Forecasting

Exponential Smoothing For Stationary Models

Basic Concept

- Exponential smoothing is actually a way of "smoothing" out the data by eliminating much of the "noise" (random effects).
- At each period t, an **exponentially smoothed level, L_t,** is calculated which updates the previous level, L_{t-1}, as the best current **estimate of the unknown constant level, β_0**, of the time series by the following formula:

Revised Estimate of the Level at time t

$$\boxed{L_t = \alpha y_t + (1-\alpha)L_{t-1}}$$

Weight placed on last estimate for the Level

Last estimate for the Level

Weight placed on current time series value

Current time series value

α in Exponential Smoothing

- The idea behind "smoothing" the data is to get a more realistic idea about what is "really going on".
  - The value of the **smoothing constant, α,** is selected by the modeler.
    - Higher values of α allow the time series to be swayed quickly by the most recent observation.
    - Lower values keep the smoothed time series "flatter" as not that much weight will be given to the most recent observation.
      - Usual values of α are between about .1 and .7
      - See graphs for α = .1 and α = .7 later in this module.
  - The value **(1-α)** is called the **damping factor.**

Review

- Exponential smoothing is a way to take some of the random effects out of the time series by using all time series values up to the current period.
- The smoothed value (Level) at time period t is:

α(current value) + (1-α)(last smoothed value)

- Forecast for period t+1= Smoothed Value at t
- Initialization:

First smoothed value = first actual time series value

- The smaller the value of α, the less movement in the time series.
- Excel approach to exponential smoothing

Month	Period	Actual
Jan	0	13
Feb	1	9
Mar	2	17
Apr	3	11
May	4	13
Jun	5	11
Jul	6	8
Aug	7	7
Sep	8	9
Oct	9	12
Nov	10	11
Dec	11	13

A	B	C	D	E	F	G	H	I	J	K	L	M	N
riod	0	1	2	3	4	5	6	7	8	9	10	11	
tual	120	150	240	540	210	380	120	870	250	1100	500	950