DETERMINATION OF RESTRICTIVE ECONOMIC FUNCTIONS AND EVOLUTION TENDENCIES OF TECHNICAL INDICATORS FROM AGRICULTURE IN THE NORTH-WEST REGION

DRAGOMIR VILI[1], DRAGOMIR NELA[2]

Abstract

In the knowledge process we have a variety of methods, ways, means enabling the identification, scientific determination of the phenomena from nature and society. A current widely used model is modeling the investigated phenomena. Research methods used in order to elucidate economic processes and evolution trends of plant and animal systems in territorial profile were: ***regression function method*** *- which statistically expresses how characteristic result y changes due to changes of characteristic x factor for in the case that the variance of y would only be based on the variation of x;* ***the method of least squares*** *- through which is obtained a solution of an over determined system of equations, which has more equations than unknowns. The least square means that the obtained solution minimizes the sum of squares of deviations from the values equations. Indicators calculated very useful in assessing the development prospects of the North-West region, were based on two assumptions: a) the development trend will remain the same, in this case putting only the problem is if development rate of the phenomena will be the same or changes to the new conditions; b) assumes that changes the trend and development rate*

Key words: *modeling, assumptions, data series*

INTRODUCTION

In statistics theory and practice more frequently appear the question of using statistical data series to determine the trend of development of phenomena and phases that follows. In the social and economic phenomena usually act statistical laws, which manifest as a trend that can be observed only for a big period of time. This means that the development trend of the phenomenon within certain limits of probability can be known and be used in future calculations.

To highlight the law which is manifested in the relationship between phenomena is necessary for it to be expressed as an analytical function corresponding to the relation between factorial and the results characteristics. This function is known as regression function and its graphic representation is done by regression line (curve). The correct choice of regression function that expresses the best the relationship between the two characteristics is crucial for determining the statistical correlation indicators.

Regression function expresses statistically the way that the results characteristic y changes due to changes characteristic factor x in the case that y variation would be only based on the variation of x. For this, it's necessary the other characteristic to be considered as not essential and with constant action on all units on which it's measures the ratio of interdependence and whose influence to be summed up in a single average value character.

Regression equation, represent the trend of achieving the correlation between the two variables x and y. the values of regression equations are calculated for all units observed on individual value of the variable x. So in this interdependence report is considered that the variation of characteristic y is only for varying x factor; other factors being considered with constant action and expressed as average size through parameters a and b.

In order to determine the values of regression equations it's necessary to establish the values of the two parameters a and b which expresses the relationship between the two variables. In the case that the values of characteristic y depend into a greater degree of individual values of the variable x, then between empirical values of y obtained by observation and Y values are obtained

[1] PhD. Scientific Researcher gr. III; Institute for Agrarian Economy and Rural Development– AASS; dragomirw@yahoo.com

[2] PhD, University of Agronomical Sciences and Veterinary Medicine Bucharest, Faculty of Animal Sciences, 59 Marasti, Sector 1, Bucharest, Romania, carageanela@yahoo.com

very small deviations. In this way the regression equations calculated are becoming a way of assessing the achievement of connections between the two variables. If deviations between empirical y values and the values of regression equations Y - theoretical values - are minimal, then means that the variation of characteristic y depends to a high degree of variation of chosen factorial characteristic. As these deviations may occur in one way or another, they are squared and because of this, the method of verifying this condition is also called the method of small squares.

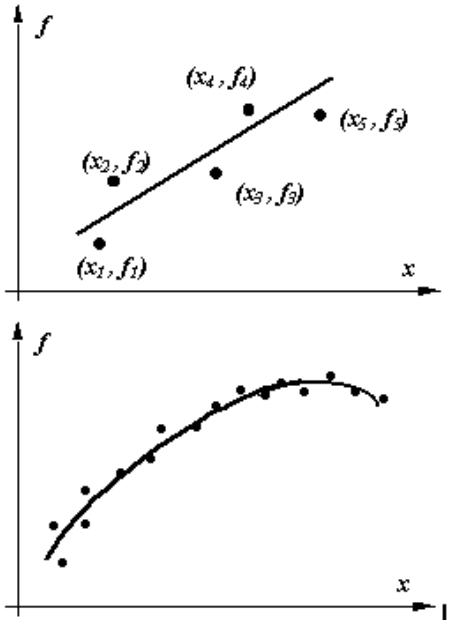
MATERIAL AND METHODS

The purpose of this paper is the applying of the method of small squares approximation of a data series, calculating in this way the regression equation for a period of n years.

