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PREDICTABILITY OF MACROECONOMIC INDEXES: EFFECTIVENESS OF STATISTICAL METHODS' APPLICATIONS

1. Introduction

This paper reviews research on the effectiveness of most important statistical methods that are designed for forecasting of different macroeconomic indexes. In this paper several statistical methods have been compared by most important criterions. It was investigated the optimal forecasting methods for different branches of application. As a result it was developed some modification,

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which takes into consideration this problem, on the base of known classification schemes. Such optimal methods were illustrated through examples. The focus is on Ukraine data from 1996—2004 because the post — 1996 data have been analyzed in more detail than before.

2. The problems of forecasting of macroeconomic indexes of Ukraine

After deep economical crisis, that have been continued ten years (1990—1999), in IV-th quarter of 1999 it was recorded by statistics the real increasing (2.6 %) of **GDP**. In 2000—2003 the according increasing was 32.9 %. Starting from 2000, the rates of economical rising in Ukraine were much more than rates of it's closed partners in foreign trade — Poland and Slovakia.

Table1

REAL GROSS DOMESTIC PRODUCT INDEX (in % to the previous year)

	Slovakia	Ukraine	Poland
1996	106,1	90	106
1997	104,6	97	106,8
1998	104,2	98,1	104,8
1999	101,5	99,8	104,1
2000	102	105,8	104
2001	103,8	109,2	101
2002	104,4	105,2	101,4
2003	104,2	109,4	103,8

The rates of population employment and inflation growth have been stabilized accordingly.

Ukraine have refused from directive planning and use the system of forecasting and indicating planning through developing of economical and social development programs by Cabinet of Ministers of Ukraine.

The main purpose of social-economical politics on average-term perspective is formation of such economics development model, that would has the long-term potential of rising, the ability to provide the consequent increasing of population welfare, the effective expanded reproducibility, the consolidating of Ukrainian products competitiveness.

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**Dynamic of the main macroeconomic indexes
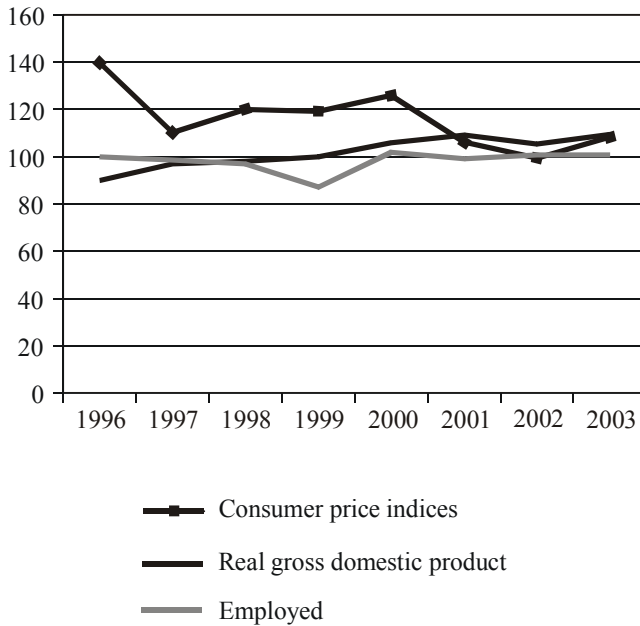of Ukraine**

Figure 3. Dynamic of the main macroeconomic indexes of Ukraine.

According to handled by Cabinet of Ministers of Ukraine purpose scenario the economical increasing for the next two years will be characterized by consumption expanding, changes in investments structure preferably to economics branches, oriented to interior market, growth of innovating component and work productivity rising as well. Economical increasing will be characterized by:

1. Consumption expanding.
2. Changes in investments structure preferably to economics branches, oriented to interior market.
3. Growth of innovating component.
4. Labour efficiency rising

