PRICE ELASTICITY OF PRODUCTION IN ROMANIA'S AGRICULTURE- A TERRITORIAL APPROACH BY MICRO-REGION

Agatha POPESCU[1], Nela-Loredana CARABA-MEITA[2]

[1]University of Agronomic Sciences and Veterinary Medicine Bucharest, 59 Marasti Boulevard, District 1, 011464, Bucharest Romania, Phone: +40213182564, Fax: +40213182888, Email: agatha_popescu@yahoo.com
[2]Craiova University, Faculty of Economy and Business Administration, 13 Alexandru Ioan Cuza Street, Craiova 200764, Romania, Email: loredanameita@yahoo.co.uk

Corresponding author: agatha_popescu@yahoo.com

Abstract

The paper analyzed price elasticity of production for short run for wheat, maize, sunflower, milk, pork, beef and honey in Romania and in its eight micro-regions in the period 2016-2018. Elasticity coefficients were determined using Cook's formula. At Romania's level, the price growth by 1 % will determine the increase of output for wheat, maize, milk, and pork, but lower than price growth rate. Considering that other factors of influence are constant, the growth of the acquisition price will favor the increase of production in the territory of Romania as follows: for wheat in NW, SE, Bucharest Ilfov and S W Oltenia micro-regions; for maize in almost all the micro-regions except Bucharest-Ilfov and West; for sunflower in BIF and SW Oltenia; for pork, in the Center, SE, S Muntenia, SW Oltenia and West regions; for beef only in NW and NE regions; for milk in NW and S Muntenia; for honey in the Center, NE, S Muntenia, and SW Oltenia.

*Key words***: *elasticity, price, agricultural production, micro-regions, Romania*

INTRODUCTION

Agriculture is an important sector in Romania's economy. In 2018, the value of agricultural production was Lei 940.5 Billion by 9.5% higher than in 2017. The contribution of agriculture to Romania's GDP was 4.4%. In 2018, the share of vegetal sector in agriculture GDP was 70.8%, while the weight of animal sector was 27.7%. However, compared to 2017, in 2018, vegetal production increased by 12.9%, while animal production declined by 1.8% [15].

The performance in agriculture is influenced by many factors such as: soil structure, farms structure, size and endowment, cultivated crops and grown animal species, cropping and animal growing systems, climate change, farmers' managerial skills, farm inputs price, and selling price of agricultural products.

Romania's agriculture is deeply oriented to cereal cropping, wheat and maize being the main cultivated crops, and the performance in the cereal sector is due mainly to the large cultivated areas, and less to the yields which are lower than in other EU countries.

However, Romania is not only an important cereal producer, but also a main exporting and importing country in the EU [42, 70].

Romania is also the most important producer and exporter of sunflower seeds in the EU. Sunflower is the main oil seed crop, being cultivated on large surfaces [41, 43].

Milk sector is a key sector of animal production, as milk is a strategic product. Despite that Romania has a high potential to produce milk, due to the low acquisition price, dairy farming has become an activity at the threshold of profitability in most of the farms. That is why in the last decades, the cattle stock declined, and milk yield is still low due to low forage production caused by droughts during the last decade with a negative influence on milk production [18, 20, 26, 28].

Milk quality does not corresponding to the standards in many farms, mainly in the smallest ones, which explains partially the low acquisition price offered by processors and the collected milk amount. In this situation, farmers are not able to cover production costs [33, 36, 37].

As a consequence the demand/offer ratio is not balanced and to cover the domestic consumption, Romania is obliged to import milk and dairy products to satisfy consumers' needs [5, 34, 54, 62, 68].

Meat is another product which plays an important role in animal production and consumers' diet. In 2018, a Romanian consumed 76.6 meat kg, of which 38.3 kg pork, 27 kg poultry meat, 19 kg beef and the remaining is represent by sheep and goat meat. In 2018, total meat consumption was by 5 kg higher than in 2017 and by 10 kg higher than in 2016. Pork is the most consumed meat sort by Romanians as it is a traditional food [3, 49, 65].

Meat supply was assured both by the domestic production but also from import. This is due to the decline of the livestock mainly regarding cattle and swine species, determined by the low feed resources, increased farm inputs price, high production cost and low acquisition price per kg live weight. In 2018, in case of pigs, the acquisition price raised for stimulating pigs fattening and also due to the pork crisis in China caused by the African Swine Fever, which resulted in a lack of piglets and carcasses in the EU market [17, 57, 61].

