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THE UTILIZATION OF THE STATISTICAL TECHNIQUES IN PROJECTING GROSS VALUE ADDED IN THE AGRICULTURE, HUNTING AND FORESTRY; FISHERY AND PISCICULTURE SECTOR

ABSTRACT

As a material production branch, agriculture features certain particularities that are essentially different from those of the other sectors of national economy, namely: active role in land operation, which increases the capacity of obtaining high yields by rational land use and use of technical advances; blending the technological process with that of natural (biological) multiplication of living organisms; strong action of weather factors upon the harvest; seasonality and diminution of working time due to the biological processes and non-coincidence with the production time. On the basis of statistical techniques, the present paper intends to reveal the evolution of the gross value added in the sector of agriculture, hunting and forestry; fishery and pisciculture, extrapolating the investigated characteristic.

Key words: Holt Winters method, seasonality, gross value added, exponential smoothing.

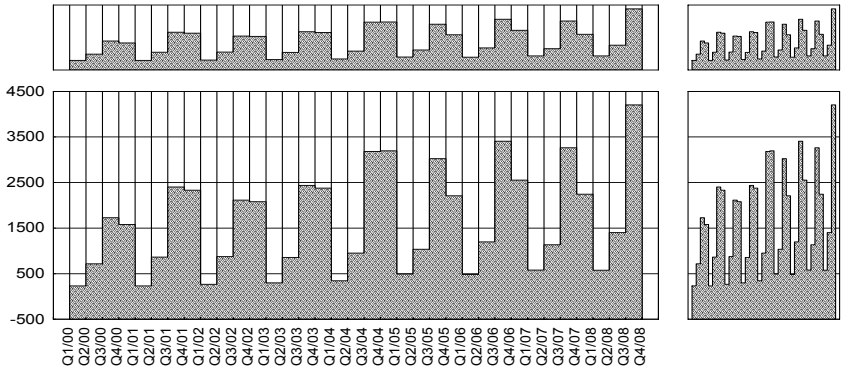
JEL Classification: C10; C53; Q19.

1. INTRODUCTION

The agricultural policy proposed by a certain social organization or government presupposes both the definition of main objectives, delimitation of instruments, establishing a strategy, as well as knowing the degree in which the economy, at its different levels, provides signals with regard to the extent in which it is getting closer to the established targets.

In this context, the economic accounts for agriculture, satellite accounts of the National Accounts, provide a systematic picture of agriculture, the economic activity results at the level of this branch being measured by means of the macroeconomic result indicator: gross value added. The gross value added of the sector: agriculture, hunting and forestry; fishery and pisciculture in the period 2000-2008, had a quarterly average of EUR 1668.6 million (9.82 percent of GDP) under the background of an increasingly great contribution of foreign investors attracted by the market potential, the real dynamics of the population incomes, maintaining accessible conditions of domestic and foreign credits, available financial resources under the programs SAPARD, ISPA. The absolute amplitude of the variation,

calculated as difference between the extreme values of the series, was EUR 3971.7 million, the minimum level being reached in the first quarter of the year 2001, under the background of unfavourable weather conditions and of the low investments in advanced technologies. By comparing the empirical frequencies with the theoretical ones calculated on the basis of the normal distribution probability law, the hypothesis on the normality tendency of the investigated series (χ_{calc}^2=4.65 < χ_{tab}^2=9.24) is confirmed. The variation coefficient level (67.08 percent) determined as a ratio of the standard deviation to the arithmetic mean reflects the absence of homogeneity. The series features moderate asymmetry (Skewness=0.38), the smoothing coefficient (Kurtosis = 1.996 < 3) indicating a platykurtic distribution. In order to find out whether the seasonality component acted at the level of the investigated variable, we determined the auto-correlation and partial auto-correlation coefficients by means of the program Statistics – "Arima model". The obtained results confirm the presence of seasonality.