In that time the real income of population will grow by rates, that are more than **GDP** increasing. It will provide the retaining of consumption share in **GDP** in average-term perspective on high level. The average annual rates of **GDP** rising will be 7 % in 2004—2005, of salary growth — 14 %, of final consumer's expenditures of domes-

tic economy — on the 8 % level, of final expenditures of state consumption is forecasting on the 4 % level.
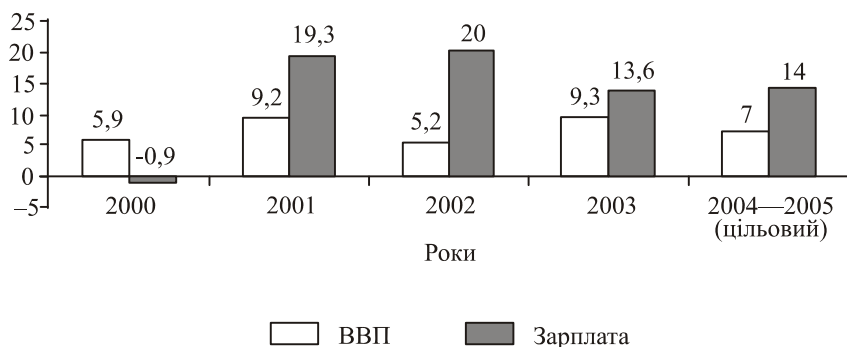
Scenario

Figure 4. Dynamic real gross domestic product
and wage rate of growth (in % to the previous year)

The inflation level will be not more than 6—7 % in 2004—2005. It will be continued the politics of stable hryvna currency rate. The ratio of M2 to GDP will enhance to 38—39 % — in 2004 and to 45 % — in 2005. On an average the growth of gross accumulation of general capital by purpose scenario will be 11.5 %.

In forecasting period the growth of industrial production on an average will be 9 %.

It's supposed by payment balance forecasting the gradual decreasing of positive balance of Ukraine payment balance current account from 2,940 billions dollars USA (6.0 % to GDP) in 2003 to 1.8 billions dollars USA (3.3 % to GDP) in 2005.

It's supposed, that rising of values of products and services foreign trade by export deliveries will be on an average 5.9 %, by import ones — 8.1 %. It's expected the receipts near 2.5 billions dollars USA of direct investments.

It's supposed that on the end of 2004 the currency reserves of National Bank of Ukraine will increase to 8.6 billions dollars USA, on the end of 2005 — to 10.1 billions dollars USA. In the connection of election campaigns conducting the main risks of determined tasks realization are shifted today to the sphere of political relations. As a result of this fact the losses that Ukrainian economy will undergo may be very considerable.

The problems of macroeconomic forecasting are connected with insufficiently sure statistical information, correctness and efficiency of forecasting methods, verification and quality of forecasting.

In turn the indefiniteness of transient period of Ukraine economics results in unstable behavior of object in time, difficulties for adequate model of it's development selection.
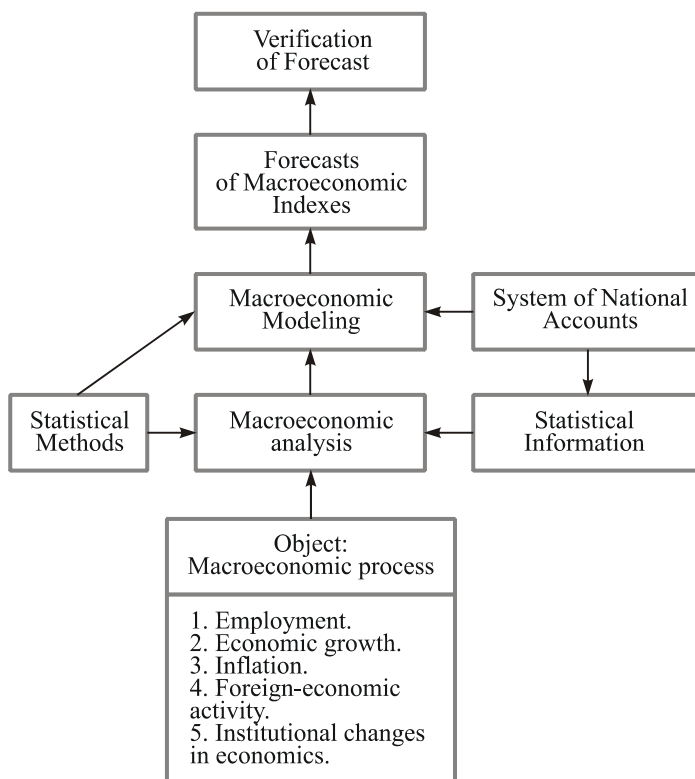

Figure 1. Stages of Forecasting Process.