Romania is an important honey producing and exporting country in the EU due to large diversity of flora for pickings, the long tradition in apiculture, the increasing number of apiaries, honey yield and production, the low domestic consumption, but the high demand in the other EU countries [27, 80].

More and more beekeepers raise more than 100 bee families for increasing the profitability and the subsidies are a real incentive to produce more for export. However, the climate change has affected pickings during the last years [22, 24, 47].

The agricultural products obtained by farmers are destined to be delivered in the market. Evaluated at the prices per measure unit in close relationship with their quality, agricultural productions bring incomes which have to cover production costs in order to assure farm profitability.

Therefore, the difference between selling price and production cost, could assure or not the profitability of a product. However, at the farm level, besides the production cost, production performance and mainly marketed production is another item which determines profitability in close relationship with the acquisition price.

Between production and price it is a close relationship, in which production, Q, could be considered the dependent variable, and price, P, the independent variable, which together may describe the supply function or curve along which there is a multitude of output-price pairs in various moments, m.

By definition, the price elasticity of production is the percentage change of production, ΔQ corresponding to 1 % change of price, $\Delta P = 1$ %.

The price decline could determine farmers to diminish production, while the price growth will encourage farmers to produce more, either at a higher or at a lower growth rate than the increase rate of the price [7, 81].

In this context, the paper objective was to analyze the relationship between production and price for the selected agricultural products: wheat, maize, sunflower seeds, milk, pork, beef, and honey carried out in Romania for short-run, 2016-2018.

The statistical data were used to estimate the price elasticity of production both at the country level, and also in the territory by the eight micro-regions of development and the analysis of elasticity level and signs allowed to distinguish the differences between regions. Finally, the paper aimed to establish in which micro-regions, production could positively respond to the growth of the acquisition price.

MATERIALS AND METHODS

The study is based on the available data picked up from the National Institute of Statistics, Tempo Online data base for the period 2016-2018,

The formula used for the calculation of elasticity of production, E_{QP} is:

$$E_{QP} = \frac{\Delta Q\%}{\Delta P\%} = \frac{\frac{\Delta Qm}{Q_0}}{\frac{\Delta Pm}{P_0}} = \frac{\Delta Qm}{\Delta Pm} \cdot \frac{P_0}{Q_0}$$

where:

$\Delta Q\%$ is the percentage deviation of production,

$\Delta P\%$ is the percentage change of price,

$\frac{\Delta Qm}{\Delta Pm} = 1/$tangent slope to production curve,

$\Delta Qm = Q_1 - Q_0$, that is the production change in the moments 1 and zero

$\Delta Pm = P_1 - P_0$ is the price change in the moments 1 and zero

P_0, Q_0 represents the point of the production (supply) curve where elasticity was computed.

The calculations were made based on the values of the m moments of the chronological series compared to the value in the previous year [4, 69].

The results have been interpreted according to [6] as follows:

(i)If the production elasticity is negative, $E_{QPm} < 0$, this means that the production would decline when the price increases;

(ii)If production elasticity is positive, but lower than 1, $(0 < E_{QPm} < 1)$, production would increase when the price will go up, but the increase of production will have a lower growth rate than the price increase rate;

(iii)If production elasticity is positive, but higher than 1, $(E_{QPm} > 1)$, production would increase with a higher growth rate than the price increase rate.

Therefore, price elasticity of production depends both on the production level and price level, under the condition that all the other factors of influence are constant.

In practice, this situation is available for short-run, that is for 2-3 years, but for long-run, the economic and technical circumstances could change.

Because the conditions of production vary from a farm to another, from a region to another, from a country to another, there is a large variability of price elasticity which needs adjustments.

For this reason, in this study, it was estimated the production elasticity in Romania's agriculture for short-run, more exactly for two years, 2017 and 2018.

The elasticity was estimated for following agricultural productions:

(a)In vegetal sector, for the most representative crops in Romania: wheat, maize and sunflower.

(b)In animal sector, for the most representative productions: milk production, meat production in live weight of the slaughtered pigs and bovines, and extracted honey.

