THE INFLATION INDEX PROGNOSIS BASED ON THE METHOD OF DECISION-MARKING "TREE"

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Abstract: The description of the support system for marking decision in terms of prognosing the inflation level based on the multifactor dependence represented by the decision – marking "tree" is given in the paper. The interrelation of factors affecting the inflation level – economic, financial, political, socio-demographic ones, is considered. The perspectives for developing the method of decision – marking "tree", and pointing out the so-called "narrow" spaces and further analysis of possible scenarios for inflation level prognosing in particular, are defined.

Keywords. Method of decision - marking "tree", multifactor analysis, inflation index, expert information.

Introduction

Economic growth is considered to be one of the most important social problems which is in the focus of economists' and politicians' attention. So the importance of inflation index prognosing means that the main tendencies of economic development are reflected in it and the charges in the dynamics of Gross Domestic Product (GDP) affect the changes of living standard of each citizen of Ukraine. There exist no universal and perfect approaches to finding solution to this problem nowadays. Some attempts for building possible scenarios for developing either phenomenon in future only have been made. Various method of qualitative characteristics based on using expert information are used for this purposes.

Economic prognosis should define and evaluate the main directions of economic development reflecting total combination of internal and external interrelations between the components on the macroeconomic level in the first place. Macroeconomic prognosis means that the investigation should be aimed at strategic level. All the main elements of economic and social sphere in progress should be considered in the context of their cause and effect relations and interdependence.

Irrespective of the aim any macroeconomic prognosis is based on definite theoretical grounds to correspond with scientific grounds. In terms of mechanisms of achieving adequacy and information unity the apparatus of economic mathematic modeling becomes indispensable because of using complex economic-mathematic methods based on apparatus of econometric modelling too often. The methods of quantitative prognosing (time lines, regressive analysis, imitation modelling, etc.) based on "continuation if the past" present poor results while prognosing "unstable" processes which are characterized by "breaking the monotony" and are based on sudden changes and cannot be referred to as distinctive features for describing the development of the process in the past [Popov, 1996]. The problem lies in representing the future as a usual thing related to continuation of the past as far as the future can acquire some principally new shares. This prognosing ("qualitative prognosing") is based on direct usage of human (expert) knowledge, inaccuracy of expert information being taken into account in the first place, which depends on the expert's professional and psychological characteristics (competency, independence, impartiality, real vision, risk taking, etc.) [Ivchenko, 1984].

The method of decision - marking "tree"

The method of decision - marking "tree" represented in this paper may be referred to as a basic ground for prognosing inflation level, expert information being used for building the tree itself and method of double comparison [Voloshin, 1999]. Expert information can be presented both as determined and inaccurate one. In processing expert information for finding out "collective" estimates the algebraic method based on using Hemming's metrics and measure of nonconformity of object ranks [Ushakov, 1979]. The group with $n(n \geq 1)$ of experts working together singles out the problems and sub-problems and builds the decision - marking tree, and also defines the importance (priority) of each task (each element of the tree). Processing expert information is

carried out taking into account “priorities” set by expert and degree of agreement on their estimates [Kozeletskyy, 1979]. The basic factors are presented at the top of the tree. Then these factors fall into smaller sub-problems, etc. As a result the decision - marking tree is built. The leaves of the tree stand for the factors which do no fall into further sub-problems. After heaving set the priorities in the decision - marking tree the importance of each factor is evaluated [Seber, 1980].

The tree is built by a group of experts (persons who make decisions). Each of the elements (key points) of the tree (expert of the leaves) has its sub-elements (i.e. each problem has a sub-problem). Then the priorities (chances) for coming from one top of the tree to another one are set.