At the same time the main is the problem of forecasting verification (estimating of it's certainty, accuracy or validity). The statistical evaluation of confidence interval for calculated forecasting values are often used by verification methods. It may be detected two types of mistakes, caused by: 1) information or ob-

ject description and 2) forecasting method. So, it's very important to estimate and determine the optimal accordance between initial information and method (methods) of forecasting during forecasting calculations pursuing. In information-methodological conditions of Ukraine the data of national accounts are the most conformed to such requirements. Besides, today the system of national accounts is the model of economics, that most accurately describes it.

For this problem solution the accordance «information — method» can be considered as criterion for formation of forecasting methods classification. Classification allows to regulate the procedure of forecasting verification and to enhance it's quality as well.

3. Classification of forecasting methods

So, what are the main purposes of forecasting methods classification? It can be noted at least two such purposes. At the first the providing of process of methods studying and analysis, at second one — usage the process of method selection for forecasting development. Today is too hard to propose the sole classification, that will satisfy the both mentioned purposes. Now together with significant number of published forecasting methods the numerous methods of their classification are known. Nevertheless we can't consider that this problem is solved because the sole useful and complete classification doesn't exist. More of them have not sufficient cognitive importance. The main disadvantages of such schemes are — irregularity of such classification principles as sufficient completeness of forecasting methods, classification points has not be crossed, and the openness of classification scheme (the possibility of it's addition by new methods).

It's accepted to select three general groups in native literature: heuristic, factual (formalized) and complex (combined). The heuristic methods are: methods of expert's evaluations, the factual ones are: logical and mathematical-statistical models.

In the western tradition they are divided on univariate or time series, multivariate or causal and qualitative.

It was mentioned above that each of these schemes has some disadvantages. So, we have developed the classification scheme by functional characteristic, that will maximum satisfy our investigation requirements.
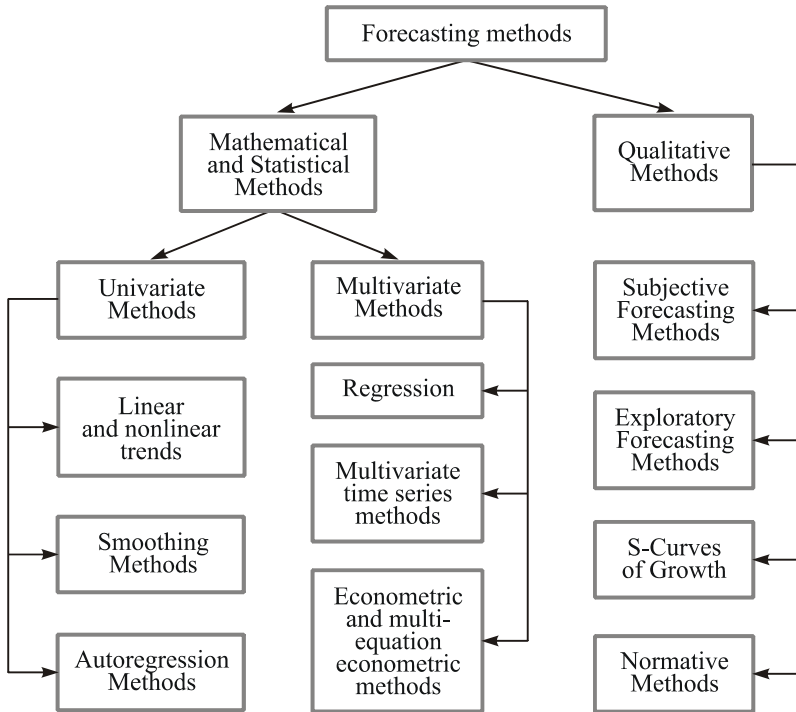
Figure 5. Classification of forecasting methods.

4. Effectiveness of statistical methods

One of the actual problems of economic process forecasting theory is the selection of optimal method. Today exist a great number of forecasting methods. So, the problem of most optimal method selection is permanent for investigator. And it's very important to formulate and introduce such criteria, which would permit to select this method. It's important as for theory, so for practice. We introduce the conception of efficiency such as this criterion.

The absolute index of efficiency of forecasting method will be the difference between benefit from this method usage and cost of it's introduction and usage.

Net benefit = Benefit from use – Cost of use

On the basis of this fact it can be derived the conception of efficiency for one or another method. Method may be determined as more economically efficient if it results in increasing of this difference.

