

EVALUATING SPECIFICATION TESTS FOR MARKOV-SWITCHING TIME-SERIES MODELS

BY DANIEL R. SMITH

Simon Fraser University

First Version received July 2006

Abstract. We evaluate the performance of several specification tests for Markov regime-switching time-series models. We consider the Lagrange multiplier (LM) and dynamic specification tests of Hamilton (1996) and Ljung–Box tests based on both the generalized residual and a standard-normal residual constructed using the Rosenblatt transformation. The size and power of the tests are studied using Monte Carlo experiments. We find that the LM tests have the best size and power properties. The Ljung–Box tests exhibit slight size distortions, though tests based on the Rosenblatt transformation perform better than the generalized residual-based tests. The tests exhibit impressive power to detect both autocorrelation and autoregressive conditional heteroscedasticity (ARCH). The tests are illustrated with a Markov-switching generalized ARCH (GARCH) model fitted to the US dollar–British pound exchange rate, with the finding that both autocorrelation and GARCH effects are needed to adequately fit the data.

Keywords. Markov regime-switching; Lagrange multiplier; specification tests; autocorrelation; ARCH.

JEL classification numbers. C12, C15, C22.

1. INTRODUCTION

The Markov regime-switching model has been widely applied in empirical economics and finance. The model posits that the conditional distribution of a time series depends on the underlying latent state or regime, which can take one of a finite number of values and evolves through time as a Markov chain. One of the main attractions of these models is that many interesting financial and economic phenomena are naturally classified into regimes. For example, we routinely talk about bull and bear stock markets, and booms and busts in the business cycle. These models have also been found to be empirically useful. They have been used to address such diverse topics as optimal asset allocation (Ang and Bekaert, 2002, 2004), mean reversion (Kim *et al.*, 2001), structural breaks (Kim *et al.*, 2005), and the risk–return relationship (Kim *et al.*, 2004; Whitelaw, 2000) in stock returns.

Despite the enormous volume of research using Markov regime-switching models, very little theoretical or empirical research has been devoted to specification testing in these nonlinear models. It is actually quite rare for an empirical paper that fits a Markov regime-switching model to conduct any model