The work of the expert group results in building the decision - marking tree aimed at prognosing the inflation index (Figure 1) which incorporates the following main problems:

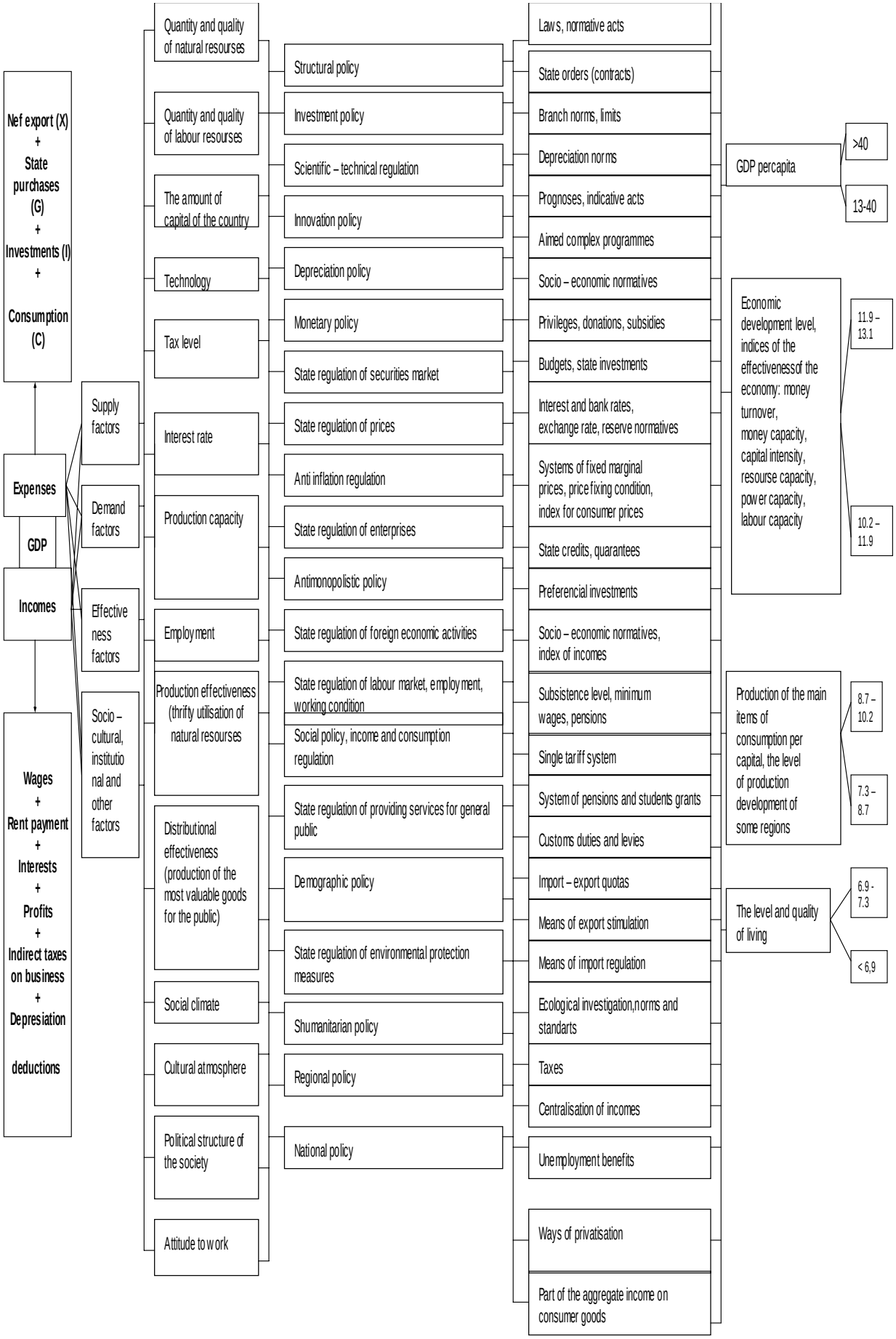
- economic - industry, agroindustrial complex, financial market, commerce, etc;
- political - irregular economy, investment, monetary and antimonopolistic policy, etc;
- social – demographic situation – unemployment, social-demographic load, tempo of population increment, etc;
- financial – financial-budget, monetary policy, sate regulation of securities market, state regulation of prices, etc.

