Seasonality, Nonstationarity and the Structural Forecasting of the Index of Industrial Production*

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Summary. In this paper we focus on two STS models suitable for forecasting the index of industrial production. The first model requires that the index be transformed with a first and seasonal difference filters. The second model considers the index in its second difference filter, while seasonality is modeled with a constant and seasonal dummy variables. Tests designed to discriminate empirically between these two models are also conducted. Our results prefer the performance of the second model, particularly when the conventional ML estimation procedure is replaced by the ALS procedure. This process together with appropriate seasonal adjustment advances the possibility of using the suggested index forecasts to help to predict business cycle turning points.

Key words: : Index of industrial production, Forecasting, Structural time series models.

JEL classification: C22, E23, E27

1 Introduction and Motivation

The analysis and forecasting of indexes of industrial production, both in aggregate and for individual sectors, continues to capture interest, because of their pertinence as measures of economic performance and international cross-performance comparisons. Despite this notable role, consensus has not yet been reached as to which

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appropriate modeling and forecasting strategy to adopt. In this paper we consider two structural models as possibilities for forecasting the index of industrial production. The first is the well-known basic structural time series (STS) model advocated by Harvey and Durbin [13], which requires that the series under consideration be transformed by first and seasonal difference filters (e.g., see Harvey [10, 11]) respectively to achieve stationary. The second is the STS model that makes use of a second difference filter and assumes that the sum of the seasonal components in twelve consecutive periods equals zero and hence the seasonal pattern can be described with a constant and seasonal dummy variables (e.g., see Harvey [10, 11]).

The rationale and primary motive of the present study is the observation that the forecasts for the index of industrial production from the first model, following Harvey and Todd [12], Harvey and Durbin [13] and Harvey [10, 11], fluctuate too widely. This might indicate that the model is mis-specified; and that the second would be more appropriate.

This paper continues as follows. In Section 2, the two competing forecasting models are introduced and their theoretical backgrounds discussed. In Section 3, a brief account is given of a method to test for (seasonal) unit roots in monthly data, as a procedure to choose between the models. Section 4 introduces and extends the asymptotic least squares (ALS) estimation method for the case of monthly data, as an alternative to the classic and well-known maximum likelihood (ML) estimation method of STS models developed by Harvey and Peters (1990). In Section 5, an ALS method is applied to estimate both STS seasonal models, while in Section 6 forecasting schemes are applied to the industrial production series under investigation. From an extensive predictive performance analysis the appropriate model for forecasting the index of industrial production emerges. Finally, in Section 7, some concluding remarks and suggestions for future research are given.

2 Model Specification

Consider y_t a time series to be modeled and which can be decomposed as:

$$y_t = \mu_t + \gamma_t + \vartheta_t, \qquad t = 1, \ldots, T \tag{1}$$

where μ_t is the trend component, γ_t is the seasonal component, and ϑ_t is the irregular component.

In the STS methodology described by Harvey [10, 11], the process generating the trend is regarded as a local approximation to a linear trend, i.e.,

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t, \qquad t = 1, \ldots, T \tag{2}$$

and

$$\beta_t = \beta_{t-1} + \varsigma_t, \qquad t = 1, \ldots, T \tag{3}$$

where, β_t is the slope and η_t and ς_t are distributed independently of each other and over time with means zero and variances σ_η^2 and σ_ς^2, respectively.