

Time Series Modeling as A Tool to Produce Short-Term Indicators

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1. Introduction

Time series modelling is an area of considerable activity in recent years. Official statistics agencies make frequent use of it to carry out seasonal adjustment and trend-cycle estimation. Nevertheless, time series modelling is not used as much in other phases of the statistical production process. This paper discusses the way time series modelling can be used as a tool to produce short-term indicators. The applications of this approach carried out by the National Statistical Institute of Spain to produce industrial monthly short-term indicators are also presented.

2. Using time series modelling to produce short-term indicators

The central idea behind the approach described in this paper comes from the fact that short-term indicators lead to a set of sequential observations collected over time. Therefore, the appropriate theoretical framework of short-term indicators should not be limited to that of the static random variables, but should rather be enlarged on random variables varying with time (i.e. the stochastic processes). Indeed, if useful information from previous surveys is available, it should be used to its fullest in different phases of the statistical production process. Certainly, the use of information of previous surveys is not new in statistical methodology and practice. Ratio and regression estimates, benchmarking techniques, or ratio edits are only some examples. However, these methods are frequently based on a partial use of the information from previous surveys. It would be convenient to use, in an efficient way, all the available information (i.e. the entire history of the series). This means taking advantage of the complete structure of correlation (cross and auto-correlation). To achieve this, it is convenient to use models that have stochastic processes as a theoretical framework, such as time series models.

From a theoretical point of view, multivariate models (that pick up the correlation of all the variables) would be appropriate for surveys with more than one variable. However, the difficulty of their practical application, suggests the use of a univariate environment. In this paper, the use of very simple time series models is proposed: univariate ARIMA models (Box-Jenkins, 1970) and univariate ARIMA with Intervention Analysis models (Box-Tiao, 1975).

3. Applications

Time series modelling (in particular, ARIMA with Intervention Analysis modelling) are being used by the Spanish National Statistical Institute to produce Industrial Production and Price Indices. The models are used, besides their common application for seasonal and working day adjustment, for two additional purposes: data editing and the description of data characteristics as a tool for improving the methodology of the indices.

The most useful information for short-term indicators data editing is the past data of the same population. For example, monthly and annual rates are often used. Editing based on monthly and annual rates can be improved using ARIMA modelling. A set of tools which are functions of ARIMA forecast have been designed (Revilla-Rey, 1999). ARIMA modelling method has the following advantages over traditional monthly and annual rates: 1) monthly and annual rates use just one value of previous data. On the contrary, ARIMA forecast uses the whole of the previous data, in an optimal way. In fact, ARIMA forecast is a linear function of the latter. 2) ARIMA forecast enables the use of probabilistic data editing. This allows taking into account the different variability of the series.

Another way of using time series modelling is to obtain the data characteristics from the estimated models. In producing short-term indicators, as much information as possible about the phenomenon being measure is needed. Indeed, different subsets of data (for example, different economic branches in the indices) often show very different behaviour and variability. Hence, it is useful to acquire information about the different dynamic characteristics of each of the branches of the indices, to improve the design and editing strategies. Several characteristics of each of the indices, such as level behaviour, seasonal behaviour, calendar effects, special event effects (for instance, a strike) and unpredictability, are estimated from the results of the Arima with Intervention Analysis modelling.

REFERENCE

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RESUME

Dans cet article, il s'agit de la façon dans laquelle la modélisation des séries temporelles des données peut être employée comme un outil pour produire des indicateurs à court terme. Les usages de cette approximation réalisés par l'Institut Nationale de la Statistique de L'Espagne, pour produire des indicateurs industrielles sont aussi présentés.