

Estimating Markov-Switching Regression Models in R: An application to model energy price in Spain

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Markov switching regression models can be used to study heterogeneous populations that depend on covariates observed over time. The model formulation involves a mixture of regressions models with a Markov chain defining the mixing distribution. In each instant the time series is assumed to be under a determined regime. This unobserved process, that governs the evolution of the series, defines a state variable related to the Markov chain process and is characterized by a matrix consisting on the probabilities of transition between states. Applications of Markovian Switching models can be found in several fields including, for instance, ecology, engineering and econometrics.

Following Hamilton(1989), we have implemented a set of R functions in order to explain time series according to a switching regression model. Estimation of parameters defining the model and imputation of the unobserved state process is performed under the Maximum Likelihood criterion. The implemented routines deal with Ordinary Least Squares regression to relate the response variable to the explanatory variables, although this model can be of different and more complicated types (i.e. Auto-Regressive models or Transfer Functions). The equations from the mixture of models can include some regressors with switching effect (different coefficient for each state) and others with common coefficients for all states. The last ones indicate a constant relationship not depending on the current regime.

Due to the large number of parameters to estimate, standard non-linear optimization procedures can be unstable. To avoid this problem, an EM approach has been included that guarantees a more robust approximation to the global optimum.

An illustration of the use of this routines is presented to model the evolution of the energy price in Spain between 2002 and 2008, according to the demand level, raw material prices (oil, coal and gas) and finance indicators (Ibex35 and exchange rate EUR/USD). A Markovian Switching model with two states has been considered with all regressors with switching effect. The R functions provide estimation of parameters and probabilities of being in each state along the series.

References

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