Bul. Stiinţ. Univ. Baia Mare, Ser. B,
Matematică-Informatică, Vol. XIV(1998), Nr. 2, 235-244

USING MICROSOFT EXCEL IN FORECASTING

Virginia RUSU, Cristian RUSU

Abstract. Forecasting is a basic component of marketing. Time-series models are particularly useful when little is known about the underlying process. They are inexpensive to apply, both in time and effort. Microsoft Excel may successfully be used in forecasting. It allows the implementation of a wide range of forecasting methods, the update of dynamic series, forecasts graphic presentation, and results testing. An example of using Microsoft Excel in forecasting is shown. It concerns the evaluation of the metal prices at London Metal Exchange.

Keywords: marketing, forecasting, time-series models, algorithm, Microsoft Excel, metal price forecast.

Forecasting in marketing research

Forecasting is a basic component of marketing. Marketing forecasts are marketing variables levels estimations for future time periods. Marketing variables forecasts are made based mainly on examination of their previous evolution. Marketing forecasts are made on a large scale of phenomenon and processes, both endogenous and exogenous. Major aims of marketing forecasts are:

- strategic marketing's objectives highlighting;
- marketing politics foundation;

- marketing decisions improvement.

Main forecasting circumstances are:

- forecasts context;
- forecasts intervals;
- availability and features of previous behavior;
- influence factors considered;
- formalization level;
- precision;
- time interval in which forecasts must be made.

Time-series models

Some kind of logical structure or model is implicit in every forecast. Even the intuitive forecaster builds some type of model, even without being aware of doing so. Three general classes of models can usually be constructed in forecasting:

- time-series models;
- single-equation regression models;
- multi-equation simulation models.

Each involves a different degree of model complexity, and presumes a different level of comprehension about the processes one is trying to model. Time-series models presumes to know nothing about the causal relationship that affect the examined variable. Only the past behavior of a time series is examined, in order to infer something about its future behavior.

Time-series models are particularly useful when little is known about the underlying process. Theirs limited structure makes them most reliable in the short run. Because of their simplicity, times-series models are sometimes used even in the long run. They are inexpensive to apply, both in time and effort.

As any other predictions, those using times-series models can be adjusted to conform with the good sense of the forecaster. Time-series forecasts are not based on economic theory, but on statistical theory. Even if economic theory is not formally incorporated into the procedure, the forecaster can adjust the predictions in light of current economic events.

Percentage modification

The percentage modification method is meant to evaluate the percentage changes of one variable during different successive time moments. The indicators that express these changes are calculated first. Then they are averaged from one period to another.

Forecast for next period is:

$P_{t+1} = (1+PMA_t) * X_t$;

where:

P_{t+1} is the forecast value corresponding to t+1 period;

PMA_t is the percentage modification average corresponding to t periods;

X_t is the noticed value of forecasting-variable in t period.

When during a long period the dynamic series has positive or negative trend the method is inadequate. In the first case the forecasting would be overestimated and in the second one it would be underestimated. Sometimes the most recent changes can be over-weighted in order to have an increased significance.

Percentage modification moving

If certain trend is present the percentage modification moving method is more suitable. The percentage modification moving during t period is:

$$PMM_t = \left(\frac{X_t - X_{t-1}}{X_{t-1}} + \frac{X_{t-1} - X_{t-2}}{X_{t-2}} + \ldots + \frac{X_{t-n+1} - X_{t-n}}{X_{t-n}} \right) / n;$$

The forecast value in t+1 period is:

$P_{t+1} = X_t * (1+ PMM_t)$;

where:

X_t is the noticed value in t period;

n is the number of periods taken into account.

For periods following the last period of dynamic series the forecasting made is based on:

$P_{k+m} = (PMM_k * m+1) * X_k$;

where:

P_{k+m} is the percentage modification moving during k period;

k is the last period of dynamic series (the period of last noticed value);

m is the number of the following periods the forecasting is made for.

Moving averages

The method takes into account the most recent data of dynamic series. The forecast values are based on a constant number of data:

$$P_{t+1} = \frac{X_t + X_{t-1} + \ldots + X_{t-n+1}}{n} = \frac{1}{n} \sum_{i=t-n+1}^{t} X_i ,$$

where:

X_t is the noticed value in t period;

n is the number of values taken into account.

If the dynamic series has random changes on long terms it is advisable to increase n. The previous formula can be written as following:

$$P_{t+1} = \frac{X_t}{n} - \frac{X_{t-n+1}}{n} + P_t .$$

It is obvious that the new period is a correction of the last one, by adding the most recent value and removing the oldest one.