To specify “narrow” spaces means to single out the affecting factors at each stage of the sub-problem, for instance, let’s consider the state of economic development: state orders (contracts), privileges, subsidies, state credits, warrants and taxes, internal and external investments, the allotment of the aggregate income expenses on consumer goods. Let’s consider the problem of unemployment, the number of jobs available, the system of allotment of pensions and students grants, state regulation of labour market. Employment and working conditions, etc. Having considered the importance the leaves of this tree we obtain the probable specific indices of inflation fir a certain period of time. Each of the experts produces estimates of three types: a_1^i - “optimistic”, a_2^i - “realistic”, and a_3^i - “pessimistic”. The resulting estimate is calculated in such a way. The average estimate of each expert $a_i = \frac{a_1^i \cdot \gamma_1 + a_2^i \cdot \gamma_2 + a_2^i \cdot \gamma_3}{\gamma_1 + \gamma_2 + \gamma_3}$, is considered in the first place, then with reference to the importance of all the experts, the resulting estimate is calculated. In this case: $a_1^j,\ j = \overline{1,3},\ i = \overline{1,n}$ is introduced indistinctly by means of function (vector of essential quality and looks like: $a_j^i = (a_{1j}^1,...,a_{kj}^i)\ j = \overline{1,3},\ i = \overline{1,n}$. Coefficients $\gamma_1, \gamma_2, \gamma_3$ are calculated empirically and present numerical characteristics [Tsurkov, 1981].

In accordance with one of the method $\gamma_1 = \gamma_3 = 1, \gamma_2 = 4$ (for expert-“realist”), according to other - $\gamma_1 = 3,\ \gamma_2 = 0,\ \gamma_3 = 2$ (for an “optimist”) and $\gamma_1 = 2,\ \gamma_2 = 0,\ \gamma_3 = 3$ (for a “pessimist”). To specify the psychological type of the expert (pessimist, optimist, realist) by means input in the system the psychological testing of the experts is carried out and then the coefficients of “realisticity” $k_1^i = (1/3 \le \lambda \le 2/3$ for realist, $0 \le \lambda \le 1/3$ for pessimist, $2/3 \le \lambda \le 1$ for optimist correspondingly are taken into account). The coefficients of competency k_2^i are calculated on the basis of the previous prognoses accuracy in conformity with the methods suggested. The initial coefficients k_2^i equal $\frac{1}{n}$ [Gladun, 1987].

The theory

To analyse the way the decision - marking tree can respond it is necessary to find the facts which dramatically affect the inflation level and could be taken into consideration in this model. Bearing this in mind we should single out the “narrow” spaces which depend greatly on being placed on a certain leaf of the tree – the estimate of the prognosed parameter.


