PROGNOSTICATION OF PRODUCTION OF GOODS ON THE BASIS OF FUZZY SETS

Senior teacher Olesya TOTSKA
Volyn National University, Ukraine
Associate Professor Ph.D. Alexandru NEDELEA
"Stefan cel Mare" University of Suceava, Romania

Abstract:

In the article the authors forecast the issue of commodities by the enterprises of food retail industry of the Volyn region of Ukraine by the use of the fuzzy sets theory. The algorithm of such foresight consists in passing of the following stages: construction of dynamic rows of issue of ten basic food stuffs in the last few years; equipping them after growth; construction fuzzy interval for every commodity; determination optimistic estimation for every index. On the basis of obtained information the ge neral issue of food products is calculated also in next years. Determination of optimistic estimation is conducted after the original method developed by an author. Basic its idea consists in that an interval which answers the "golden" mean of dynamic row is most credible.

Keywords: fuzzy intervals, food retail industry, production of goods, optimistic estimation, pessimistic estimation.

JEL Classification: A12, D24

INTRODUCTION

As known, the logistic is the system instrument of management, which allow s to manage all material streams and supplies, and also financial and informative streams which accompany moving of materials and services on an enterprise. And one of functions of management is prognostication on the basis of which managers carry out plan ning of activity of the enterprises.

For prognostication of issue of commodities in any sphere, in particular in food retail industry, next to classic (least squares and exponential smoothing), infrequently -accessed (probabilistic) and it is comparative ne w (neurons networks) by methods it is expedient to apply also fuzzy numbers and to examine them as fuzzy information.

To the use of unclear measures and integrals for the decision of the poorly structured tasks devoted the scientific publications S. Arapov, I. Arapova, A. Matvijchuk, N. Mytsa, O. Rybytska, M. Siavavko, M. Solyanichenko, L. Zadeh, G. Zaichenko et al [1-7]. In particular, they are applied for estimation of internals of public service [1], decision -making close [2-3], previous analysis of issuer of securities [4, 177-186], prognostication of income of enterprises of playing business [5], prognostication of volume of realization of products by bread -making factories [6] and others like that. And basic work in the fuzzy sets theory considers the book of the American mathematician L. Zadeh published in 1965.

The purpose of writing of this article is prognostication of indexes of production of basic types of food products by the enterprises of the Volyn region of Ukraine with the help of fuzzy sets. For its realization it is needed to untie such tasks:

1) to build the dynamic rows of issue of commodities in the last few years (1990 and 1995 - 2005);
2) to put in order them after growth;
3) to build for every commodity fuzzy interval of production;
4) to define optimistic estimation for every index.

EXPOSITION OF BASIC MATERIAL

The fuzzy set A on the set X is the aggregate of pair of kind $(x, \mu_A(x))$, where $x \in X$, and μ_A it is function of $x \rightarrow [0, 1]$, which is named the function of belonging of fuz zy set of A. Value $\mu_A(x)$ for concrete x is considered the measure of belonging of this element to the fuzzy set of A [3, 490]. More frequent in all for forming of function of belonging choose trapezoids and triangles methods.

Above the fuzzy sets, as well as above ordinary, it is possible to conduct the varied operations, in particular addition (logical objection), association (logical copula "or"), crossing (logical copula of "³"), work, presentation to the degree, concentration (presentation to the degree 2), tension (presentation to the degree 0,5), protuberant combination [2, 39], difference, Dekartian work and others like that.

During the decision-making on the basis of fuzzy sets use both fuzzy numbers and fuzzy intervals.

An unclear number is the protuberant normalized fuzzy set A of the set of material numbers X=R, for which one number is only x_0 with $\mu(x_0)=1$, and $\mu(x)$ it is a lump-continuous function.

An unclear interval is the protuberant normalized fuzzy set A of the set of material numbers X=R, for which exists anymore as one number with $\mu(x)=1$, and $\mu(x)$ it is a lump-continuous function [7, 84].

As expedience of image of fuzzy sizes in the form of trapezoids consists in the comfort of mathematical calculations and considerable possibilities fro m presentation of functions [5, 181], we will give the indexes of production of basic food stuffs exactly in the form similar to the trapezoid fuzzy intervals by such four:

$$\text{commodity } i = (l_i; h_i; a_i; b_i),$$

where l_i is lower value of optimistic (with most mea sure of belonging) estimation of parameter i;

h_i - it is high value of optimistic estimation of parameter i;

a_i - it is difference between the low bounds of optimistic and pessimistic (with the least measure of belonging) estimations of parameter i;

b_i - it is difference between the high bounds of pessimistic and optimistic estimations of parameter i.