Most general formulation of the approximation problem requires that, starting from a function f(x) defined on a domain, to determine another function F(x), with a more simple form, which to approximate as well the function f(x) over the entire domain of definition.

Method of approximation by interpolation determines approximate the function F(x) imposing the condition that to coincides with the approximated function f(x) in all nodes of interpolation. Thus, the curve associated to function F(x) is forced to follow a trajectory imposed by the position of interpolation nodes.

But this criteria is hardly effective in the case of a large number of nodes of interpolation, because the determination of polynomial coefficient approximation require a large amount of calculation and there is the risk of oscillations appearing between nodes. In addition, if the values shown itself to function f(x) are not accurate, resulting e.g. from measurements with errors, it makes no sense to impose their replication by function approximation. In these situations it is convenient to apply a method to determine the "best" function to minimize the standard deviation between f(x) and F(x) in all points of the original function value is known.



Approximate by the criteria of small squares determines a function F(x) which didn’t pass through the points of definition, but between them, so that the sum of squares of deviations between the function F(x) and f(x) in these points is minimized.

To formulate this criteria, is considered the function in s table form, with n measurements (x1, x2, x3, xnk) affected by inherent errors and aims to determine an approximation function F(x), defined such as that the sum of squared deviations in points to be minimal:

$\sum(xi-Xi)^2=Minim$

Work assumptions

For extrapolation of statistical data for the next stage can be used independent statistical series whose interpretation is based on time and interdependent statistical series whose development trend in the next stage of evolution depends on the factorial characteristic.

In the second case assumptions that are put into establishing the foresight calculations have in sight in the first way the knowing the development trend of phenomena and of the form in which the dynamic correlation links are made.

So, in the first assumption we can appreciate that the development trend will remain the same in this case is just a question if keeps the same development rate or it's changing to the new conditions.

A second hypothesis assumed that would change the evolution trend but also the development rate. Obviously in this case it must still exist in the statistical series - during the period which expired - a trend change of the form of evolution of phenomena that suggest the changing of development trend.

In the predicting model that we will present it is necessary to consider the solving of the following problems:

a. checking the shape and direction of a relationship between factorial variable (t) and resulted variable f (t);

b. Finding the theoretical values of characteristic (t) during the period in which the extrapolation is made. For this it is necessary to analyze the characteristic (t) independent from characteristic f(t);

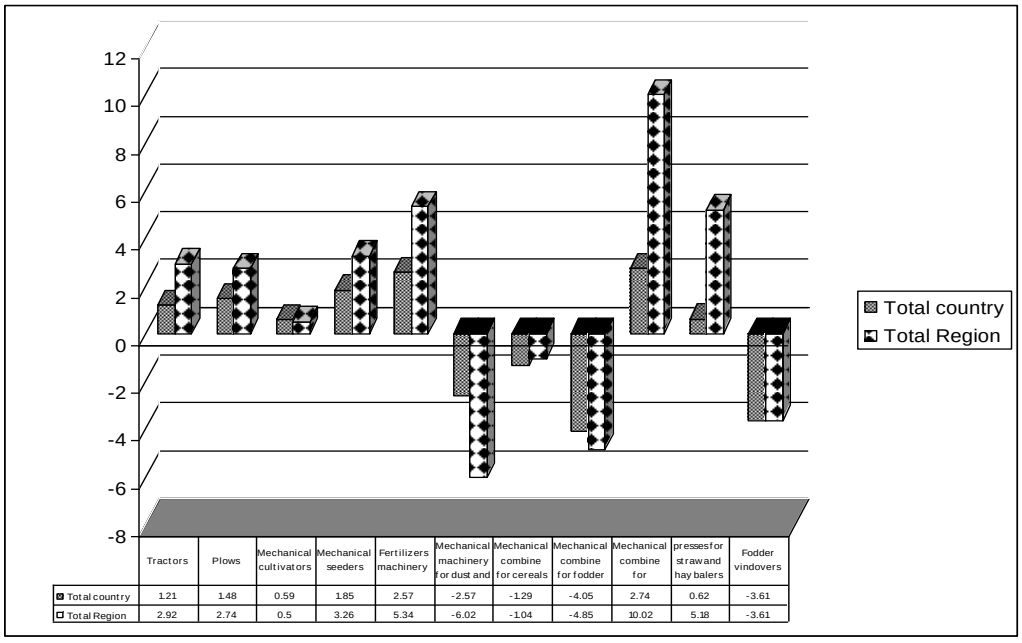
c. Finding theoretical values of resulted characteristic f(t) according to the new values of the factorial characteristic t.