The elasticity of these productions was determined in all the eight micro-regions of development of Romania: North West (NV), Center (C), North East (NE), South East (SE), South Muntenia (SM), Bucharest Ilfov (BIF), South West Oltenia (SWO) and West (W) for reflecting the differences between the micro-regions.

Also, the elasticity is determined at the level of Romania to show that the results may substantially very compared to the elasticity in the territory.

The results were illustrated in graphics and tables, being accompanied by comments and finally the main conclusions have been drawn.

RESULTS AND DISCUSSIONS

Evolution of agricultural productions and of average product acquisition price at the level of Romania

Wheat, Maize, Sunflower

Wheat production increased by 40 % in the interval 2013-2018, from 7.29 million tons in 2013 to 10.14 million tons in 2018. This was favored both by the growth of the cultivated area, which reached over 2.1 million ha and by the yield which accounted for 4,803 kg/ha in 2018 [9].

The largest surfaces cultivated with wheat are in the following micro-regions: South Muntenia 28.37%, South East 22 %, South West Oltenia 19.72% and West 10.43% of the total cultivated area. Smaller surfaces are also cultivated in the other micro-regions: North East 7.27%, North West 6.96%, Center 4.31% and Bucharest Ilfov 0.89 %.

The highest contribution to wheat production is given by the following micro-regions: South Muntenia 29.75%, South East 22.8%,

South West Oltenia 19.1 % and West 15.47%, followed by the other micro-regions with lower shares.

Therefore, total wheat production is closely linked to the cultivated areas, but of course of the yield levels, depending on soil conditions, wheat varieties, applied technologies, local climate etc [79].

Maize was cultivated in Romania on 2.37 million ha in 2018, compared to 2.51 million ha in 2013, meaning a decline which will continue in the coming years, because the maize yield registered a continuous growth. In 2018, maize yield was 7,740 kg/ha by 72.4% higher than in 2013. As a result, in 2018, Romania produced 18.3 million tonnes of maize grains by 61.6% more than in 2013 [10, 67].

The highest contribution to the country maize production is brought by the following micro-regions: South Muntenia 18.2 %, West 18.1 %, South East 17.5%, and North East 15.9%. The other micro regions contribute by a lower percentage: North West 11.1 %, Center 7 %, and Bucharest Ilfov 0.45% [55, 56].

Sunflower production increased by 42.8% in the period 2013-2018, accounting for 3 million tonnes in 2018. This was due to a slight increase of about 2.1 % in the cultivated area, which reached 1.09 million ha in 2018 and of a high growth rate of 40.7% of sunflower yield, which accounted for 2,805 kg/ha in the same year 2018 [11].

The highest contribution to the total production of sunflower seeds is given by: South East region 31.9%, South Muntenia 22.4%, South West Oltenia 14.7%, and West 13.7%. The other micro regions contributed by: North East 9.61%, North West 5.52%, Bucharest Ilfov 1.07% and Center 0.96%.

Romania came on the top position in the EU for its sunflower seeds output, and also it is among the main exporting countries of the EU [41, 72].

In the last three years of the analysis, 2016-2018, wheat production increased from 8.4 million tonnes in 2016 to 10.14 million tonnes in 2018, meaning +20.3%.

Maize production also increased but by a higher rate, +70.4% from 10.7 million tonnes

in 2016 to 18.6 million tonnes in 2018. Sunflower production increased by 50.6% from 2 million tonnes in 2016 to 3.1 million tonnes in 2018 (Fig.1).

This was due to the large surfaces cultivate with these crops in various regions of the country and the performance in yields per surface unit despite of the droughts and other extreme climate phenomena which affected a part of the output.
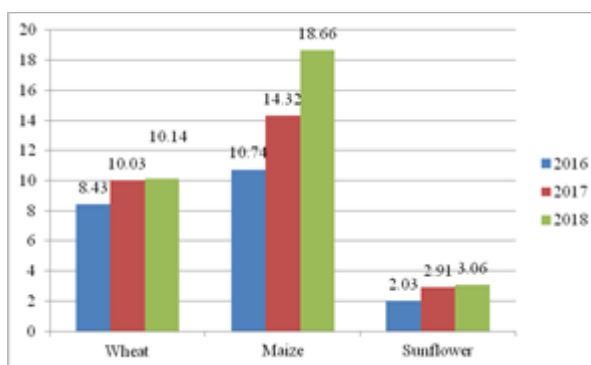

Fig.1. Dynamics of Wheat, Maize and Sunflower Production, Romania, 2016-2018 (Million tonnes)
Source: Own design based on the data from [14].