Source: Own calculations on the basis of data from the Monthly Statistical Bulletins, National Institute of Statistics (2000–2009)

Figure 1. Quarterly evolution of the gross value added of the sector: agriculture, hunting and forestry; fishery and pisciculture in the period 2000–2008 (EUR million).

Series: VABA	
Sample: 2000Q1 2008Q4	
Observations: 36	
Distribution: Normal	
Number of categories:9	
χ^2=4,65, df =2, p=0,0975	
Kolmog.- Sm. d=0,12	
Mean	1668.575
Median	1492.150
Maximum	4203.100
Minimum	231.400
Std. Dev.	1119.236
Skewness	0.383296
Kurtosis	1.995745
Jarque-Bera	2.394285
Probability	0.302056

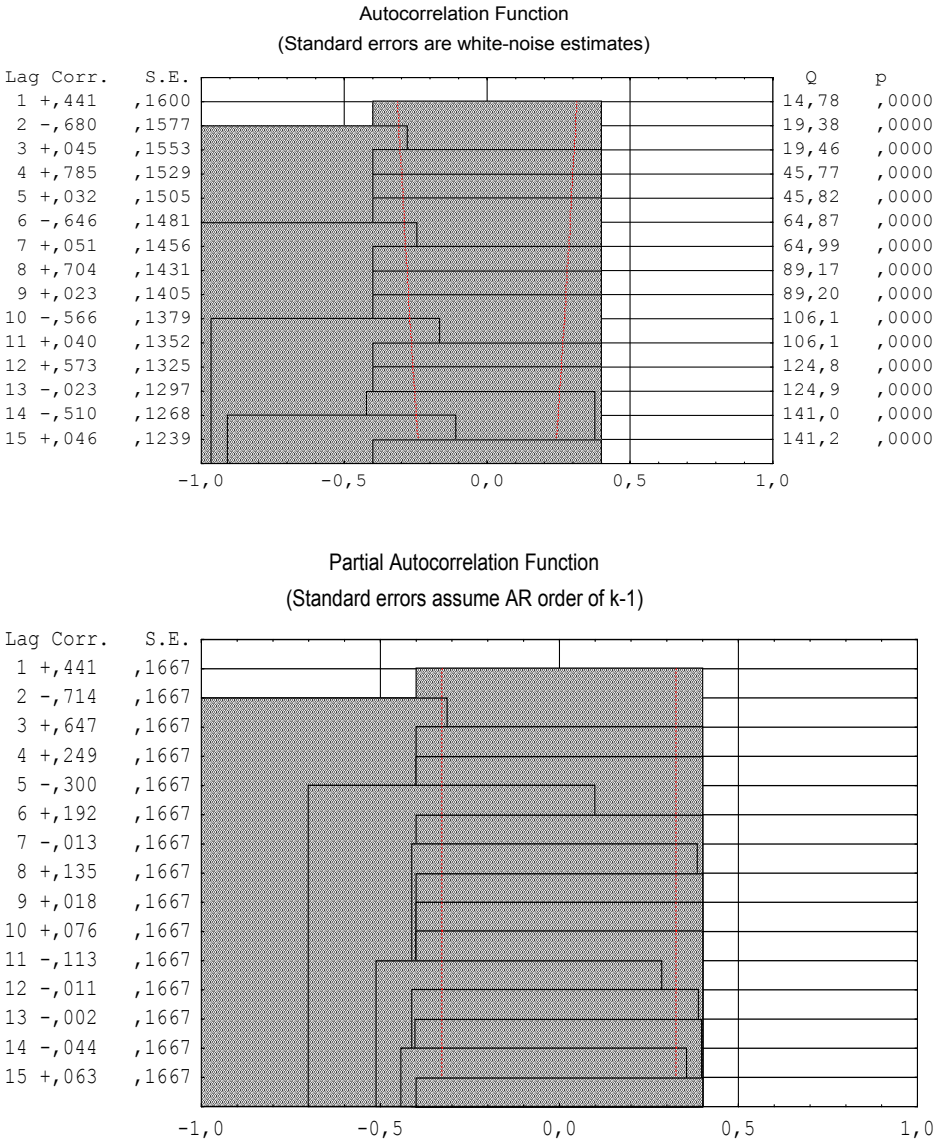


Figure 2. The Corel gram of the gross value added evolution in the sector: agriculture, hunting and forestry; fishery and pisciculture