Thus there is a question, how on the basis of rows of dynamics of issue of food products to choose the high values of optimistic and pessimistic estimations l ower and. Pessimistic estimations we decided to depict as least and most value of production of food stuffs in Volyn region of Ukraine for analyzable period (1990 and 1995 -2005).

And for determination of optimistic interval we developed such method:
1) location of elements of sentinel row in the order of growth;
2) calculation of amount of elements of sentinel row of n;
3) determination of optimistic interval (with most measure of belonging):

) if n is not pair number and size $n/2$ – also not pair, central $n/2$ elements will be included in the sought interval after, thus the first from these elements will be his low bound, and last – overhead. The row of dynamics in this case will consist of such three parts: $n/4+n/2+n/4=n$. Number of lower element of optimistic interval – $(n/4+1)$, and overhead – $(n/4+n/2=3/4*n)$;

) if n is not pair number, and size $n/2$ it is odd, central $n/2+1$ elements will be included in the sought interval after, thus the first from these elements will be his low bound, and last – overhead. The row of dyna mics in this case will consist of such three parts: $(n/4-1/2)+(n/2+1)+(n/4-1/2)=n$. Number of lower element of optimistic interval – $((n/4-1/2)+1=n/4+1/2)$, and overhead – $((n/4-1/2)+(n/2+1)=3/4*n+1/2)$;

) if n is odd number, central $n/2-1/2$ elements will be included in the sought interval after, thus the first from these elements will be his low bound, and last – overhead. The row of dynamics in this case will consist of such three parts: $(n/4+1/4)+(n/2-1/2)+(n/4+1/4)=n$. Number of lower element of optimistic interval – $((n/4+1/4)+1=n/4+5/4)$, and overhead – $((n/4+1/4)+(n/2-1/2)=3/4*n-1/4)$.

The basic idea of this method consists in that most credible, to our opinion, there is an interval which answers the "golden" mean of dynamic row.

We will build the unclear int ervals of issue of food products in the Volyn region of Ukraine on the basis of information for 1995 -2005, but will take advantage also of information for 1990 year, as exactly then the indexes of production of food stuffs were maximal practically after al l kinds (see table no.1).

Table no. 1 Volumes of output of food stuffs in the Volyn region of Ukraine, thousand of tons

Year	Commo-dity 1	Commo-dity 2	Commo-dity 3	Commo-dity 4	Commo-dity 5	Commo-dity 6	Commo-dity 7	Commo-dity 8	Commo-dity 9	Commo-dity 10
1990	61,8	13,5	18,3	106,0	6,0	221,0	271,2	184,2	15,7	6,4
1995	23,1	4,7	6,3	22,9	2,0	81,5	136,4	59,5	4,3	2,1
1996	21,8	4,0	5,7	15,8	1,7	103,3	112,9	49,3	4,3	2,8
1997	20,9	4,7	4,7	9,4	1,5	67,9	84,7	44,5	4,6	1,8
1998	16,2	3,0	4,0	8,2	1,5	67,8	83,0	39,9	5,4	2,7
1999	12,5	3,1	4,8	9,7	1,3	76,4	84,1	41,5	7,1	6,2
2000	13,6	6,7	6,3	12,4	3,2	71,0	90,6	42,7	7,4	7,0
2001	13,2	12,1	7,1	27,8	5,9	70,5	70,3	45,4	6,0	4,5
2002	12,3	16,7	4,0	25,2	6,2	77,8	63,5	45,7	3,9	5,2
2003	16,1	13,8	4,0	32,8	6,4	223,2	74,8	49,2	8,2	10,4
2004	19,8	17,0	3,7	37,1	8,7	181,2	78,1	48,7	11,0	9,9
2005	22,2	13,9	4,3	40,9	8,5	198,7	72,3	46,6	8,5	10,2

It is concluded by an author on basis [8, 67; 9, 79; 10, 83; 11, 83]

In this table: commodity 1 is meat and meat wares of 1-st category;

commodity 2 are sausages wares;

commodity 3 is animal butter;

commodity 4 is products from a full-milk (in the count on milk);

commodity 5 are fat cheeses, including a brynza;

commodity 6 is the granulated sugar;

commodity 7 is flour;

commodity 8 is bread and bread wares;

commodity 9 are pastries wares;

commodity 10 are macaronis wares.

Farther we will dispose the elements of sentinels rows in the order of growth (see table 2).

