

Lecture Notes 8

1. Trend Forecasting (or Trend Extrapolation)

1. *Polynomials*

$$Y_t = \beta_1 + \beta_2 t + \beta_3 t^2 + \dots + u_t$$

Y_t is the series you want to forecast

t is the trend variable

Start $t = 1$

u_t is the noise term

Note – then you use adjusted R^2 , AIC, or SIC to choose the best model.

Never use R^2 , because it will choose the largest model with the most k 's

2. *Exponential Growth*

$$Y_t = \beta_1 \exp\{\beta_2 t\} \exp\{u_t\}$$

Or taking the natural logarithm, then

$$\ln(Y_t) = \beta_1 + \beta_2 t + u_t$$

β_2 is the rate of growth

3. *Moving Average*

$$Y_{t+1} = \frac{1}{M} (Y_t + Y_{t-1} + \dots + Y_{t-M+1}) + e_t$$

e_t is not a residual. It is the error in the forecast calculated by

$$e_t = Y_t - M_t$$

M_t is the predicted value

There is no error once you start forecasting

There is no estimation. You are smoothing out the data and then carrying the average forward.

4. Exponential smoothing

$$Y_{t+1} = \alpha Y_t + \alpha(1-\alpha)Y_{t-1} + \alpha(1-\alpha)^2 Y_{t-2} + \dots + e_t$$

Similar to the moving average. There is no estimation. You are smoothing out the data and then carrying the average forward.

2. Forecasting Errors

1. Mean Squared Errors (MSE)

$$MSE = \frac{1}{M} \sum_{t=1}^M (F_t - A_t)^2$$

F_t is your forecasted errors

A_t is the actual data when it becomes known

t is index for forecasting into the future

M is the number of periods you forecasted into the future

Note – this is very similar to calculating a variance

2. Root Mean Squared Errors (RMSE)

$$RMSE = \sqrt{MSE}$$

3. Mean Absolute Errors (MAE)

$$MAE = \frac{1}{M} \sum_{t=1}^M |F_t - A_t|$$

The future is unknown. How do you calculate the forecasting errors?

One trick is drop the last five or 10 values of your data set and pretend you do not know them. Then forecast for those missing values. Then you calculated the forecasting errors and choose the method that yields smallest error.

3. Composite Forecasts

Forecasters may use several models to forecast future values

Possible to combine the forecasts into once model

Two methods

1. Average the Forecasts

You have a time series, like Y_t and you used two methods to forecasts, FM_{1t} and FM_{2t} , where CF_t is the composite forecast

$$CF_t = \frac{FM_{1t} + FM_{2t}}{2} = 0.5FM_{1t} + 0.5FM_{2t}$$

2. Use Regression to choose the weights

Do the regression with the restriction imposed:

$$Y_t = w_1 FM_{1t} + w_2 FM_{2t} + u_t$$

$$w_1 + w_2 = 1$$

Use Excel Solver and impose this restriction

The restriction is needed to ensure Solver converges to a value.

The weights should be positive.