Wheat, maize and sunflower acquisition price varied from a year to another in close relationship with output and demand ratio. Its level influenced the profitability in case of each crop [9, 10, 11, 39, 40, 58].

In case of wheat, in 2018 the average acquisition price was 0.71 Lei/kg compared to Lei 0.85/kg in 2013, meaning by -16.5% less. In case of maize, the average price varied between Lei 0.74 per kg in 2013 and Lei 0.63 in 2018, when it was by 15% smaller. In case of sunflower seeds, the average price accounted for Lei 1.59 per kg in 2013 and Lei 1.37 in 2018, meaning a reduction of 14%.

The highest acquisition price was registered in the year 2012, when the country was facing a terrible draft which led to a lower production performance. In this year, the average acquisition prices reached the highest level per kg as follows: Lei 0.91 for wheat, Lei 0.87 for maize and Lei 1.84 for sunflower seeds [16].

In the analyzed period 2016-2018 in this paper, the average acquisition price of wheat increased by 7.9 %, from Lei 0.63 per kg in 2016 to Lei 0.68 in 2018, the price of maize

remained constant at Lei 0.62/kg and the price of sunflower seeds declined by 12.6%, from Lei 1.51 per kg in 2016 to Lei 1.32 in 2018 (Fig.2).
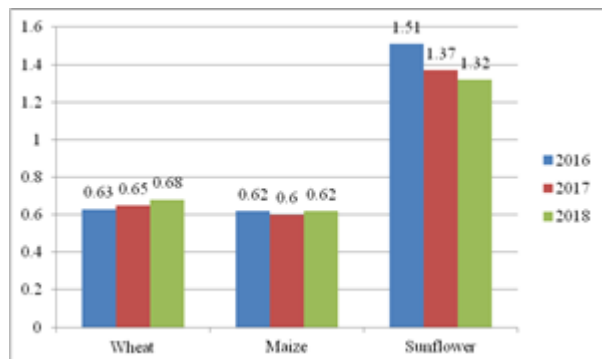

Fig.2. Dynamics of the average acquisition price of Wheat, Maize and Sunflower, Romania, 2016-2018 (Lei/kg)
Source: Own design based on the data from [14].

Milk

Milk sector registered in general a decreasing evolution in Romania, due to the most numerous subsistence and semi-subsistence farms raising in average 2-3 cows, and carrying out a low yield per cow. This does not allow them to resist to the pressure of the competition in the market.

After the period when milk quota was applied till April 2015, dairy farmers were facing huge problems regarding production allowed per farm in close relationship with the performance per cow and the number of cows [19, 21, 23, 73].

The funds from the EU favored the creation of new and modern dairy farms and the modernization of large old farms. However, the number of farms which are market oriented, applying modern technologies which could assure a high yield, production and of high quality represents just a small number of dairy farms [25].

In 2018, Romania had 1.17 million dairy cows which achieved 3.93 million tonnes milk, meaning a yield of 3,360 kg/cow/year. This yield was by 46.5 % higher than in the year 1990 when a cow was able to produce just 2,292 kg milk. The general trend regarding the dairy cows livestock is a decreasing one. In 2018, the number of dairy cows was by 64.6% smaller than in 1990 when Romania had 1.81 million dairy cows [53, 59].

This decreasing trend is similar to the one at the EU-28 level, where the number of cows accounted for 22.6 million heads in 2018 being by 13% less numerous than in 1990. But, the decline in the number of dairy cows was compensated by the increase in cow yield, which reached 7,407 kg/year, the average EU level in 2018, being by 34% higher than in the year 2000 (5,525 kg/cow).

Therefore in 2018, the EU produced 167.4 million tonnes milk by 11.3% more than in the year 2000 (150.3 million tonnes) [2, 12].

Romania is far away of the average milk yield in the EU and of the milk performance in the top producing countries in the EU.