Table no. 2 Production volumes of food stuffs in the order of gr owth, thousand of tons

Commo-dity 1	Commo-dity 2	Commo-dity 3	Commo-dity 4	Commo-dity 5	Commo-dity 6	Commo-dity 7	Commo-dity 8	Commo-dity 9	Commo-dity 10
12,3	3,0	3,7	8,2	1,3	67,8	63,5	39,9	3,9	1,8
12,5	3,1	4,0	9,4	1,5	67,9	70,3	41,5	4,3	2,1
13,2	4,0	4,0	9,7	1,5	70,5	72,3	42,7	4,3	2,7
13,6	4,7	4,0	12,4	1,7	71,0	74,8	44,5	4,6	2,8
16,1	4,7	4,3	15,8	2,0	76,4	78,1	45,4	5,4	4,5
16,2	6,7	4,7	22,9	3,2	77,8	83,0	45,7	6,0	5,2
19,8	12,1	4,8	25,2	5,9	81,5	84,1	46,6	7,1	6,2
20,9	13,5	5,7	27,8	6,0	103,3	84,7	48,7	7,4	6,4
21,8	13,8	6,3	32,8	6,2	181,2	90,6	49,2	8,2	7,0
22,2	13,9	6,3	37,1	6,4	198,7	112,9	49,3	8,5	9,9
23,1	16,7	7,1	40,9	8,5	221,0	136,4	59,5	11,0	10,2
61,8	17,0	18,3	106,0	8,7	223,2	271,2	184,2	15,7	10,4

We will represent the fuzzy intervals of volumes of output of basic food commodities by such four:

commodity 1=(13,6; 21,8; 13,6-12,3; 61,8-21,8)=(13,6; 21,8; 1,3; 40);

commodity 2=(4,7; 13,8; 4,7-3; 17-13,8)=(4,7; 13,8; 1,7; 3,2);

commodity 3=(4; 6,3; 4-3,7; 18,3-6,3)=(4; 6,3; 0,3; 12);

commodity 4=(12,4; 32,8; 12,4-8,2; 106-32,8)=(12,4; 32,8; 4,2; 73,2);

commodity 5=(1,7; 6,2; 1,7-1,3; 8,7-6,2)=(1,7; 6,2; 0,4; 2,5);
commodity 6=(71; 181,2; 71-67,8; 223,2-181,2)=(71; 181,2; 3,2; 42);
commodity 7=(74,8; 90,6; 74,8-63,5; 271,2-90,6)=(74,8; 90,6; 11,3; 180,6);
commodity 8=(44,5; 49,2; 44,5-39,9; 184,2-49,2)=(44,5; 49,2; 4,6; 135);
commodity 9=(4,6; 8,2; 4,6-3,9; 15,7-8,2)=(4,6; 8,2; 0,7; 7,5);
commodity 10=(2,8; 7; 2,8-1,8; 10,4-7)=(2,8; 7; 1; 3,4).

And the sum of common production of food stuffs will be association of previous ten four:

$$S=(13,6; 21,8; 1,3; 40) \oplus \oplus (4,7; 13,8; 1,7; 3,2) \oplus (4; 6,3; 0,3; 12) \oplus (12,4; 32,8; 4,2; 73,2) \oplus$$
$$\oplus (1,7; 6,2; 0,4; 2,5) \oplus (71; 181,2; 3,2; 42) \oplus \oplus (74,8; 90,6; 11,3; 180,6) \oplus \oplus (44,5; 49,2; 4,6; 135) \oplus$$
$$\oplus (4,6; 8,2; 0,7; 7,5) \oplus (2,8; 7; 1; 3,4)=(13,6+4,7+4+12,4+1,7+71+74,8+44,5+4,6+2,8;$$
$$21,8+13,8+6,3+32,8+6,2+181,2+$$
$$+90,6+49,2+8,2+7; 1,3+1,7+0,3+4,2+0,4+3,2+11,3+4,6+0,7+1;$$
$$40+3,2+12+73,2+2,5+42+180,6+135+7,5+3,4)=$$
$$=(234,1; 417,1; 28,7; 499,4).$$

