ANALYSIS OF THE EVOLUTION OF THE PRODUCTION OF THE AGRICULTURAL BRANCH

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Abstract

Agriculture is one of the oldest branches of the Romanian economy which, in certain periods, represented the majority share of the results obtained by our country.

After 1989, agriculture, despite the fact that until this year it was a branch with very high production for exports, collapsed. The transition of agriculture in an unprecedented situation until that moment was due to Law no. 18 on agrarian reform, which was carried out without any logical analysis, as well as climatic conditions which, most of the time, are not favourable, especially in the absence of irrigation, fertilization, high agrotechnical works and others.

The purpose of this article is to highlight the fact that in 2020, a year marked by the pandemic and economic and financial crisis, overlapping and over a climatic year, with a very deep drought, obtained results below the possibilities available to the country ours.

The aim is to highlight the results achieved in 2020, to clearly establish the existing reserves for increasing agricultural production and, in particular, to suggest that in the next period, ie after 2020, left to chance, climate (nature), agriculture will offer even less, both for domestic consumption, now dominated by imports, but especially for exports where, practically, it does not even matter.

In the analysis of this situation we used the methods provided by statistics, respectively indicators, dynamic series, graphical representations, databases, all correlated to highlight the way in which this branch of the national economy has evolved.

Having a seasonal character, we also performed a spectral analysis, to highlight the evolutionary trend.

The current economic and financial crisis overlapped with the health crisis will have increasingly negative effects on the participation of this branch, as a resource of the national economy, in the formation and growth of gross domestic product.

Keywords: *agriculture, climatic conditions, indicators, variables, statistical methods and models.*

JEL classification: *C10, Q10*

Introduction

This article aims to highlight the way in which the production of the agricultural branch was achieved in 2020, a particularly delicate year in terms of the effects of the health and economic and financial crisis, but also of the climate on the development of agriculture, the vegetable branch, through very deep drought. .

The main data obtained in 2020 are compared, compared to 2019, highlighting the production reductions on each of the three sub-branches, respectively plant, animal and agricultural services, in the year of the pandemic crisis. It is found that in each of them and in total also, there were significant decreases.

Through graphical representations and some tables we managed to present the evolution of agriculture in 2020, with emphasis on identifying the evolutionary trend, the situation that will be in the next period taking into account, especially, the perspective as the effect of the drought in 2021 and which probably also due to climate change in the coming years, to have a delicate, increasingly negative effect on agricultural production.

Through a spectral analysis and a use of simple linear regression, the authors highlighted the fact that agriculture is an increasingly uncertain branch, despite the fact that there is a desire, there is a concern to subsidize, both domestically and by the Union. European Union, only that the non-correlation of the granting of subsidies with the needs demanded by agriculture does not lead to obtaining very special results.

In this respect, the data processed showed that agriculture is playing an increasingly unimportant role and has given way to imports of agri-food products, as domestic producers can no longer be supported by the European Union Directive which provides for the free movement of goods.

The article presents a series of data. From the processed materials and the use of statistical-econometric models (spectral analysis and simple linear regression) we were able to clearly deduce some trends that agriculture has in its evolution in the next period.

Literature review

A number of authors have turned their attention to the agricultural sector. Thus, Angelsen (2010) presented a series of notions related to agricultural production. Anghel, Anghelache and Panait (2017) analyzed the results obtained in agriculture in the European Union, as a whole and each Member State. Anghelache, Samson and Stoica (2020) studied the main elements of the European Union's strategy in the field of agriculture. Bezemer and Headey (2008) sought to identify measures that can be taken to develop agriculture. Fleurbaey (2009) tried to identify social welfare measures. Hansen et al. (2013) conducted a study that revealed the negative effect of forestry in some areas. Islam (2011) conducted a comparative study on the various incentives leading to the development of agriculture. Lowder, Bertini and Croppenstedt (2017) presented data and perspectives on the evolution of agriculture. Mogues, Fan and Benin (2015) studied the role of public investment in agriculture. Quamrul and Michalopoulos (2015) analysed how climate volatility influences agricultural activity. Swintona, Lupi, Robertson, Hamilton (2007) analysed the role of agricultural ecosystems for various benefits.

