SGPE ECNM11049

Advanced Time Series Econometrics

Computer Tutorial 2

Nonlinear Time Series Models

SCOTTISH GRADUATE PROGRAMME IN ECONOMICS

Semester 2 Options

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1. The Threshold autoregressive (TAR) model

The file *Lab2data1.csv* contains monthly observations of the $S\&P500$ stock market index from January 1959 through August 2016.

(a) Construct a new variable which is the log difference of the stock price index. Graph the stock price index and its log difference. Use the log difference as your dependent variable, y_t, for the remaining parts of this question;

(b) Look through the html file, run it and examine the output it produces;

(c) While you are doing this, keep in mind the following facts and questions:

i. Estimate an AR(1) model for y_t. Calculate information criteria for this model;

ii. Estimate a homoskedastic TAR model for yt using $z_t = y_{t-1}$ as threshold trigger and $\tau = 0$ as the threshold. Calculate information criteria for this model;

iii. Estimate a heterokedastic TAR model for yt using $z_t = y_{t-1}$ as threshold trigger and $\tau = 0$ as the threshold. Calculate information criteria for this model;

iv. Discuss your results. Is there evidence of threshold nonlinearity in this variable? If so, which parameters are changing across regimes?

2. The Markov switching model

In the lecture I went through an empirical example using a two regime Markov switching AR(1) model for US GDP growth (see the lecture slides for data denition, the data set is called *Lab2data2.csv*). I compared a homoskedatic variant of the model to a heteroskedastic one where the two regimes had different error variances and found strong evidence in favour of the latter.

(a) Carry out a simiar model selection exercise including a wider range of Markov switching models including:

i. models with 3 regimes,

ii. models with long lag lengths and

iii. models with regime switching only in the error variance (i.e. the AR coefficients and intercept are the same in all regimes). What is your preferred model?

(b) For your preferred model, plot estimates of the probabilities that each time period falls in each regime. In the lecture slides, for the heteroeskedastic model, I was able to interpret the two regimes as reecting high and low variances. Can you offer a similar interpretation of the regimes for your preferred model? If not, how do you interpret your regimes?

3. Digression: A time-varying intercept model/unobserved component model

The html file contains an example that explains in detail the mechanism of the Forward Filtering Backward Sampling (FFBS) algorithm. If you are ambitious, you may wish to take a look at this code.