Statistical Applications  ACTIVITY 10: Time Series: Forecasting by Trend

Why

When a time series shows a pattern of movement (increasing or decreasing values) over time, our prediction should take this into account, and exponential smoothing or moving average smoothing will not produce good results (the predictions will be systematically too large (for a decreasing pattern) or too small (for an increasing pattern)) \textit{Trend} refers to this idea of a pattern (linear or curved) of increase or decrease in average value over time; trend analysis aims to represent the increasing (or decreasing) average.

LEARNING OBJECTIVES

1. Work as a team, using the team roles
2. Understand the use of trend as a prediction tool
3. Gain further understanding of time series

CRITERIA

1. Success in completing the exercises.
2. Success in answering questions about the model
3. Success in working as a team

RESOURCES

1. The “Time Series and Forecasting” handout from Wednesday - particularly the “Forecasting Vacancies at Castle Point” example
2. Your Text - especially section 18.3
3. Your Calculator
4. 40 minutes

PLAN

1. Select roles, if you have not already done so, and decide how you will carry out steps 2 and 3 (5 minutes)
2. Work through the exercises given here - be sure everyone understands all results (30 minutes)
3. Assess the team’s work and roles performances and prepare the Reflector’s and Recorder’s reports including team grade (5 minutes).
4. Be prepared to discuss your results.

EXERCISE

1. For each of these: Would you expect trend to be useful for forecasting? If there is a trend, does there appear to be a non-linear (curved) component to the trend?

![Graph](a)
2. Use the “Forecasting Vacancies at Castle Point” example for the following.

(a) Plot the time series of the actual data (represent 1996 as “Year 1”, 1997 as “Year 2” etc.). [do this fairly carefully - you will be adding more stuff to this graph].

(b) Plot the predictions from the exponential smoothing of the series on the same graph. Notice that the values (after the first) are consistently below the actual data - the predictions are always behind the rising series.

(c) What does the exponential smoothing model give as a prediction for the number of vacancies in 2006 (Year 11)?

(d) What does the trend model give as the prediction for the number of vacancies in 2006 (Year 11)?

(e) What does the trend equation give as the average yearly increase in the number of vacancies?

(f) The trend equation was calculated using linear regression, with year number (1, 2, etc.) as predictor. Use the LinReg command on your calculator to check the trend equation [Does your result match — to the precision given?]. What is the $r^2$ value for the regression?

(g) Which of the models 2-5 (ignore “autoregression” for today) best fits the data, according to our MSE criterion?

READING ASSIGNMENT (in preparation for next class)
Read Section 18.4 (Trend and Seasonal components)

SKILL EXERCISES:(hand in - individually - at next class meeting): p.784 #17 – 20 (Use Minitab where possible)