Methodology

In order to understand the content of the indicators used, we synthesized some clarifications from the methodology used by the National Institute of Statistics. Data are obtained from statistical sources comprising annual statistical surveys on cultivated area, harvested area, agricultural plant and animal production, prices of agricultural products and research on the economic activity of agricultural units with legal personality, the work Balances of main agricultural products from producers and administrative sources : Ministry of Agriculture and Rural Development - subsidies on agricultural products.

The production of the agricultural sector is determined according to the Eurostat methodology on Economic Accounts for Agriculture and includes: the value of all agricultural production (including the value of wine production obtained in agricultural establishments without industrial wineries) and the value of agricultural services performed by specialized units. This production does not include: the value of consumption of seed from own production for crops sown in autumn, the value of grapes used in wine production of agricultural units that do not have industrial wineries, the value of milk consumed by animals, the value of eggs incubated and losses to producers after harvest.

In addition, the production of the agricultural branch comprises the value of inseparable non-agricultural secondary activities and is diminished

by the value of milk transformed into derivatives (products obtained from milk processing) on the same farm.

Inseparable non-agricultural secondary activities are activities directly related to agricultural production that cannot be separated from the main agricultural activity in terms of costs (cheese production on the livestock farm).

The production of the agricultural branch is expressed in basic prices (producer prices plus subsidies per product and taxes per product) of each year.

The statistical survey on the number of bovine animals existing on 1 June 2021 was carried out in accordance with the provisions of Regulation (EC) no. Regulation (EC) No 1165/2008 of the European Parliament and of the Council of 19 November 2008 on statistics relating to livestock and meat products and repealing Council Directives 93/23 / EEC, 93/24 / EEC and 93/25 / EEC on statistics on to livestock and meat.

The statistical survey was conducted on the basis of a nationally representative sample and development regions, consisting of approximately 12000 agricultural holdings, of which 10685 agricultural holdings without legal personality.

Data, results and discussions

The value of agricultural production in 2020 decreased by 15.4% compared to the previous year. Also, vegetable production decreased by 21.5%, and animal production and agricultural services decreased by 1.2%. The structure of the value of the production of the agricultural branch is presented in table number 1.

Structure of the production value of the agricultural branch

Table 1

	2019	2020*)	Anul 2020 față de anul 2019**)
	- mii lei prețuri curente -		-%-
Total	89989063	81400417	84,6
Vegetală	62967346	52806967	78,5
Animală	25228818	26757020	98,8
Servicii agricole	1792899	1836430	98,8

Source: INS communiqué number 191/26 July 2021

The value structure of agricultural production in 2020 showed significant changes compared to the previous year. Thus, the share of vegetable production was 64.9% with 5.1 percentage points decreasing compared to

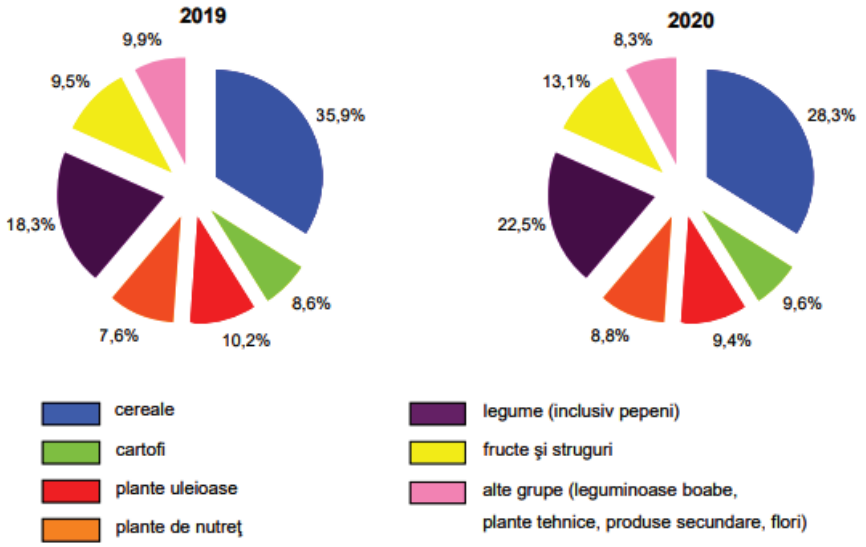
the previous year, animal production of 32.9% with 4.9 percentage points increasing compared to the previous year, and agricultural services had a share of 2.2%.