Double moving averages

The method is recommended when the dynamic series has a linear trend. Two series of moving averages are calculated. The first one is based on initial dynamic series:

$$P'_{t+1} = \frac{X_t + X_{t-1} + \ldots + X_{t-n+1}}{n} .$$

The second one is based on calculated moving averages (P't):

$$P''_t = \frac{P'_t + P'_{t-1} + \ldots + P'_{t-n+1}}{n} .$$

The forecast value is:

$P_{t+m} = a_t + b_t * m$,

where:

$a_t = 2P'_t - P''_t$;

$$b_t = \frac{2}{n-1}(P'_t - P''_t);$$

n is the number of period taken into account;

m is the number of the forecast periods.

Trend extrapolation

The simplest time-series technique is trend extrapolation. Trend extrapolation is based on assumption that the dynamic series evolution can be justified by its shape, adding random error. The dynamic series can be fitted to a nonlinear form, if it has not a linear trend.

Microsoft Excel

Microsoft Excel is the most used and probably the best software in its category. It can be used for data storage, calculation, analyze and forecasting, data and results presentation in attractive manners. Microsoft Excel is integrated in Microsoft Office suite, but can also be used independently. It is used in many fields: offices, accounting, management, marketing, forecasting, statistics, engineering, etc.

Microsoft Excel takes benefit of all Windows technologies:

- **OLE** (***O**bject **L**inking and **E**mbedding*);
- **ODBC** (***O**pen **D**atabase **C**onnectivity*);
- **DAO** (***D**ata Access **O**bjects*);
- Plug & Play.

Excel worksheets can be used in multiply access environments and computer networks. Microsoft Excel offers its own macro language and a powerful programming language, Visual Basic for Applications, which allows visual programming, oriented on objects and events. It includes wizards and a complete help system that may assist users in any operations.

The first Excel version appeared in 1985. Next versions were more and more powerful, designed for new Windows versions. Excel 7.0 was redesigned to take full advantage of Windows 95 facilities.

Forecasting algorithms implementation using Microsoft Excel

Microsoft Excel may successfully be used in forecasting. It allows the implementation of a wide range of forecasting method, the update of dynamic series every time when new values become available, forecasts graphic presentation, and results testing, both formerly or by time test. Microsoft Excel 7.0 offers 14 different types of graphic charts, 8 of them 2D and 6 of them 3D. Methods of prediction's evaluation may easily be implemented.

We implemented five forecasting techniques, using Excel formulas and functions:

- percentage modification moving;
- moving averages;
- double moving averages;
- linear trend extrapolation;
- exponential trend extrapolation.

In all cases, using a combination of absolute and relative address, formulas can be copied in other areas of spreadsheet, in order to make new forecasts. Linear trend extrapolation can be made using either **Trend** or **Forecast** Excel functions. Exponential trend extrapolation can be made using **Growth** Excel function.

An example of forecast using Microsoft Excel

The computer has been used to elaborate a marketing study concerning the evaluation of the metal prices at the London Metal Exchange. It has been tried to forecast the prices by using the following methods: percentage modification moving, moving averages, double moving averages, trend extrapolation by classical fitting.

Considering the past evolution of price-variable we tried to estimate its future values. The methods we used presume that the variable configuration is the same in the past and in the future, even it permanently changes. The main aim of all used method is to identify the specific configuration of the dynamic series in the past and to extrapolate it in the future, without explicitly considering the elements that influence its behavior.

Forecasts we made were the base of marketing studies since 1995. Prices of five metals were studied: Copper, Lead, Zinc, Gold and Silver. Input values were the average weekly values. Predictions were tested both by time test and using statistical indicators (square average errors and percentage average errors). All forecasting phases (data input and update, forecasting algorithms implementation, graphic presentation, predictions' test) were made using Microsoft Excel.

A comparison between Copper price forecast for 1997, using the percentage modification moving method, and the real prices for 1997, is shown in fig. 1. Three types of predictions were made, using the known real prices in 1996 (1 year history), 1995-1996 (two years history), and 1994-1996 (3 years history), as input data.

