1
Introduction

Over the recent years, applied research using nonlinear time series techniques has been comprehensive. Among the several new models and methodologies, those based on multiple regimes have proved popular (see van Dijk et al (2002) and Stevenson and Peat (2001) to mention just two papers). The smooth transition autoregressive model (STAR) is one such model that was first introduced by Chan and Tong (1986) and further developed by Terasvirta (1994). It incorporates a smooth transition between two regimes. Each regime is modelled as an autoregressive process of order *p* with a transition function which determines the data composition of each regime. Bacon and Watts (1971) used the hyperbolic tangent function to characterize the transition, a close relation to the logistic function, as well as the cumulative distribution function of the standard normal variable. However, the use of the logistic function as a transition function has become the standard choice.

A potential application where these models may prove useful is the electricity market. Over the past decade, many countries have begun structural reforms of their electricity markets. The main goals of these changes are to break up monopolies and replace them with generation and distribution utilities that aim to trade electricity through a wholesale market. Problems faced by participants in these markets include the forecasting of both electricity load and the wholesale spot price of electricity. This thesis addresses the issue of forecasting load in the New South Wales market by using nonlinear time series models.

Much previous research has concentrated on modelling and forecasting electricity load. Smith (2000) and Cottet and Smith (2003) proposed a multi-equation regression model with a diagonal first-order stationary vector autoregression (VAR) specification by application of a Bayesian model selection methodology. Hippert et al (2005) compared both large neural networks and conventional regression based methods. Taylor (2003) introduced the double seasonal exponential smoothing method to forecast short term electricity load. Other papers in this area include, Engle et al (1986), Harvey and Koopman

(1993), Hyde and Hodnett (1997), Taylor (2002, 2006a, 2006b) and Koopman et al (2007).

It has long been accepted that the load electricity time series is highly predictable as a result of the strong daily, weekly, and yearly periodicities. Another class of models that has been developed in the literature that accounts for periodicity are known as periodic models. The use of these models for application in economics dates back to the late eighties[1]. According to Franses and Paap (2004), a periodic autoregressive model is one in which the parameters change with the periodicity.

This thesis reports the new nonlinear periodical model (STPAR) to forecast electricity demand. The forecasting performance of the STPAR model is compared with other models. The thesis is organized as follows: Chapter 2 discusses the family of periodic models, while chapter 3 develops the modelling cycle for the STPAR model that includes specification, estimation, evaluation and forecasting; Chapter 4 presents a Monte Carlo experiment in order to verify the performance of the LM-type tests; Section 5 shows the results when real data is considered; Concluding remarks are made in Section 6.

[1]See Osborn (1988), Birchenhall et al (1989) and Osborn and Smith (1989).