Milk yield and production varies between farms according to the number of dairy herd, breed, feeding, reproduction performance, milking system, applied technologies, farmers' managerial skills. For this reason, milk quality is also different according to the milking systems, maintenance and hygiene conditions of the cows, sheds etc.

Many farms have milk quality problems for which milk processors either refuse milk collection or offer a low acquisition price affecting economic efficiency and profitability in dairy farming [8, 29, 30, 31, 32, 73, 75, 77]. In the period 2016-2018 to which this research refers, milk production registered a decline in Romania from 44.5 Million hl in 2016 to 43.1 Million hl in 2018, meaning a reduction of 3.1%. This decrease is determined mainly by the reduction of the cow livestock and by the low milk yield which in average at the country level accounts for 3,360 kg/cow/year (Fig.3).
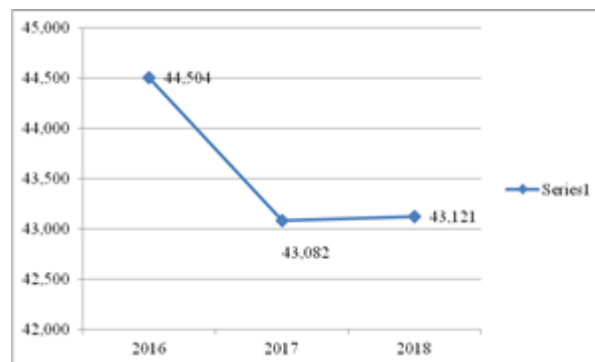

Fig.3. Dynamics of Milk Production, Romania, 2016-2018 (Thousand Hl)
Source: Own design based on the data from [14].

Milk price at delivery plays a very important role in the profitability in dairy farming, because it needs to cover production cost. The income that the farmer receives depends on the marketed milk and milk price, and this income has to cover all the production costs to assure profit [51, 52, 60, 76].

Milk price has slightly increased from a year to another, being also different from a season to another, in general in winter season, in the months of December, January and February, milk price is higher, while in summer season, in the months of June, July and August milk price has the lowest level.

In 2018, average acquisition milk price at farm gate accounted for Lei 1.27/kg or Euro 27.18/100 kg [1].

In the present study, the analysis showed that milk price increased by 10.4% from Lei 1.15 per liter in 2016 to Lei 1.27 in 2018, but its level is still low and in many farms it is not enough to cover production cost, affecting farm profitability (Fi.4).
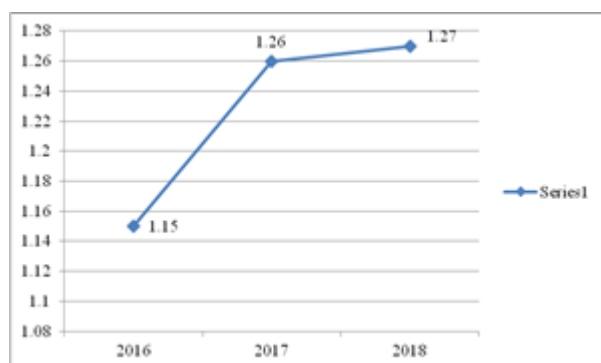

Fig.4. Dynamics of the average acquisition price of Milk, Romania, 2016-2018 (Lei/liter)
Source: Own design based on the data from [14].

Pork and Beef (Pig and Bovine- live weight)
Meat market is dominated by pork which is a traditional meat in Romania. Pork production in carcass equivalent depends on the number of slaughtered pigs and average live weight at slaughter [17, 38].

The economic efficiency in pig fattening is the reason for pig breeders to continue their business or to quip. This means that the price per kg live weight to cover production cost and assure a profit to the breeder [35, 46].

The pig livestock registered a continuous decreasing trend, in 2018, Romania had 3.92 million pigs by -24.4 % less than in 2013 (5,18 million heads).

The live weight of the slaughtered pigs in industrialized processing units accounted for 470.1 thousand tonnes in 2018 being by +17.5% higher than in 2013, when it was 400.2 thousand tonnes [13].

In case of beef production, whose level also depends on the number of slaughtered animals and their live weight at slaughter, it was noticed a similar decreasing trend regarding livestock with a negative impact on output. In 2013, the weight of the slaughtered bovines was 232.6 thousand tonnes and the average weight at slaughter accounted for 327 kg/head. In 2018, the live weight of the slaughtered bovines was 187.82 thousand tonnes, by 19.3 % lower than in 2013.