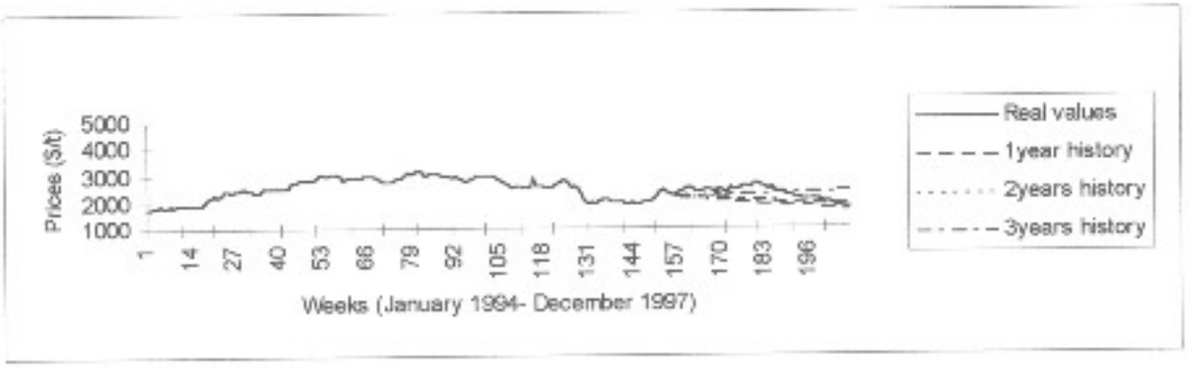

Fig. 1 Comparison between Copper price forecast (1997) by percentage modification moving method and the real prices

A comparison between Copper price forecast for 1997, using the moving averages method, and the real price for 1997 is shown in fig. 2. Three types of predictions were made, using the known real prices for the previous 10, 26 and 52 weeks, as input data.

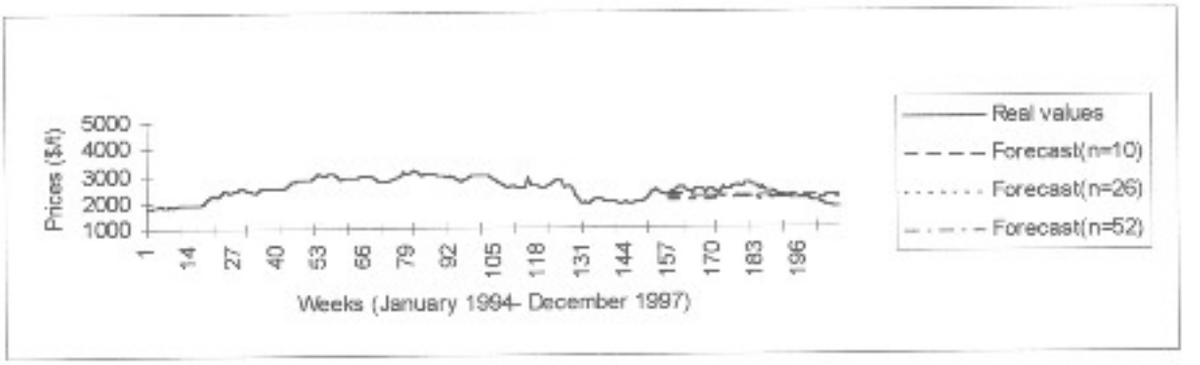

Fig. 2 Comparison between Copper price forecast (1997) by moving averages method and the real prices

A comparison between Copper price forecast for 1997, using the double moving averages method, and the real price for 1997 is shown in fig. 3. Two types of predictions were made, using the known real prices for the previous 26 and 52 weeks, as input data.

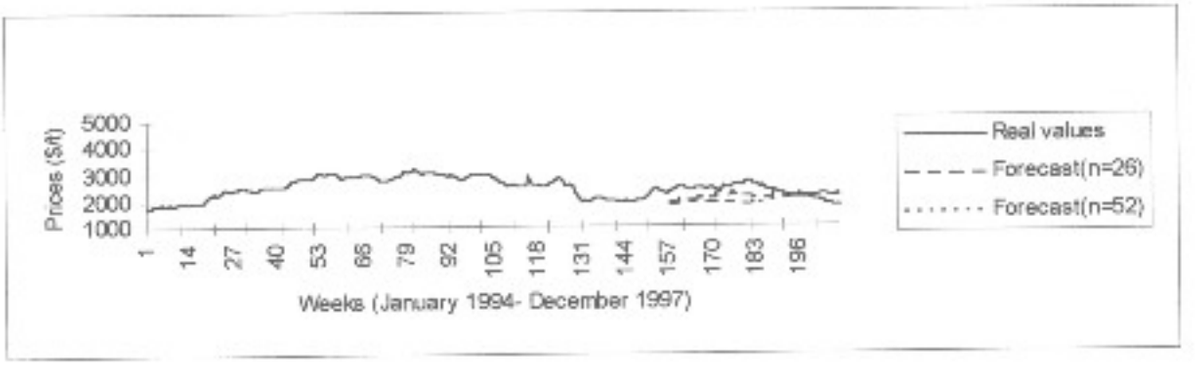

Fig. 3 Comparison between Copper price forecast (1997) by double moving averages method and the real prices

A comparison between Copper price forecast for 1997, using the linear trend extrapolation method, and the real prices for 1997, is shown in fig. 4. Three types of predictions were made, using the known real prices in 1996 (1 year history), 1995-1996 (two years history), and 1994-1996 (3 years history), as input data.