The structure of the value of vegetable production in 2020, by main crop groups, shows the following differences compared to the previous year: increases in the share of the value of production were recorded for vegetables, including melons (+ 4.2%), fruits and grapes (+3, 6%), fodder plants (+ 1.2%) and potatoes (+ 1.0%) and decreases in the share of production were recorded in cereals (-7.6%), other product groups (-1 , 6%) and oily plants (-0.8%).

The structure of the value of vegetable production on the main crop groups is presented in figure number 1.

Structure of the value of crop production by main crop groups

Figure 1

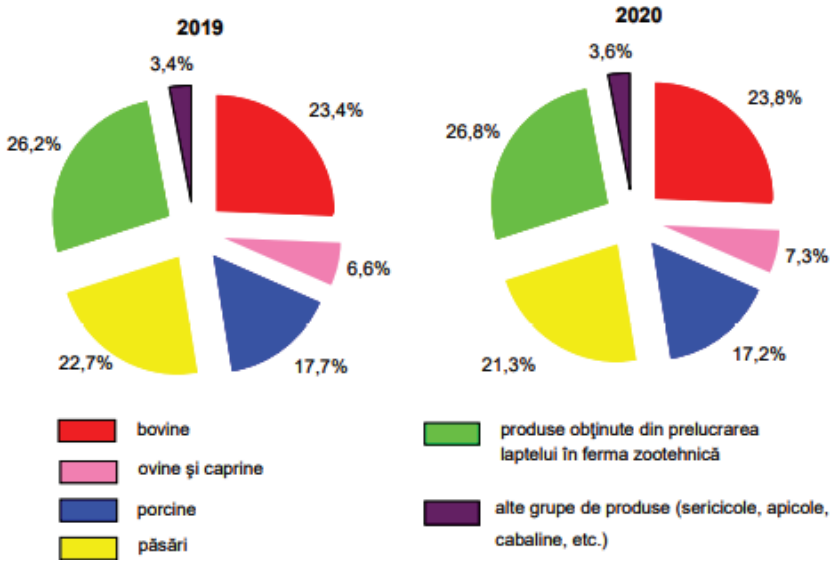


The structure of the value of animal production in 2020, by main species and product groups shows the following differences compared to the previous year: increases in the share of production were recorded in sheep and goats (+ 0.7%), products obtained from milk processing on the farm livestock (+ 0.6%), cattle (+ 0.4%) and other product groups (+ 0.2%) and decreases in the share of production were recorded in birds (-1.4%) and pigs (-0 ,5%).

Figure 2 shows the structure of the value of animal production by main species and product groups.

Structure of the value of animal production by main species and product groups

Figure 2



Analysing the provisional data regarding the existing herds of cattle on June 1, 2021, we find that they decreased by 2.6% in total and by 0.7% in the herd, compared to June 1, 2020. The data are structured in table number

Cattle and queen herds existing on 1 June 2021 compared to 1 June 2020

Table 2

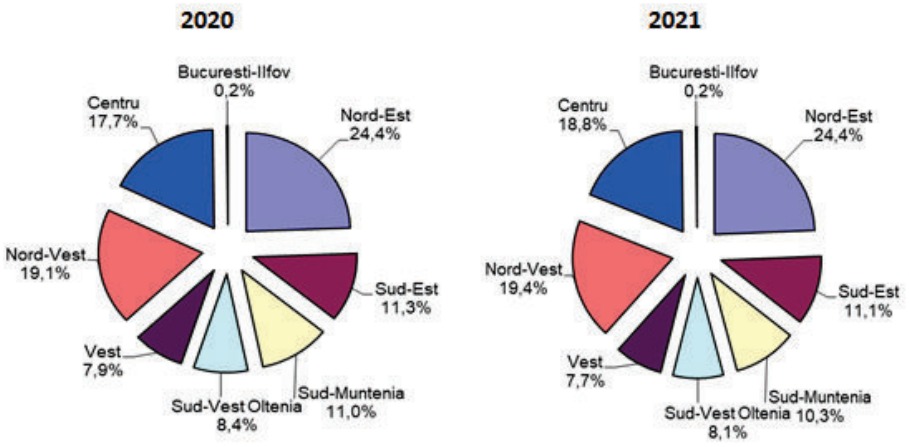
	2020	2021	2021 faţă de 2020 (±)
Cattle - total	1914602	1864577	-50025
of which: actually queen	1241059	1231868	-9191

Source: INS communiqué number 245/21 September 2021

Figure 3 shows the distribution by development regions of the existing cattle on 1 June.