2. METHODOLOGY OF THE GROSS VALUE ADDED FORECASTING SYSTEM

2.1. Model structure specification

In order to investigate the gross value added variation of the sector: agriculture, hunting and forestry; fishery and pisciculture, we used the Holt Winters method (1960) that is applied when the tendency and seasonality are random; the exponential smoothing can be used in order to obtain a combined forecasting.

On the basis of the H-W method, the smoothing of "a" mean, "b" tendency and "s" seasonality can be obtained, through the intermediary of the smoothing constants: í € [0.1], ő € [0.1] and ђ € [0.1] respectively.

The following equations are obtained for smoothing:

– the observations:

$$a_t=í(y_t/s_{t-p})+(1-í)(a_{t-1}+b_{t-1})$$

– the trend:

$$b_t = ő\,(a_t - a_{t-1})+(1-ő)b_{t-1}$$

– the seasonality:

$$s_t = ђ\,(y_t / a_t)+(1-í)s_{t-p}$$

The extrapolation for a time horizon h is determined by the relations:

$$\hat{y}_{t+h} = (a_t + hb_t)\cdot s_{t-p} + h,\ \ 1 \le h \le p;$$

$$\hat{y}_{t+h} = (a_t + hb_t)\cdot s_{t-2p+h} + h,\ \ p+1 \le h \le 2p,$$

with: $\hat{y}_{t+h} = y_{t,t+h}{}^{p}$, where: a_t – smoothed mean of the observations of the series; y_t – observed value of the series; s_t – smoothed seasonality quotient; p – periodicity of terms; b_t – levelled estimated tendency; í,ç,ő – smoothing constants.

An additional condition, related to seasonal factors, postulates the existence of seasonal movements compensation: $\sum_{i=1}^{p} S_i = p$. Initiations (for the first year, t=1,p): $a_p = \bar{y}$; $b_p = 0$ $\left(S_t = \frac{y_t}{\bar{y}}\right)$.

2.2. Results and discussions

By applying the calculation methodology on the statistical data referring to the evolution of the gross value added of the sector: agriculture, hunting and forestry; fishery and pisciculture in the period 2000–2008, the following results were obtained:

Method: Holt-Winters Multiplicative Seasonal			
Original Series: VABA			
Parameters:	IOTA(i)		0.8500
	UPSIL(ʊ)		0.0000
	DJE(ђ)		0.0000
Sum of Squared Residuals			1046363
Root Mean Squared Error			238.4186
End of Period Levels:	Mean		2270.403
	Trend		39.95937
	Seasonals:	T:1	0.242147
		T:2	0.623419
		T:3	1.706009
		T:4	1.428425

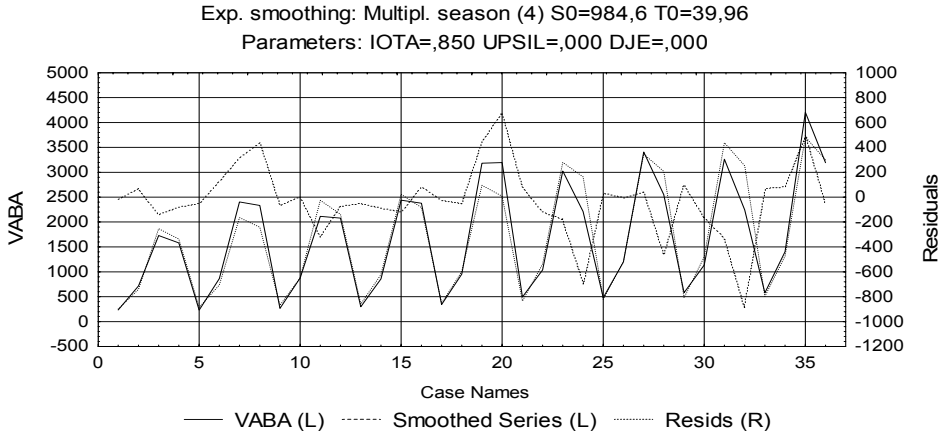


Figure 3. Components of time series.