Knowing the average growth rates can be calculated some very useful indicators in assessing the prospects of developing regions.

RESULTS AND DISCUSSIONS

Here are some data regarding the annual growth rate and the trend for some of the technical agricultural indicators over a period of 11 years.

1. Endowment of agriculture

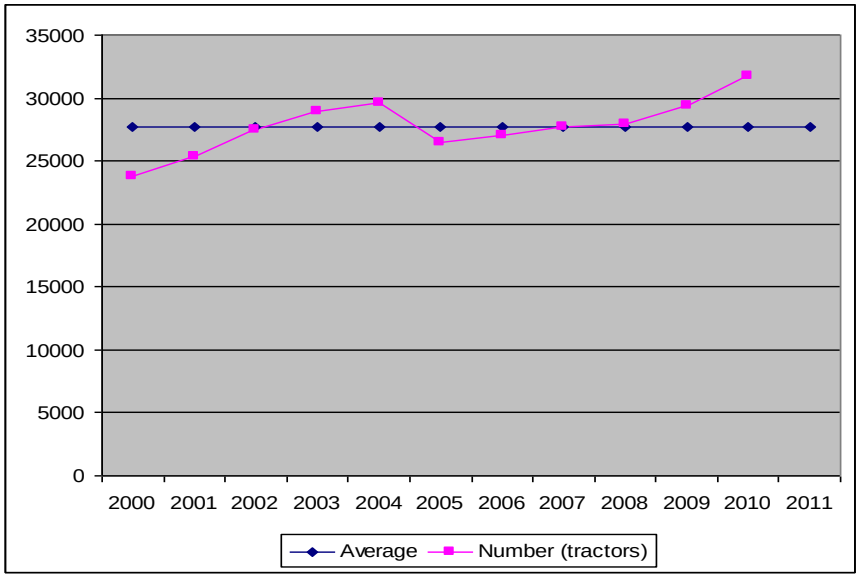


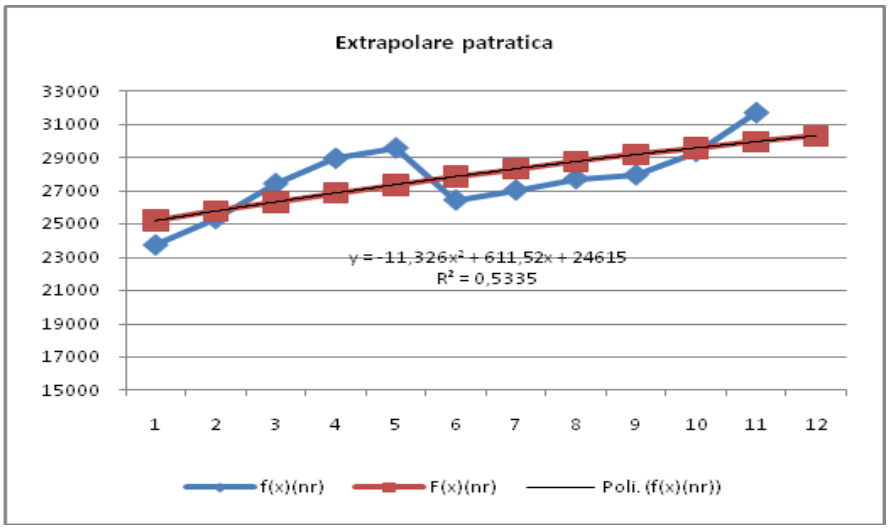
	Tractors	Plows	Mechanical cultivators	Mechanical seeders	Fertilizers machinery	Mechanical machinery for dust and	Mechanical combine for cereals	Mechanical combine for fodder	Mechanical combine for	pressesfor straw and hay balers	Fodder vindovers
Total country	1.21	1.48	0.59	1.85	2.57	-2.57	-1.29	-4.05	2.74	0.62	-3.61
Total Region	2.92	2.74	0.5	3.26	5.34	-6.02	-1.04	-4.85	10.02	5.18	-3.61

Dynamic of tractors number and adjustment of the dynamic series by linear regression

A. Purpose: The method of small squares of approximation the data series aiming the number of tractors for the period 2000-2010.