We will represent the graphically got unclear interval on fig. 1.
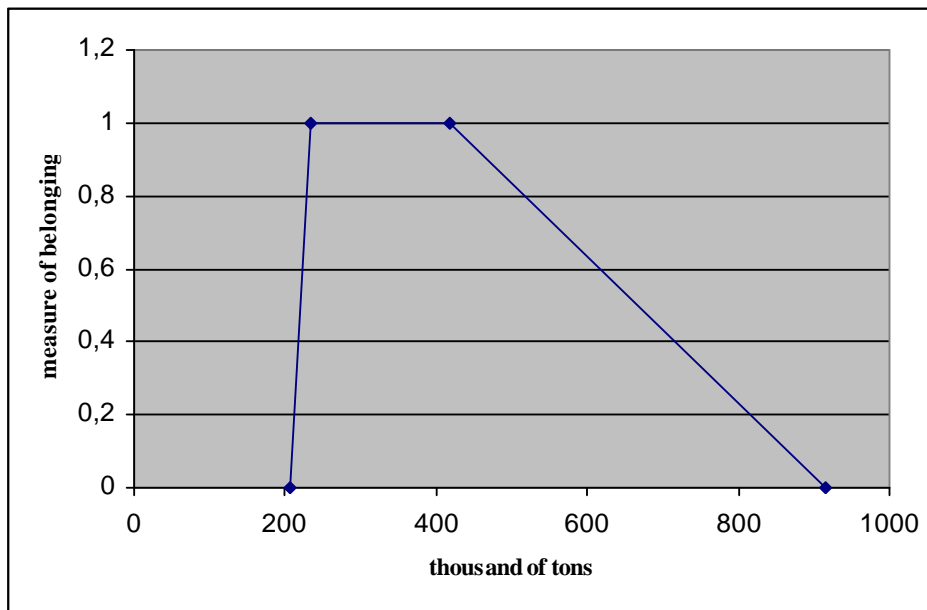

Figure no. 1. Fuzzy interval of common production

From him evidently, that in next years the general issue of food products is most credible in scopes from 234,1 to 417,1 thousand of tons. In any case he can not go down below 205,4 thousands of tons (234,1-28,7) or to rise higher 916,5 thousands of tons (417,1+499,4).

For acceleration of calculations to our opinion it is expedient to project in any algorithmic language program which will automatize construction of similar to the trapezoid fuzzy intervals for dynamic rows.

CONCLUSIONS

As a result of the conducted analysis it is possible to draw such conclusions:

1) in next years production is most credible from 13,6 to 21,8 thousand of tons meat; from 4,7 to 13,8 thousand of tons sausages wares; from 4 to 6,3 thousand of tons animal butter; from 12,4 to 32,8 thousand of tons products from a full-milk (in the count on milk); from 1,7 to 6,2 thousand of tons fat cheeses, including a brynza; from 71 to 181,2 thousand of tons sand of sugar; from 74,8 to 90,6 thousand of tons flour; from 44,5 to 49,2 thousand of tons bread and bread wares; from 4,6 to 8,2 thousand of tons pastries wares; from 2,8 to 7,1 thousand of tons macaronis wares;

2) the general issue of basic food stuffs in next years will be in scopes from 234,1 to 417,1 thousand of tons;

3) developed by an author the method of determination of optimistic estimations of unclear intervals can be used in the different spheres of production, as at t he level of one enterprise so industries on the whole.

BIBLIOGRAPHY

1. Arapova I., Arapov S., Solyanichenko M. Public service quality evaluation by methods of fuzzy logic. Conception // Modern state and problems of innovative development of the state: Materials of international conference. Theses of lectures. (October, 6 -7, 2006).– Lutsk: Vezha, 2006.– p. 316-318.
2. Matvijchuk A. Analyze and management by the economic risk. – Kyiv: Center of educational literature, 2005.– 224 p.
3. Mytsa N. Prognostication of income of enterprises of playing business on the basis of fuzzy logic // Sciences. messages of Ostrogian academy. Series "Economy". – Ostrog: Ostrogian academy.– 2003.–   5.– p. 179-184.
4. Siavavko M. Use of fuzzy sets and integrals for the decision of the poorly structured tasks of economy // Announcer of the Lviv university. Series economic. – Lviv.– 2007.–   37 (2).– p. 46-58.
5. Siavavko M., Rybytska O. Design on conditions of vagueness. – Lviv: Ukrainian technologies, 2000.– 320 p.
6. Statistical annual Volyn-2003.– Lutsk: Main administration of statistics in Volyn region, 2004.– 560 p.
7. Statistical annual Volyn-2004.– Lutsk: Main administration of statistics in Volyn region, 2005.– 558 p.
8. Statistical annual Volyn-2005.– Lutsk: Main administration of statistics in Volyn region, 2006.– 584 p.
9. Volyn for years independence: Statistical collection. Anniversary edition. – Lutsk: Nadstyr'ja, 2001.– 408 p.
10. Zadeh L. Concept linguistic variable and his application to the decision -making close: Transl. from English.– Moscow: World, 1976.– 168 p.
11. Zaichenko G. Operations analysis.– 3-th publ.– Kyiv: Vyshcha shkola, 1988.– 552 p.