Nef export (X)
+
State purchases (G)
+
Investments (I)
+
Consumption (C)
Expenses
GDP
Incomes
Wages
+
Rent payment
+
Interests
+
Profits
+
Indirect taxes on business
+
Depresiation
deductions
Supply factors
Demand factors
Effective ness factors
Socio – cultural, institutio nal and other factors
Quantity and quality of natural resourses
Quantity and quality of labour resourses
The amount of capital of the country
Technology
Tax level
Interest rate
Production capacity
Employment
Production effectiveness (thrifty utilisation of natural resourses
Distributional effectiveness (production of the most valuable goods for the public)
Social climate
Cultural atmosphere
Political structure of the society
Attitude to work
Structural policy
Investment policy
Scientific – technical regulation
Innovation policy
Depreciation policy
Monetary policy
State regulation of securities market
State regulation of prices
Anti inflation regulation
State regulation of enterprises
Antimonopolistic policy
State regulation of foreign economic activities
State regulation of labour market, employment, working condition
Social policy, income and consumption regulation
State regulation of providing services for general public
Demographic policy
State regulation of environmental protection measures
Shumanitarian policy
Regional policy
National policy
Laws, normative acts
State orders (contracts)
Branch norms, limits
Depreciation norms
Prognoses, indicative acts
Aimed complex programmes
Socio – economic normatives
Privileges, donations, subsidies
Budgets, state investments
Interest and bank rates, exchange rate, reserve normatives
Systems of fixed marginal prices, price fixing condition, index for consumer prices
State credits, quarantees
Preferencial investments
Socio – economic normatives, index of incomes
Subsistence level, minimum wages, pensions
Single tariff system
System of pensions and students grants
Customs duties and levies
Import – export quotas
Means of export stimulation
Means of import regulation
Ecological investigation,norms and standarts
Taxes
Centralisation of incomes
Unemployment benefits
Ways of privatisation
Part of the aggregate income on consumer goods
GDP percapita
>40
13-40
Economic development level, indices of the effectivenessof the economy: money turnover, money capacity, capital intensity, resourse capacity, power capacity, labour capacity
11.9 – 13.1
10.2 – 11.9
Production of the main items of consumption per capital, the level of production development of some regions
8.7 – 10.2
7.3 – 8.7
The level and quality of living
6.9 - 7.3
< 6,9

After this it is desirable to consider several scenarios for describing different switchovers in the tree. Under such conditions there is a possibility to obtain current statistic data for the model parameters to be estimated and using them to test statistic and economic effectiveness of the model and develop the more effective prognosis. To decide on what factors should be chosen for the model of this kind the theory of economic indicators might be of great importance. Commonly all indicators are interrelated and affect each other so inflation itself may be referred to as an economic indicator and there exist a number of indicators closed related to it. The wide range of indicators allows them to be grouped into certain system or models in conformity with the requirements specific for them.

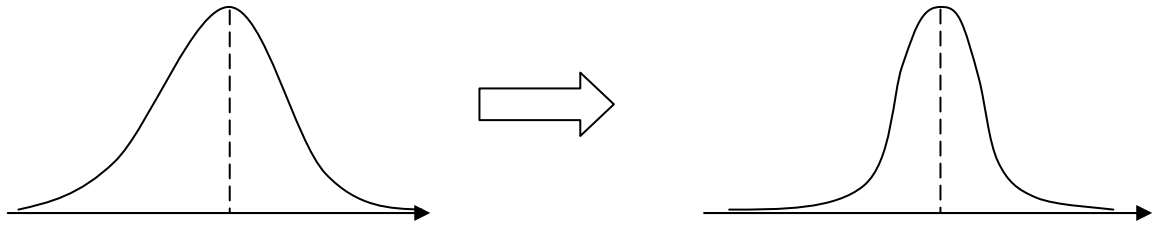
One of the methods of changing economic situation is combining economic indicators into a system in terms of their economic contents and the nature of statistic interrelation with inflation. There economic indicators can be grouped though certain elements in them can overlap. Among these indicators there may be distinguished such of them which characterise economy and economic growth, population and employment, state fiscal policy, consumption, investments industry and commerce, external cash flows, exchange rates, money and interest rates and salaries and wages. While considering indicators of each group as separate elements of the system and comparing their dynamics with the dynamics of GDD changes we may single out such of them which are directly related to inflation level and those which are not. The indicators which tend to be the components of inflation belong to the first group. They are: part of the aggregate income expenses on consumer goods, privileges, donations and subsidies, etc. In this context it is possible to define one more criterion of their relation to inflation whether they change together with economic situation or with the positive or negative lag.

There are the moments which form the basis of the statistic prognosing indicators system which is used to prognoses the inflation level. So, the indicator approach gives an opportunity to take into consideration those critical moments in the tree and the influence of different by their nature indices on the common result.