B. The statement: is calculated the regression equation for a period of 11 years.





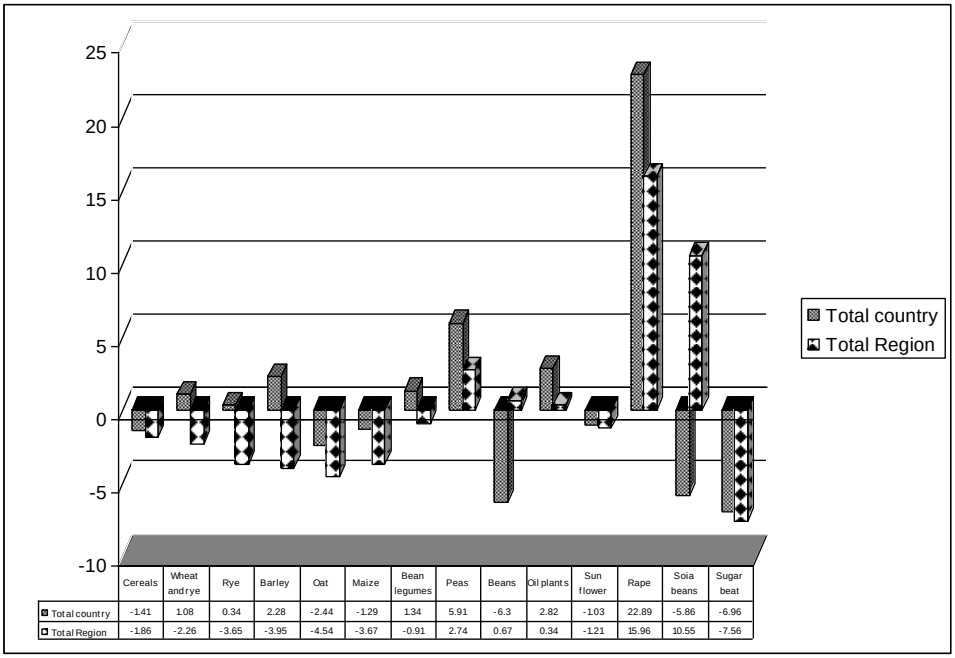
North-West region – tractors	Average growth rate 102,8%	Annual growth rate 2,92%

Table 1 Adjustment of dynamic series regarding the number of tractors series between 2000-2010 and 2011-2021 in North West Region

Adjustment of tractors number between 2000-2010				Extrapolated values for tractors number between 2011-2021					
				a) I fit keeps the same trend and the same development coefficient			b) If it keeps the same development trend but it changing the growth rate of the tractors number by 1,5 times		
t=T-1999	Years	Tractors numbers (f_t)(nr)	F*(Y_t) =a+bt+ct^2	t=T-2010	Years	F*(Y_t) =a+bt+ct^2	t=T-2010	Years	F*(Y_t) =a+bt+ct^2
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	2000	23770	25215	1	2011	33139	1	2011	37391
2	2001	25348	25793	2	2012	33717	2	2012	38247
3	2002	27450	26348	3	2013	34272	3	2013	39070
4	2003	28956	26880	4	2014	34804	4	2014	39860
5	2004	29577	27389	5	2015	35313	5	2015	40615
6	2005	26464	27876	6	2016	35800	6	2016	41337
7	2006	27061	28341	7	2017	36265	7	2017	42026
8	2007	27739	28782	8	2018	36706	8	2018	42681

9	2008	27972	29201	9	2019	37125	9	2019	43302
10	2009	29368	29598	10	2020	37522	10	2020	43890
11	2010	31694	29971	11	2021	37895	11	2021	44444
12	2011		30322	12	2022	38246	12	2022	44964

2. Cultivated area with the main crops between 2000-2010 in North West region



	Cereals	Wheat and rye	Rye	Barley	Oat	Maize	Bean legumes	Peas	Beans	Oil plants	Sun flower	Rape	Soia beans	Sugar beat
Total country	-1.41	1.08	0.34	2.28	-2.44	-1.29	1.34	5.91	-6.3	2.82	-1.03	22.89	-5.86	-6.96
Total Region	-1.86	-2.26	-3.65	-3.95	-4.54	-3.67	-0.91	2.74	0.67	0.34	-1.21	15.96	10.55	-7.56