In the analyzed interval, 2016-2018, pork and beef production in terms of the slaughtered pigs and bovines live weight decreased due to the decline of the livestock of these two species.

The live weight of the slaughtered pigs declined by 6.5% from 588.1 thousand tonnes in 2016 to 549.8 thousand tonnes in 2018, while the live weight of the slaughtered bovines went down by 8.85% from 205.9 thousand tonnes in 2016 to 187.8 thousand tonnes in 2018 (Fig.5).
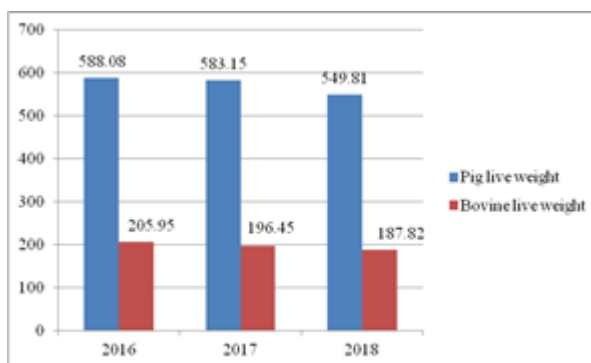

Fig.5. Dynamics of Meat production: Pig and Bovine live weight (Thousand Tonnes)
Source: Own design based on the data from [14].

The price per kilogram live weight had a positive increasing trend to stimulate farmers to improve production performance. Pig price increased by 3% from Lei 5.34 per kg live weight in 2016 to Lei 5.5 in 2018, while bovine price went up by 19.9% from Lei 5.93 in 2016 to Lei 7.11 in 2018. (Fig.6).
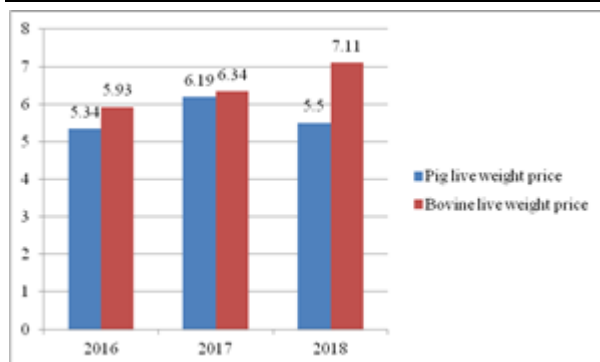
Fig.6. Dynamics of the average acquisition price of Pigs and Bovines, Romania, 2016-2018 (Lei/kg live weight)
Source: Own design based on the data from [14].

The increased growth rate of the pork price from 2017 to 2018 is explained by the "pork market crisis" which started due to the lack of piglets and carcasses determined by the EU Western producers who have been oriented to intensify their exports on the China market where the demand and price are very high as a result of the African Swine Fever.

Extracted Honey

Honey production increased along the time due to the extent of the apiaries number, bee families and bee hives, the increased honey production, and yield per bee family. The economic efficiency of an apiary is assured by the apiary size, more exactly the higher the number of bee families, usually more than 100, the higher the profitability [44, 48, 50].

Romania is not only an important honey producing country in the EU, but also an exporting country. Because, consumption per capita is low in Romania, about 0.5-0.6 kg honey per year, an important amount of honey is exported. And Romania honey has a high quality being required on the EU market [66, 71, 78].

In the analyzed interval, 2016-2018, the extracted honey production increased by 37.5% from 21.2 thousand tonnes in 2016 to 29.2 thousand tonnes in 2018, due to the growth of the number of bee families and hives and performance per apiary. The year 2018 was affected partially by unfavorable climate conditions which produced a slight decline of production compared to the year 2017, when it was recorded a peak of production (Fig.7).
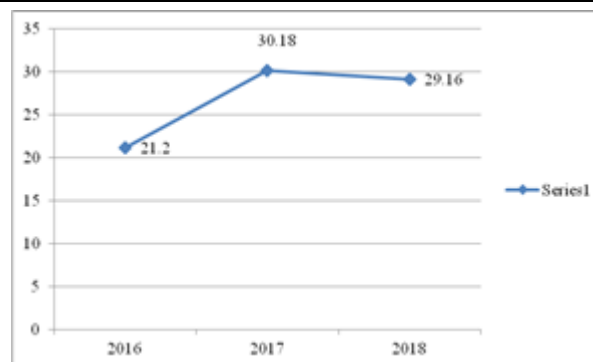

Fig.7. Dynamics of Extracted honey production (Thousand Tonnes)
Source: Own design based on the data from [14].