The seasonal deviations in the 1st and 2nd quarters were negative (under the trend line), while in the 3rd and 4th quarters they were above the long-term trend, the factors that produced an oscillating evolution of the investigated characteristic being unequally distributed within the investigated interval.

On the supply side, the seasonality was introduced by: the insufficient supply of fresh fruit and vegetables (mainly in the cold season), increase of internal operators sensitivity to the world oil price movements, reflected by the decision to revise the fuel prices on a weekly basis, the corrections applied to the administered prices, mainly to the natural gas prices and to the prices of water supply, sewerage and sanitation services; implementing new stages in the process of getting in line with excise taxes of the European Union.

On the demand side, the statistical data on the consumption of foodstuffs reflect the dynamics acceleration in the 3rd and 4th quarters, mainly due to the increase of the population's real incomes and to inflation deceleration, the acceleration being influenced by the purchase of goods and services, by the self-consumption

and the procurements on the peasant market, by the individual services provided by the public administration and the non-profit organizations.

In the 4th term, the public sector consumption grew significantly, on the basis of capital and material costs, their value on December being almost double compared to the average of the previous months. The budgetary deficit coverage was based upon foreign funds, coming exclusively from the credits provided by different international organizations and from domestic funds – attracted by the RON denominated government securities, both at the physical and the legal entities.

The amplification of investment projects reflected in the investment rate increase for equipment procurement and for the new constructions was mainly generated by the industrial production increase and by a significant growth of crediting activities. The beginning on the 1st of April 2005, the reference year – of the period of registration by the authorities of the milk production on each farm, in order to establish the yearly production quota – resulted in a significant increase in the purchase of animals.

The foreign trade in agricultural products featured a high concentration level in the 2nd half of the year. In spite of this, under the conditions of the dynamics rate increase of the population's consumption and of the investments volume, the domestic production did not increase at the same rate, which led to imports consolidation on this market segment.

The model likelihood was checked up by using the variance analysis. As the theoretical value for a significance level ά = 0,05 si 1, respectively 34 degrees of freedom, taken over from Fischer distribution table is $F_{ά, k, T-k-1} = 4,08 < F_{calc}=97,812$ the null hypothesis is rejected, and the alternative hypothesis is accepted as true. The gross value added estimations for the sector agriculture, hunting and forestry; fishery and pisciculture present a standard error of EUR 220.659 million. As regards the determination of the model, this explains 74.2 percent of the investigated characteristic variation.

For the first and second quarter of the year 2009, the punctual estimations of the previewed levels are; $\hat{y}_{Q1/09}$=559.447 EUR million and $\hat{y}_{Q2/09}$=1465.236 EUR million, respectively while the calculated trust intervals for a significant threshold α=0,05 become:[86,269; 1032,625],[989,9887;1940,483].

3. CONCLUSIONS

Romania's agricultural policy has tried to get in line fast with the Common Agricultural Policy coordinates since the invitation of our country to begin the negotiations for the accession to the European Union, at the conference from Helsinki in December 1999. The agricultural sector development targeted to shift the structural problems and to increase the competitiveness of the Romanian products, having the following main objectives: development of a competitive

agricultural and forestry sector, based upon knowledge and private initiative; diminution of the number of people employed in agriculture, correlated with the establishment of economically viable holdings, through efforts to reduce the high fragmentation of the agricultural land area and of the number of small-sized farms; maintaining the quality and diversity of rural and forestry area in order to reach an equilibrium between the human activities and the conservation of natural resources.

A thorough analysis of the steps made so far in this direction, while retaining the positive results and including the measures that generated them in the agricultural legislation provisions reveals the continuity necessity.

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