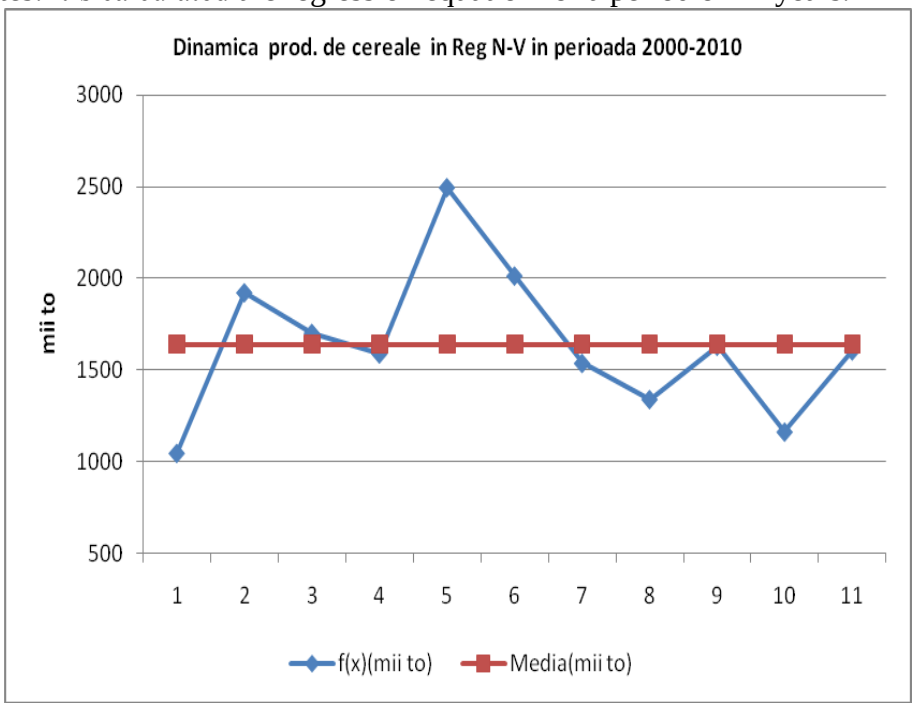
In the North-West region, in the analyzed period have been reduced the area with cereals for the legumes beans with 1,34% / year (pea bean 2.74% / year, beans 0.67% / year) and oil plants by 0.34% / year (rape 15.96% /year, soy bean 10.55% / year).

3. Total production for the main crops in North-West region between 2000-2010

Cereals production dynamic in the North-West region during 2000-2010 and dynamic series adjusting by quadratic regression.

A. Purpose: Applying the small squares method of data series approximation aimed at the production of cereals in the North-West region during 2000-2010.

B States: it's calculated the regression equation for a period of 11 years.



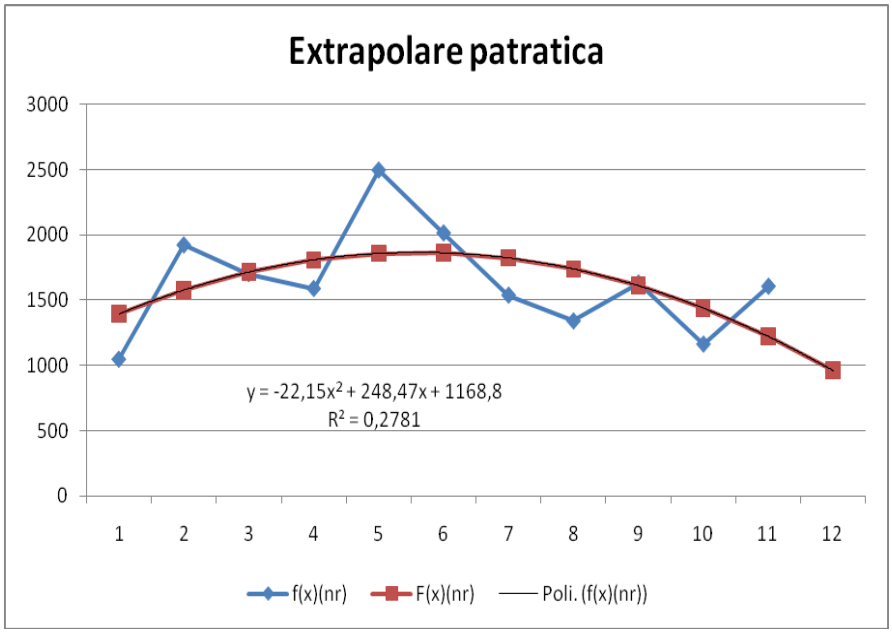


Table 2 Dynamic series adjustment regarding the cereal production between 2000-2010 and 2011-2021, in North-West region