Distribution by development regions of existing cattle on 1 June

Figure 3



Interpreting the data regarding the distribution by development regions, we find that the share of cattle existing on June 1, 2021, compared to the same date of 2020 increased in the Central (+ 1.1%) and North-West (+ 0.3%) regions.) and decreased in the regions of South Muntenia (-0.7%), South-West Oltenia (-0.3%), South-East (-0.2%) and West (-0.2%), and in the North-East and Bucharest-Ilfov regions remained constant.

The effects of the decrease in the production of the agricultural branch are reflected directly and unfortunately negatively in the results of the national economy materialized by the most complex indicator of results Gross Domestic Product. In this sense, we will further address a statistical-econometric analysis using simple linear regression in order to highlight the impact of the negative effects of declining agricultural production on the national economy. The data on the evolution of the two macroeconomic indicators are structured in table number 3.

Gross Domestic Product and agriculture in the period 2005-2020

Table 3

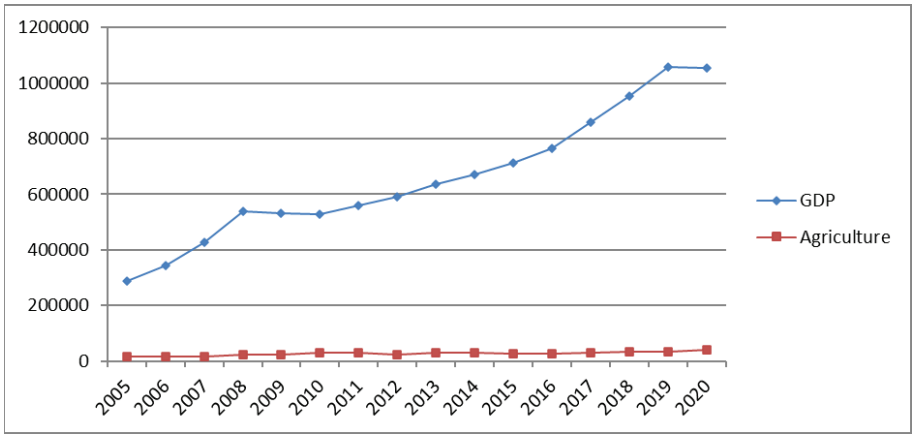
Year	GDP	Agriculture	Share of agriculture in GDP%
2005	286862	14702	**5,13**
2006	342763	17189	**5,01**
2007	425691	17493	**4,11**
2008	539835	24289	**4,50**
2009	530894	22316	**4,20**
2010	528515	28125	**5,32**
2011	558890	28857	**5,16**
2012	591799	23204	**3,92**
2013	634968	29879	**4,71**
2014	669704	29098	**4,34**
2015	711930	26925	**3,78**
2016	763653	27919	**3,66**
2017	857896	30044	**3,50**
2018	951729	35063	**3,68**
2019	1058190	33779	**3,19**
2020	1053881	40425	**3,84**

Source: http://statistici.insse.ro:8077/tempo-online. Data processed by the authors.

Graph number 1 shows the evolution of these two macroeconomic indicators under analysis, according to the data structured in table number 3.

