Simple tests for Markov-switching models

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This .zip file provides sample gauss code to implement the Markov-switching diagnostic tests proposed by Breunig et al. (2003).

The zip file contains a folder of Gauss programs,

1. `expl_data.prg`
2. `simdata.prg`
3. `np_res.prg`
4. `unconden.prg`,

three files of procedures

1. `mstest` contains procedures which implement the moment tests
2. `npdens` contains procedures to undertake non-parametric density estimation; and
3. `newwest` contains procedures to implement Newey-West standard error correction,

a sample dataset, and a set of sample results. In the results folder, we only provide a few sample figures. The simulated data can be used to provide a range of informal figures and the two testing programs (`np_res.prg` and `unconden.prg`) generate all of the results below as well as a few others. To re-create these results, follow the instructions below.

The procedure file, `mstest`, implements the following moment tests

Procedure	**Moment Test**
mstest0	Mean and variance
mstest1	p1, p2
mstest2	L1, L2
mstest3	$\widehat{\phi}$
mstest7	Q1 - Q4
mstest8	α

The first four are discussed in Breunig et al. (2003), Breunig and Pagan (2004), and Breunig and Stegman (2005) and the last two are examples of how one can create new tests specific to the data problem at hand. These two are applied to the New Zealand data.

Make sure you put the procedure files somewhere where the .prg programs can find them.

1 Data: New Zealand GDP

We use the series of New Zealand GDP from the paper of Buckle et al. (2004). The gauss program `expl_data.prg` provides some sample statistics of the data, a graph of the data against time, and a simple OLS regression of growth on volatility.

2 Simulating the data and testing the moments

The program `simdata.prg` simulates the 5 models estimated in Buckle et al. (2004) and applies mstest0, mstest1, and mstest7. The simulated data will be saved in `c:\simdata0`. Change the path name in the program if you want it to go elsewhere. The program `np_res.prg` uses the simulated data and applies those three tests and mstest8.

3 Results

In terms of the mean and variance, we find that all five models fit the data equally well.

Model	Mean	Variance
AR(0)	.01	.16
AR(1)	.02	.05
Hamilton MS(0)	.06	.16
MS (2-2)	.11	.17
MS (3-2)	.15	.32

Entries in table are test statistic values

Using $z = y - \widehat{\mu}$, define quadrants based upon high/low volatility and high/low growth

Q1 $z > 0$, $\lvert z\rvert < \widehat{\sigma}$	Q4 $z > 0$, $\lvert z\rvert > \widehat{\sigma}$
Q2 $z < 0$, $\lvert z\rvert < \widehat{\sigma}$	Q3 $z < 0$, $\lvert z\rvert > \widehat{\sigma}$

We test whether the proportion of observations in each of these quadrants from the model matches the data. We find that only the AR(0) model fails this test and only for one of the four quadrants.

Model	P1	P2	Q1	Q2	Q3	Q4
Data	.1863	.5392	.307	.307	.208	.178
AR(0)	.204 0.45	.509 0.40	.262 0.60	.263 0.90	.239 0.79	**.236** **1.81**
AR(1)	.203 0.43	.509 0.39	.277 0.40	.279 0.57	.221 0.34	.222 1.37
Hamilton MS(0)	.193 0.18	.521 0.24	.283 0.32	.275 0.66	.222 0.35	.221 1.32
MS (2-2)	.179 0.18	.554 0.20	.344 0.50	.238 1.42	.201 0.17	.217 1.20
MS (3-2)	.169 0.46	.571 0.41	.373 0.90	.255 1.08	.177 0.80	.195 0.53

We also include the P1 and P2 tests based upon one and two-period lagged growth.

References

Breunig, R. and Pagan, A. (2004). Do Markov-switching models capture nonlinearities in the data? Tests using nonparametric methods. *Mathematics and Computers in Simulation*, 64:401–407.

Breunig, R. and Stegman, A. (2005). Testing for regime switching in Singeporean business cycles. *Singapore Economic Review*, 50(1):25–34.

Breunig, R. V., Najarian, S., and Pagan, A. R. (2003). Specification testing of Markov-switching models. *Oxford Bulletin of Economics and Statistics*, pages 703–725.

Buckle, R. A., Haugh, D., and Thomson, P. J. (2004). Markov switching models for gdp growth in a small open economy: the new zealand experience. *Journal of Business Cycle Measurement and Analysis*, 1:227–257.