Adjustment of cereal production between 2000-2010					Extrapolated values for cereal production between 2011-2021							
					a) If it keeps the same trend and the same development coefficient (b)				b) If it keeps the same development trend but it changing the growth rate of the total production by 1,5 times			
t=T-1999		Years	Cereal production (f_t)(thou to)	$F^*(Y_t)$ $=a+bt+ct^2$	t=T-2010		Years	$F^{*}(Y_t)$ $=a+bt+ct^2$	t=T-2010		Years	$F^*(Y_t)$ $=a+bt+ct^2$
0		1	2	3	4		5	6	7		8	9
1	1	2000	1048	1395	1	1	2011	1953	1	1	2011	2394
2	4	2001	1922	1577	2	4	2012	2135	2	4	2012	2707
3	9	2002	1702	1715	3	9	2013	2273	3	9	2013	2943
4	16	2003	1589	1808	4	16	2014	2366	4	16	2014	3103
5	25	2004	2494	1857	5	25	2015	2415	5	25	2015	3188
6	36	2005	2013	1862	6	36	2016	2420	6	36	2016	3196
7	49	2006	1538	1823	7	49	2017	2381	7	49	2017	3128
8	68	2007	1341	1739	8	68	2018	2297	8	68	2018	2984
9	81	2008	1631	1611	9	81	2019	2169	9	81	2019	2764
10	100	2009	1164	1439	10	100	2020	1997	10	100	2020	2469
11	110	2010	1606	1222	11	110	2021	1780	11	110	2021	2097
12	144	2011		961	12	144	2022	1519	12	144	2022	1649

$F^*(Y_{2000\text{-}2010}) = 1168{,}8+248{,}47t-22{,}15t^2$

$F^*(Y_{2011\text{-}2020})$ a $= 1168{,}8+(1606-1048) = 1727$; $F(Y_{2011\text{-}2020}) = 1727+248{,}47t-22{,}15t^2$

$F^*(Y_{2011\text{-}2020})$ a'$= 1168{,}8+(1606-1048)*1{,}5 = 2005{,}8+248{,}47*1{,}72\ t -22{,}15*1{,}72t^2$; $F(Y_{2011\text{-}2020}) = 2005{,}8+426{,}4t-38{,}0t^2$

Cereal production between 2000-2010 and 2011-2020 in North-West region

Years	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
Cereal cultivated area (thou ha)	554	604	559	559	633	593	490	541	462	430	459
Total production (thou to)	1048	1922	1702	1589	2494	2013	1538	1341	1631	1164	1606
Cereals yields (kg/ha)	1892	3184	3047	2842	3943	3397	3139	2480	3529	2704	3498
Years	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
Cereal cultivated area (thou ha)	554	604	559	559	633	593	490	541	462	430	459
Total production (thou to)	2394	2707	2943	3103	3188	3196	3128	2984	2764	2469	2097
Cereals yields (kg/ha)	4323	4483	5268	5551	5040	5394	6383	5519	5981	5735	4568

CONCLUSIONS

Extrapolating data from the period 2000-2010 was conducted on two assumptions:

a) If it keeps the same trend and the same growth coefficient;

b) If they keep the same development trend but changes the growth rate by 1, 5 times.

The number of tractors analyzed during 2000-2011 grew compared to 2000 range between 7% and 33%. Extrapolated value in 2000 is 26% higher compared with 2011, ie 7924 units in the first case, and 17%, ie 6718 units in the case of the second hypotheses.

Regarding the cereals production, during the same period, 2000-2011 it varied greatly from year to year, being influenced by two aspects: one climatic and other financial. However, in dynamic from the year 2000, production showed higher values that ranged between 11% and 138%, the highest value was recorded in 2004.

Extrapolated values in the two hypotheses are 44% higher for the first hypotheses and by 57% in the case of the two hypotheses.

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