Evolution of Gross Domestic Product and Agricultural Activity in 2005-2020

Chart 1

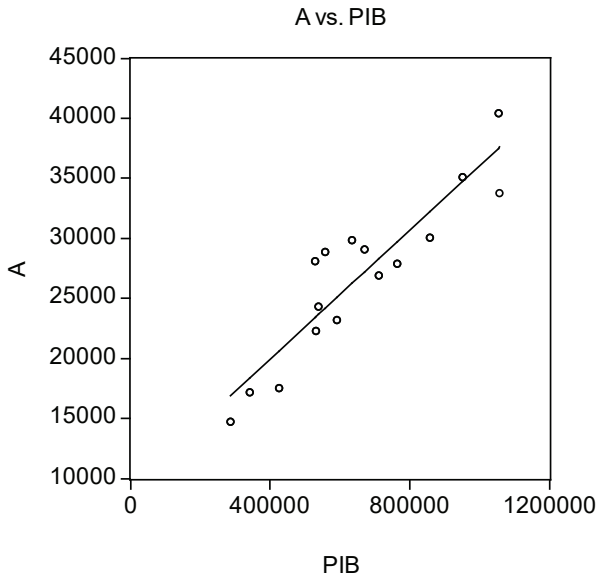


Interpreting the data presented graphically and structured in table number 3 we find that although in absolute terms agriculture has increased, they are insignificant in relation to the growth of Gross Domestic Product, which leads to the conclusion that economic development was based on other branches of the national economy. Also, if we look at the relative figures we find that the share of agriculture in the formation of Gross Domestic Product decreased from 5.13% in 2005 to 3.84% in 2020.

The interdependence between GDP and agriculture according to the data structured in table number 3 is presented in graph number 2.

Correlation between Gross Domestic Product and agriculture

Graph 2



Graph number 2 shows that the point cloud related to the values recorded by the two macroeconomic indicators studied in their evolution describe a straight line, which allows us to continue the study, making a statistical-econometric analysis, using a model of simple linear regression, which has the following form:

$$PIB = a + b \cdot A + \varepsilon \quad (1)$$

where: PIB (Gross Domestic Product) is the dependent variable;
A (Agriculture) is the independent variable;
a and b are the regression parameters;
ε represents the residual variable.

Both for estimating parameters a and b, respectively $\hat{a}$ and $\hat{b}$, using the least squares method, as well as to test the significance of the model we used the statistical-econometric analysis program EViews, and the results are presented in figure number 4.

Results of the GDP dependence analysis of Agriculture

Figure 4

Dependent Variable: PIB
Method: Least Squares
Sample: 2005 2020
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-177381.4	102093.0	-1.737449	0.1042
A	31.08568	3.694368	8.414343	0.0000
R-squared	0.834908	Mean dependent var		656700.0
Adjusted R-squared	0.823116	S.D. dependent var		232378.5
S.E. of regression	97732.85	Akaike info criterion		25.93433
Sum squared resid	1.34E+11	Schwarz criterion		26.03091
Log likelihood	-205.4747	F-statistic		70.80117
Durbin-Watson stat	1.560168	Prob(F-statistic)		0.000001

According to the results presented in figure number 4, we conclude that the model is a good one and can be used in estimating the evolution of GDP. This fact is confirmed both by the significantly different values of zero recorded by the estimated parameters, and by the statistical tests F-statistic and t-Statistic whose values are higher than the tabulated ones, and the estimation of the theoretical values of the dependent variable can be done using the relation:

$$\widehat{PIB} = -177381.4 + 31.08568 \cdot \hat{A} + \varepsilon \quad (2)$$

The high value of the free term coefficient confirms the fact that there are other factors that influence the evolution of the Gross Domestic Product in Romania, which were not taken into account.

Noting the oscillating evolution of the data contained in table number 3 of the agricultural branch in Romania, we will further analyse the seasonal nature of this activity and also the cyclicity and trend of evolution using spectral analysis. Thus, the analysed data are structured in table number 4.