It is also by means of other methods to change the data obtained from the experts according to their characteristics. Let i- expert give the approximate estimate $a^j = (a_1^j, ..., a_k^j)$ of the problem that might become one of the tops of the decision – making tree. If for example, the expert is not risk taking enough it is advisable to process the obtained estimate in such a way [Zagoruiko, 1999].

The maximum $a_j^i \max$ and the minimum $a_j^i \min$ values are calculated then the average value a_j^i is calculated. Any a_j^i is changed in such a way: $a_j^i = a_j^i - \frac{\left(a_j^i - \min\right)\cdot\left(\max - a_j^i\right)}{\left(\max - \min\right)^2}$.

This changer will change the type of the function essential quality: (Figure 2.)



Judging from this figure we may arrive to the conclusion that this kind of transformation makes the function more vividly expressed. This may be understood as increasing the degree of expert's risk taking.

Besides, in accordance with the task it is also possible to perform certain transformations in terms of increasing expert's realisticity, independence, etc.

The main advantages of such approach are:

- It allows to solve effectively the tasks of technological forecast doing the research of unstable processes and phenomena with insufficient description as far as they are based on the experts knowledge and do not depend on the information abut the behaviour of these phenomena in the past;
- It allows the structuring of colleting expert information dividing the subject area into certain segments which makes it possible to select more highly specialized and hence more skilled experts/

Conclusion

This system was used for prognosing the inflation index on 1. 01. 2005, the system was used in July, 2005, the inflation index obtained was equal 12.8%, the prognosed estimates of the official institutes and external experts were fluctuating between 8% to 20% and plus. The official statistic data of the ministry of Economy of Ukraine come up to 10,5% and the Institute for Economics and Prognosing suggested 12,5% - 13%. Taking into consideration the level of irregular economy the second figure seems much more realistic.

Bibliography

[Popov, 1988] E. V. Popov Expert systems. – M.: Nauka, 1988. 183p

[Popov, 1988] E. V. Popov, I. B. Fominykn, E. B. Kisel. Statistic and dynamic expert systems: Educational material – M.: Finance and statistics, 1996. 320p.

[Ivchenko, 1984] G. I. Ivchenko, I. Medvedev. Mathematical statistics/ M.: Publishing House Vysshaya Shkola, 1984. 248p.

[Seder, 1980] J. Seber. Linear regressive analysis. – M.: Mir, 1980. 456p.

[Voloshin, 1999] A. F. Voloshyn, M. B. Panchenko, E. P. Pikhotnik. The expert system of supporting the prognosing hrivnia exchange rate Artificial intellect. – 1999. - №1. Pp. 354–359.

[Ushakov, 1979] I. A. Ushakov the tasks of optimal reserving. – M.: Znaniye, 1979. 343p.

[Tsurkov, 1981] U. I. Tsurkov Decomposition in great demensions sums – M.: Science, 1981. 352p.

[Koseletskyy, 1979] Yu. P. Koseleletskyy. Psychological theory of making decisions. – M.: Progress, 1979. 504p.

[Gladun, 1987] V. P. Gladun Decision Planning. – Kiev: Naukova dumka, 1987. 167p.

[Zagoruiko, 1999] N. G. Zagoruiko. The applied methods of analyzing data and Knowledge. – Novosibirsk: Publ. House NM SB RAN.

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SYNERGETIC METHODS OF COMPLEXATION IN DECISION MAKING PROBLEMS

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Abstract. Synergetic methods of data complexation are proposed that make it possible to obtain a maximal amount of available information using a limited number of channels. Along with freedom degrees reducers, a mechanism of freedom degrees discriminators is proposed that enables all the channels to take part in the development of a cooperative decision in accordance with their informativeness in a current situation.

Keywords: Synergetics, data complexation, information channels, decision making

Introduction

In advanced information systems, information on the same object (a process or an event) is usually transmitted over *several* channels. The problem lies in determining the channels over which more significant data are transmitted. Depending on this, it is required to combine (integrate) obtained data to develop a cooperative decision on the state of an object.