Econometrics 475 Spring 2024

Exam 1 Study Guide

The first exam will be administered in class on Tuesday, February 20. The exam will be short answer format.

Be familiar with Lag and Difference operator notation.

Price Indexes and inflation adjustments

- Be able to explain conceptually how to "re-center" a price index from one base period to another (you will not have to do any calculations here)
- Be able to explain conceptually how to use a price index to adjust a nominal time series for inflation – that is, to convert a nominal series into a real series (again, you will not have to do any calculations here)

Deterministic Trend/Seasonal Models

- Be able to identify the difference between a quadratic trend/seasonal series versus a log-linear series based on residual plots.
- Be able to write out the conceptual form of a trend model forecast with or without seasonal effects (you will not be asked to calculate a forecast value).

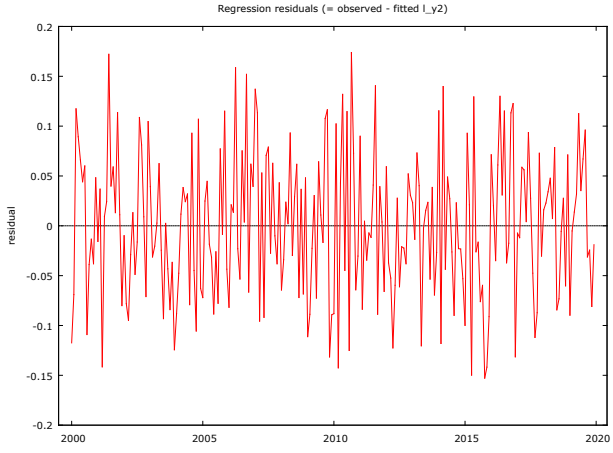
Spline Models

- Be able to derive Spline restrictions for a piece-wise linear spline with one or more break points.
- Be able to derive Spline restrictions for a quadratic trend with a single break point.

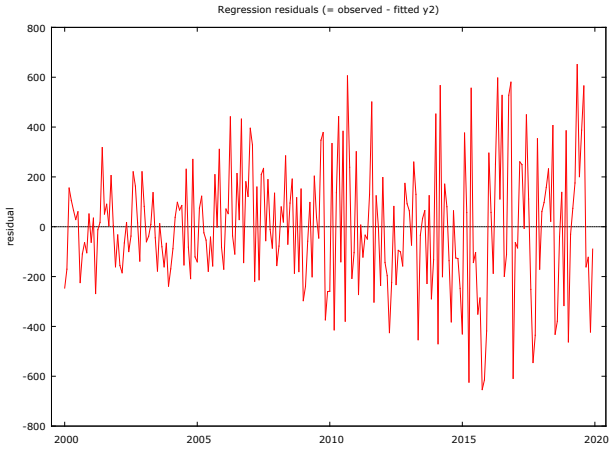
Example Problems

Consider the residual plots of the hypothetical time series below. Both a Quadratic Trend and Exponential Trend model have been used to fit the data. Which model do you think would be more appropriate to use for forecasting this series? **Explain your answer.**

Residuals from Exponential Growth Model



Residuals from Quadratic Trend Model



Answer: The Exponential Growth Model (Log-Linear Trend Model) is more appropriate because the errors appear proportional – they are growing in the Quadratic Trend Model.

The daily web-hits data for the on-line bookseller SchulmanReads.com, covering the period Monday January 1, 2007 to Friday September 28, 2007, is modeled below as a exponential growth model with seasonal components where {dummy_1, dummy_2} represent seasonal dummy variables for the days of the week with Sunday being associated with dummy_1, Monday with dummy_2, etc.

$$\ln(Hits_t) = \beta_0 + \beta_1 \times t + \sum_{i=1}^{6} \gamma_i D_i + \varepsilon_t$$

Model: OLS, using observations 2007/01/01-2007/09/28 (T = 271)
Dependent variable: ln(HITS)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Constant	9.48	0.0394069	240.5559	<0.00001	***
Time	0.002	0.000157923	13.7506	<0.00001	***
dummy_1	0.045	0.0463541	0.9613	0.33730	
dummy_2	0.076	0.046353	1.6431	0.10155	
dummy_3	0.054	0.0463525	1.1727	0.24197	
dummy_4	0.084	0.0463525	1.8145	0.07074	*
dummy_5	0.0026	0.046353	0.0557	0.95562	
dummy_6	-0.0011	0.0466527	-0.0228	0.98186	

On what days ("seasons") do the seasonal peak and trough occur for this series. Explain your answer.

Answer: Seasonal Peak is on Wednesday (day 4) because it has the largest positive seasonal coefficient. The Seasonal Trough is on Friday (day 6) because its seasonal coefficient is negative.

With $t = \{1, \dots, 271\}$, write out the forecast equations for T+8 and T+11 forecasts. (You do not have to calculate the forecasts).

With T=271, occurring on Friday September 28, T+8=279 occurs on Saturday Oct. 6 (S_7)

$$y_{T+8|T,S=7} = b_0 + (b_1 \times 279)$$

$$y_{T+8|T,S=7} = 9.48 + (0.002 \times 279)$$

T+11=282 occurs on Tuesday Oct. 9 (S_3)

$$y_{T+11|T,S=3} = b_0 + b_1 \times 282 + S_3$$

$$y_{T+11|T,S=3} = 9.48 + (0.002 \times 282) + 0.054$$

For Spline model restrictions, see the Lecture 6 slide deck.