_t - L_{t-1}) + (1-\beta) (T_{t-1}) \\
3. \quad H_{t+1} &= L_t + T_t
\end{align*}
\]

For the initial run of the model choose \(\alpha = .1, \beta = .3\) (Set up the model with alpha and beta in two dedicated cells in the spreadsheet)

(It would be worthwhile to read your notes pages on the Holt model)

d. From the third equation you should be able to generate in sample forecasts.
   Generate in adjacent columns the errors of forecast and calculate the MAD, MSE and MAPE using the spreadsheet.

e. Alter the values of \(\alpha, \beta\) and see what effect it has on the model and the error criteria.

f. Use the Solver tool on EXCEL to find the “optimum” values of \(\alpha\) and \(\beta\)

Task 2

Retrieve the data Domestic Sales of Australian wine and Table wine:Original:Table Red and rose wine:Total from the DX data. (You will find it in the ABS Time Series Database in the category Business Surveys)

a. Comment on the nature of the data plot. What factors influence the nature of the data?

b. Copy the data into MINITAB (you will find it easier when copying data into MINITAB to eliminate the identifier information in DX when copying to the clipboard.)

c. Using MINITAB generate a Winters’ model for the data. Generate forecasts for the next 12 months. (Use the default values of \(\alpha, \gamma, \delta\) \(\delta = \gamma, \gamma = \beta\) in the notes)
d. Try a few alternate combinations of \( \alpha, \gamma, \delta \) and see what effect it has on the error criteria.

e. Use the decomposition routine in MINTAB to generate forecasts for the next 12 months. Compare the performance of the Decomposition model with that of the preferred Winters’ model.

**Task 3**

Retrieve the data *Original:Production:Beer (including ale and stout)* from the Dx Econ Data. (You will find it in the *ABS Time Series* database in *Manufacturing*.)

Refer to your notes on Decomposition for this task.

   a. Copy the data for the last 24 observations and dates into EXCEL. (Don’t copy the identifier information)

   b. We will create a decomposition model on the spreadsheet. In the next column to the data create a 4 period moving average for the data. Place the first moving average value next to the second period and the final value next to the third last period.

   c. In the next column create a centred moving average by using a two period moving average of the moving average data. Place the first observation of the centred moving average at the third period and the final value at the third last period. Plot the centred moving average. What components of the data are evident?

   d. Use the original data and the centred moving average to create the seasonal relatives (=Original/ Centred M.A.)

   e. From the seasonal relatives create 4 seasonal indexes by averaging the seasonal relatives for each relevant quarter.

   f. Apply the Seasonal Indexes created above to all of the data. (You might need to use the Paste Special (Values) function when copying)

   g. Create the deseasonalised data by dividing the original data by the seasonal indexes. Plot the original data and the deseasonalised data on the same plot.

   h. Copy the deseasonalised data into the next column by using the Paste Special (values) option.

   i. Highlight the data and use the drop and drag facility to create linear trend projections for the next 4 quarters.

   j. Using the seasonal indexes and the linear trend projections create forecasts for the next 4 quarters.