According for formalization of this conception the efficiency may be considered as function from two variables: quality and cost. Besides, the first variable may be expanded on accuracy of forecasting and quality of design, which is how accurately our model reproduces the essentiality of effect. It's naturally that rising of forecasting accuracy results in according benefit increasing from introduction of selected method (or expenses decreasing from inaccurate forecasting). The second component is responsible for time of such method usage, because as better our model conforms to nature of investigating effect, so more accurate will be it's next forecasting. These two components are closely connected, but there are some specialties. So, we shall analyze them separately.

It is naturally that for efficiency increasing it's necessary to improve the first variable and decrease second one.

The most important component of quality is accuracy. Accuracy is responsible for expenses decreasing from forecasting inaccuracy. The ratio between accuracy and losses from inaccuracy is illustrated on Fig. 1.
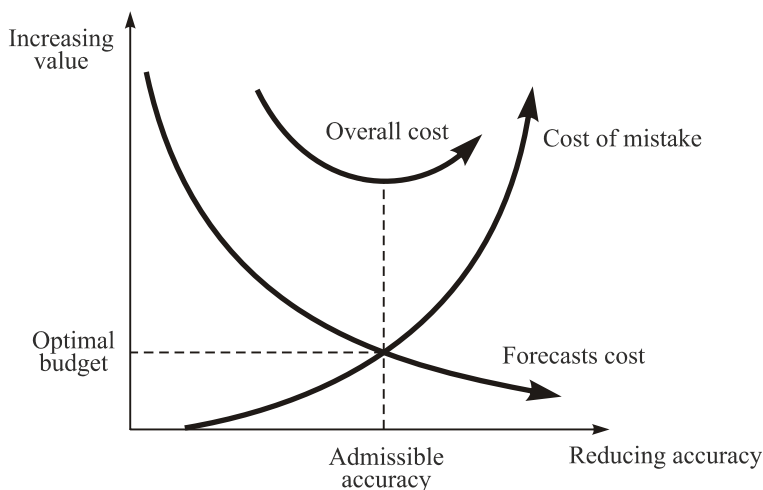

Figure 1. Relations between cost and accuracy of forecast

At the last years a lot of investigations were devoted to forecasting accuracy problem. The results of these investigations show, that more difficult and more expensive methods are not sure more accurate than simple ones. So, we can see that problem of obtained forecasting accuracy evaluation is one of the principle problems for forecasting the-

ory. Today it's unsolved. As a rule, the most simple method of approach is used — the most accurate is determined such model that minimized sum of squared errors. But such method of approach has a number of disadvantages; first of all it results in models complication and growth of parameters number, that cause to artificiality of developed model, and this fact accordingly represent on accuracy of following forecasting. The more generalized are Bayesian information criteria (BIC) and Akaike information criteria (AIC). They was developed for selecting methods that trade off model complexity and the error in fitting so as to achieve the most accurate out–of–sample forecasts. These two objective measures better balance model complexity and goodness of fit measures than does sum of squared errors. But these criteria are not free from disadvantages mentioned above. So, they are indicated as auxiliary and the final solution is accepted by investigator, basing on theory, own experience and intuition. This problem can be solved by another method — to estimate accuracy of methods on the basis of previous investigations and results.

Three of the most comprehensive studies of forecasting method accuracy were completed by Makridakis and Hibon in 1979, Makridakis et al. in 1982, and Makridakis et al. in 1990. The first study in 1979 investigated the accuracy of 21 different methods in forecasting 111 different series. A second study conducted by Makridakis et al, (1982) involved seven experts who used 24 forecasting methods. They analyzed 1001 different actual time series. This competition is now commonly called the M— competition.

The similar investigations have been carried out by us on the basis of Ukrainian macroeconomic series. It was selected nine the most simple and widely used methods, that are using for forecasting. Besides, it was used one more method, that is the fourth methods average value. The list of methods is resented in table.