Quarterly evolution of agricultural activity in the period 2005-2020

Table 4

Quarter	Agriculture	Quarter	Agriculture	Quarter	Agriculture
2005 QI	3500	2010 QIII	6837	2016 QI	6640
2005 QII	3535	2010 QIV	7762	2016 QII	6780
2005 QIII	3570	2011 QI	7431	2016 QIII	6983
2005 QIV	4097	2011 QII	7002	2016 QIV	7516
2006 QI	3906	2011 QIII	7282	2017 QI	7153
2006 QII	3984	2011 QIV	7142	2017 QII	7360
2006 QIII	4064	2012 QI	5686	2017 QIII	7515
2006 QIV	5235	2012 QII	5743	2017 QIV	8016
2007 QI	4165	2012 QIII	5970	2018 QI	7968
2007 QII	4248	2012 QIV	5805	2018 QII	8528
2007 QIII	4333	2013 QI	6790	2018 QIII	8615
2007 QIV	4747	2013 QII	7130	2018 QIV	9952
2008 QI	5900	2013 QIII	7484	2019 QI	8198
2008 QII	6012	2013 QIV	8475	2019 QII	8280
2008 QIII	6613	2014 QI	7273	2019 QIII	8360
2008 QIV	5764	2014 QII	7418	2019 QIV	8941
2009 QI	5469	2014 QIII	7567	2020 QI	9187
2009 QII	5496	2014 QIV	6840	2020 QII	9372
2009 QIII	5524	2015 QI	6410	2020 QIII	10839
2009 QIV	5827	2015 QII	6530	2020 QIV	11028
2010 QI	6696	2015 QIII	6670		
2010 QII	6830	2015 QIV	7315		

Source: Data processed by the authors.

Using the STATISTICA economic analysis program, the results in terms of oscillation frequency, Euler-Fourier coefficients, as well as the values of the periodogram and density are structured in the following table.

Results of the spectral analysis of the quarterly evolution of agricultural activity in the period 2005-2020

Table 5

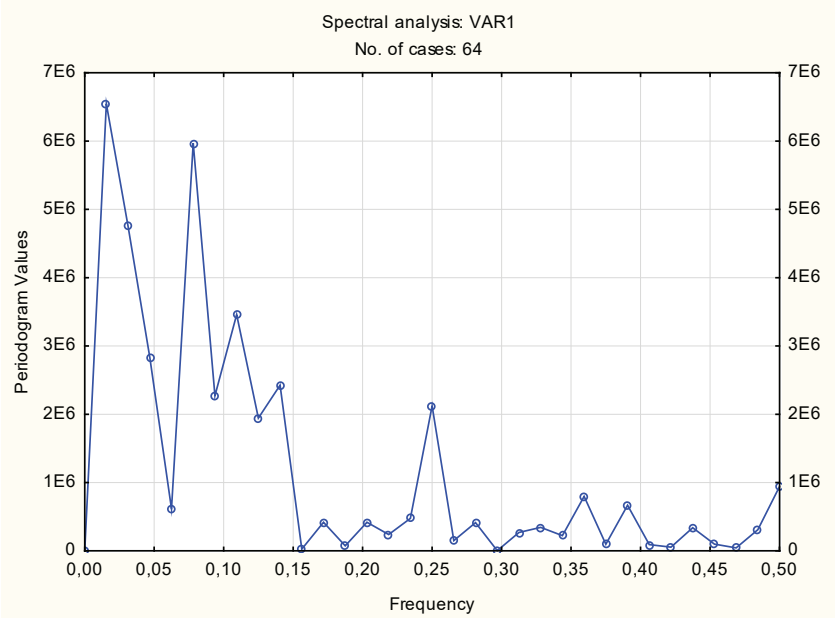
Spectral analysis: VAR1 (Spreadsheet1.sta) No. of cases: 64 Largest Periodog. values

	Frequency	Period	Cosine - Coeffs	Sine - Coeffs	Periodogram	Density
1	0,015625	64,00000	-102,770	440,432	6545346	4403066
5	0,078125	12,80000	276,666	-331,704	5970289	3586128
2	0,031250	32,00000	92,362	-374,208	4754002	4405441
7	0,109375	9,14286	-33,702	-327,052	3459159	2860594
3	0,046875	21,33333	54,741	-292,525	2834164	3006706
9	0,140625	7,11111	60,265	-268,657	2425878	1696302
6	0,093750	10,66667	72,507	256,386	2271715	3378771
16	0,250000	4,00000	-100,769	-237,019	2122645	1122049
8	0,125000	8,00000	-41,550	-242,995	1944727	2368923
32	0,500000	2,00000	-171,332	0,000	939347	572192

The following graph shows the values of the periodogram related to the oscillation frequency.

