Systems Research Institute, Polish Academy of Sciences

**Preprints**

# TRANSITION TO ADVANCED MARKET ECONOMIES

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# SESSION 15

## OR: PROBLEMS AND SOLUTION METHODS

## Part 15B

# A NEW APPROACH IN TRAFIC DEMAND ESTIMATION MODELLING

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For assessing the costs and benefits associated with thedifferent transportation policies , and specially, for estimating the charges in travel demand, this new methodology has been developed. The approach could be easily used to estimate the changes in travel demand due to changes in the level of service along one or more transportation modes serving an urban area. The suggested approach is much less cumbersome to use than any other traditional techniques. Many other transportation policies such as fare structures, traffic headway time, traffic operating costs, intersection traffic management, etc., can be quickly analyzed using the proposed methodology.

# TIME SERIES FORECASTING ON THE BASIS OF MARKOVIAN PIECEWISE LINEAR TREND MODELS

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In the paper two time series models are presented. They are aimed at forecasting of: (i) turning points of the trend and (ii) the slope of the future segments of the trend.

The first model, a univariate one - can be represented as the sum of two components: the first one, called Markovian piecewise linear trend, is a discrete semi-Markov process, while the second one is the normal white noise. The realisation of the first component is a continuous piecewise linear function; the sequence of slopes of the function is a realisation of the homogenous Markov chain with finite number of states, while the holding time of each state is a realisation of some random variable associated with this state. Model predictors are constructed for some objective functions (e.g. mean square error, absolute error, minimax square error, probability of realisation) under assumption that incomplete information about current state of the process is available only.

The second model, a bivariate one - is a combination of two piecewise trends: the first one is the mentioned above Markovian piecewise trend. The second one is assumed to be some piecewise linear trend (not neccessarily continuous or with finite number of possible slopes) that provides information about turning points of the first process. Predictors of the bivariate model are determined under assumption, similar to those adopted in univariate model.

Examples of applications for short term forecasting of commodity prices are presented. In the bivariate model the volume of the turnover is considered as the second process.

# FORECASTING WITH SHORT AND SEASONALLY UNADJUSTED DATA THE STRUCTURAL MODELLING APPROACH VERSUS ARIMA MODELS

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Transition processes are always combined with a structural break in the data generating mechanism. This situation confronts decision makers in economies with a relatively short period of reliable data and high degree of uncertainty. In this paper we compare the structural time series approach to model and forecast time series, specifically the Basic Structural Model including a trend, seasonal and irregular component, with multiplicative seasonal ARIMA models. By imposing a particular, economically interpretable structure on the time series, these models avoid the problems commonly associated with the Box-Jenkins methodology. The forecasting performance of the Basic Structural Model is known to be equivalent to that of reduced form ARIMA models, implying that this approach can be considered as a viable alternative to Box-Jenkins ARIMA modelling. An illustration of the methodology is given for 6 seasonally unadjusted Canadian and Austrian macroeconomic time series, where the estimation period is restricted to 10 years. Since time series methodology are designed for short term forecasts we compared predictions for one up to five quarters with realized data.

# LOCAL-R - PACKAGE TO SOLVE LOCATION PROBLEMS

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In the mixed integer programming the most interesting are problems with objective functions or constraints taking special forms. One of such problems is the facility location - transportation issue. The family of mathematical models describing location issue range from single-commodity linear deterministic models to multicommodity non-linear stochastic models.

Since 1986, in the System Research Institute mathematical models for the location problem in the investment planning were examined. Finally, of the intense analysis of the characters and the posibility of practical solutions of these models, the authors of this paper has separated two groups:

In ONE-LEVEL LOCATION PROBLEM: there are located original facilities with given bounded product possibilities in order to satisfy a given demand at minimum investment-transportation costs. In TWO-LEVEL LOCATION PROBLEM commodities are delivered from origin facilities to destination points through warehouses. There are located simultaneously plants and warehouses among the set of given locations in order to satisfy a given demand at minimum investment-transportation costs: no capacity restrictions are imposed.

A large amount of practical applications and growing meaning of computer aid for investment decisions have induced the authors to create of processing programs useful for both problems: LOCAL-1 and LOCAL-2.

In 1991 the System Research Institute of the Polish Academy of Sciences in co-operation with the Institute of Mathematic and Informatic of the Lithuanian Academy of Sciences has worked out the software package LOCAL-R consisting of both modulas LOCAL-1 and LOCAL-2. LOCAL-R works in an interactive mode. The problem is solved for points of a given region, which is presented as a map on the screen. The user fixes all potential location objects on this map. The solution obtained is presented on the map too. The map is created by the independent part VEC of the package LOCAL-R.