Table 1

THE LIST OF METHODS WHICH WERE USED IN RESEARCHES

Name of Methods	Description of Method
Naïve 1	$Y_t = Y_{t-1}$
Single EXP	Single (simple) exponential smoothing with optimal alpha
Holt EXP	Holts two — parameter trend smoothing with optimal parameter
Regression	Simple linear regression with time as independent variable
Naïve 2*	Deseasonalized data used in Naïve 1 model

D Single EXP*	Single EXP using deseasonalized values
D Holt EXP*	Holt EXP using deseasonalized values
D Regression*	Regression using deseasonalized values
Winters'	Winters' three-parameter) exponential smoothing with optimal parameters
Combining	A simple average of D Sing EXP, D Holt EXP, D Regression, Naïve 2

* The method of ratio to moving average — Multiplicative was used to determine seasonal indexes.

These methods were applicated to 21 macroeconomic time series, hat were selected from list of macroeconomic time series, that are using by for forecasting. It's necessary to determine the degree of accuracy measuring during investigation of accuracy. The results of this investigation are presented in table 2.

Table 2

AVERAGE RANKING OF 10 MODELS USING 21 SERIES

Methods	Forecasting Horizons (quarterly data)						All — horizons rank
	1	2	3	4	5	6	
Single EXP	7,9	4,7	6,8	7,9	4,2	5,8	6,5
Holt EXP	9,1	5,8	3,1	4,3	5,2	3,3	4,3
Naïve 1	9,0	5,1	6	6,9	4,5	5,7	6,6
Winters'	4,1	4,6	3,2	2,9	3,9	3,8	3,1
Regression	6,0	5,2	7,1	7,3	4,0	4,4	5,4
D Sing Exp	3,8	6,4	6,5	6,8	7,9	7,7	7,4
D Holt EXP	3,5	4,3	3,7	2,8	4,1	4,2	3,2
Naive 2	4,2	6,8	6,9	7,1	8,3	8,1	7,9
D Regress	4,1	6,3	6,2	4,5	6,1	5,4	5,0
Combining	3,4	5,8	5,5	4,6	6,7	6,5	5,5

It is seen that different forecasting methods give different results depending of horizon length. So we can separate the methods that give

best results for short and medium horizon length. These results are shown in Table 3 and Table 4 accordingly.

Table 3

THE BEST FORECASTING METHODS FOR SHORT HORIZON LENGTH

Methods	Average Ranking for 1 horizon length	Mean of Average Ranking for 1 and 2 horizon length
Combining	3,4	4,6
D Holt EXP	3,5	3,9
D Sing Exp	3,8	5,1
D Regress	4,1	5,2
Winters'	4,1	4,1

One of the more significant results of this study is the effectiveness of combining forecasting methods. As shown in Tables 1 and 2, Combining methods achieve much better performance than using only one method. Combining method consists of deseasonalized exponential smoothing, deseasonalized Holt, Winters'. These are all easily implemented forecasting methods. This suggests that it may be better to combine a few methods than to rely on the chance that one can isolate a best method.

Table 4

THE BEST FORECASTING METHODS FOR MEDIUM HORIZON LENGTH

Methods	All –horizons rank	Mean of Average Ranking for 3 — 6 horizon length
Winters'	3,1	3,5
D Holt EXP	3,2	3,7
D Sing Exp	4,3	4

Further research by Makridakis in 1990 showed that by choosing different models for different horizons, one can dramatically improve accuracy. Thus, intelligent selection of different forecasting methods for different horizons and applications can dramatically improve forecasting performance in specific settings.

The characteristics of methods illustrated above are very important in choosing one method over another, however, other factors enter into choice. These include the availability of data, the expertise

of the analyst, the availability of software and hardware, the benefits from instead forecast accuracy, and cost of forecast errors. Fortunately, the choice of the forecasting method for many situations is quite easy, and most frequently, univariate methods have a cost-effectiveness advantage. This is true because they are relatively inexpensive to use, have high accuracy in immediate to medium range forecasts, lend themselves to automated application, and don't require forecasts of independent variables.

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INTENSITY ON THE LABOUR MARKET OF UKRAINE: REGIONAL ASPECT OF THE STATISTICAL ESTIMATION

Output of Ukraine from an economic crisis and the decision of strategic tasks on formation of national economy are possible under condition of increase of efficiency of functioning of regional labour markets. The market mechanism of managing demands improvement of processes which occur on a labour market in regions of the country. Existing real disproportions in development of regions of the country form the certain difficulties at management of the market. Therefore in the centre of interests of many economic researches the estimation of probability of occurrence in the certain territory, in separate regions of local social cataclysm which accepts features of economic instability lays. It concerns also intensity on regional labour markets.