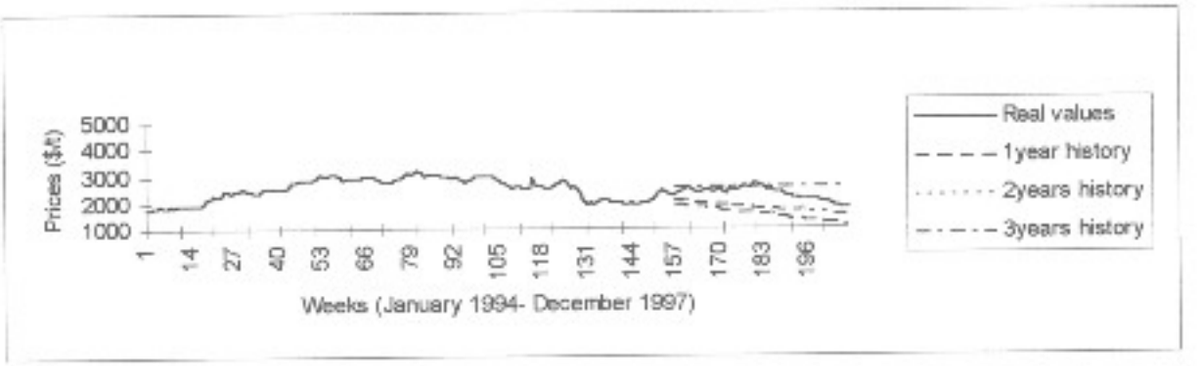

Fig. 4 Comparison between Copper price forecast (1997) by linear trend extrapolation method and the real prices

A comparison between Copper price forecast for 1997, using the exponential trend extrapolation method, and the real prices for 1997, is shown in fig. 5. Three types of predictions were made, using the known real prices in 1996 (1 year history), 1995-1996 (two years history), and 1994-1996 (3 years history), as input data.

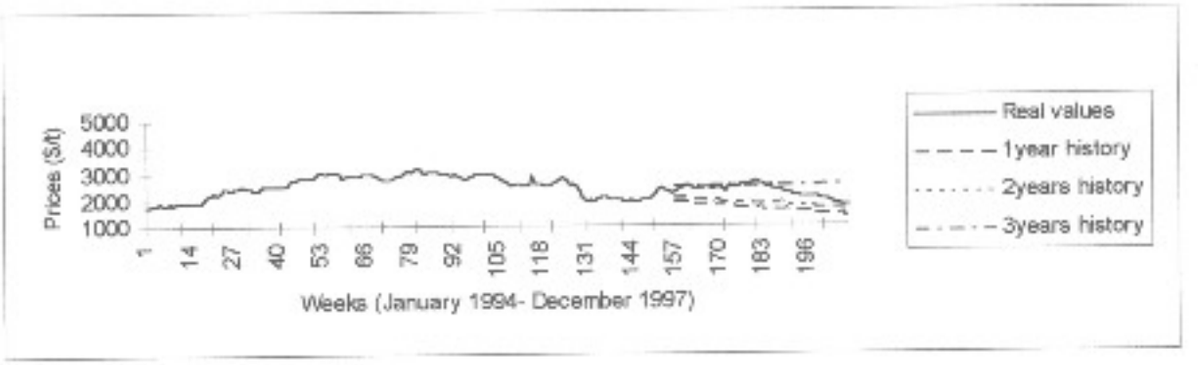

Fig. 5 Comparison between Copper price forecast (1997) by exponential trend extrapolation method and the real prices

REFERENCES

1. Cerghizan M. A.: Excel 7.0 pentru Windows 95, Ed. Tehnică, Bucureşti, 1996.
2. Florescu C. ş.a.: Marketing, Ed. Marketer, Bucureşti, 1992.
3. Hergert D.: Excel pentru Windows 95. Ghid de referinţă, Ed. All, Bucureşti, 1997.
4. Kacapyr E.: Economic Forecasting. The State of the Art, M.E. Sharpe Armonk, New York, 1996.
5. Pindyck R., Rubinfield D.: Econometric Models and Economic Forecasts, McGraw-Hill, New York, 1991.
6. Rusu C., Rusu V.: On a computerized marketing study concerning the evaluation of metal prices, Proceedings, The VIth international symposium on application of mathematical methods and computers in mining, geology and metallurgy, Prague, Czech Republic, October 6 - 10, 1997.
7. Rusu V.: Sudiu informatic al unor algoritmi de previziune pentru evoluţia preţurilor metalelor neferoase şi preţioase la bursă, lucrare de diplomă, Universitatea Babeş-Bolyai, Cluj-Napoca, 1998.

Received 19.07.1998

North University of Baia Mare

Department of Economics

Department of Mathematics and Computer Science

Baia Mare, Victoriei, 76, RO-4800, Romania

e-mail: crusu@univer.ubm.ro