Representation of the periodogram by frequency

Graph 3



Interpreting the results presented in table number 5 and represented in graph number 3 we find that due to high amplitude values for periods close to or less than 12 months (in the case analysed at 64, 12 and 32 months), it

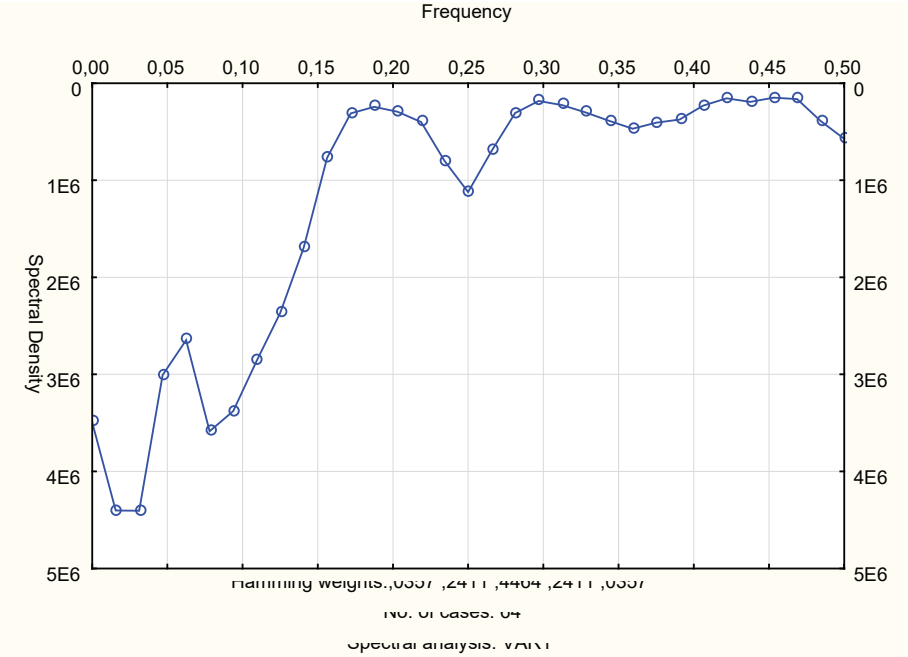
results that we cannot signal a strong influence of the seasonality of agricultural activity. Also, due to the large amplitudes recorded for periods longer than one year (64, 12 and 32 months), it is concluded that we can confirm the presence of cyclicality.

The existence of the trend is signalled by the high amplitude values (indicated by the periodogram in table number 5 column six) for frequencies lower than the unit value (table number 5 columns two).

Graph number 4 shows the evolution of the spectral density depending on the size of the frequency.

Representation of spectral density as a function of frequency

Graph 4



Interpreting the data presented in graph number 4 and in table number 5, we find that the maximum peaks recorded by the spectral density as a function of frequency are also at 64, 12 and 32 months, which is expected otherwise, because the values of spectral density are analogous to those of the periodogram by its very calculation formula, which represents the first derivative of the process spectrum function.

Conclusions

From this article, based on extensive research, and processing of existing data in the databases of the National Institute of Statistics and Eurostat, a number of conclusions can be drawn, especially practical. First of all, it is found that agriculture is suffering greatly as a result of the agro technics used which do not ensure the creation of conditions during the growing season for agricultural crops.

Also, the animal breeding units are not in the best conditions and as such the herd, for all animal species, has decreased. Strong measures are needed to support farmers through subsidies from the state budget, as well as through the rapid allocation of subsidies from the European Union.

Another conclusion is that agriculture is still in a position to be rehabilitated, to be able to take new measures to ensure the increase of irrigated areas, soil fertilization and crop care to avoid the attack of diseases and pests, mechanical processing at all stages of development of cultures.

There are possibilities but efforts must be made and a way must be found for Romania to produce as decades, years in a row, has made sufficient production of agri-food products for domestic consumption and export needs.

Another conclusion is that the superior agro-technical processing of the lands cannot be achieved in a very high percentage due to the too pronounced fragmentation of the agricultural surfaces. From this point of view, the authors consider that the forms of reallocation, leasing and formation of high-area subdivisions should be supported, those that can be processed in a superior way, using the latest agro-technical methods and techniques.

Another conclusion is that Romania has a superior agricultural / arable fund, one that may be the best in Europe, but which does not give the results we can expect precisely because of these difficulties.

Another conclusion is that the migration of the labor force from rural to urban and from here onwards, abroad, is another problem that determines the obtaining of unsatisfactory results in the agricultural branch.

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