Honey price offered by the Association of Beekeepers is still low in Romania, but the subsidies offered by the Government to encourage beekeepers to produce more honey have had a very good impact on beekeepers income and profit [45, 63, 64].

In the analyzed period in this study, 2016-2018, honey price registered an increasing trend, 10.4% growth rate, so that in 2018, a kilogram of honey was sold in the market for Lei 16.68 compared to Lei 15.11 in 2016 (Fig.8).

Fig.8. Dynamics of the average acquisition price of Honey, Romania, 2016-2018 (Lei/kg)
Source: Own design based on the data from [14].

The price elasticity of production at the level of Romania for the agricultural products analyzed in this study is presented in Fig.9.

In case of wheat, it was noticed that the price increase by 1% assures a production growth higher than the price increase in 2017 and lower than the price growth in 2018.

In case of maize, the price had a negative effect on production, but in 2018, the price had a benefic impact on the output.

Sunflower production was not stimulated by price level in this year, as the price went down.

In case of pork (live weight), an increase of price will stimulate production, but twice less than the price growth rate.

Milk production is positively influenced by price growth, but its growth rate is still below the price increase rate.

Beef production is not encouraged by price increase, and continued to decline.

Honey production was advantaged by the price increase in 2017, when its growth rate exceeded the price increase rate, but in 2018, despite of the high price, production went down for other reasons, especially due to the climate extreme conditions which affected pickings (Fig.9).
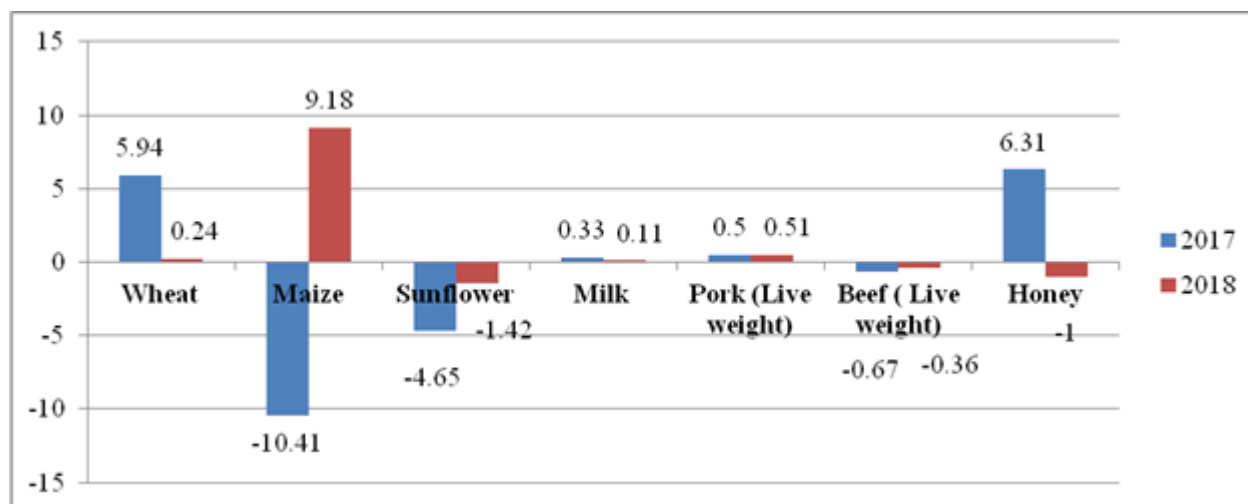

Fig.9. Price elasticity of production for the main agricultural products in Romania in 2017 and 2018.
Source: Own design and calculation.

The price elasticity of production by micro-region of Romania

Due to the lack of space, the productions and prices at the level of each micro-region are not presented in this study, but they were used for calculating the elasticity of production for the main agricultural products studied within this research.

Wheat, Maize and Sunflower price elasticity of production is presented in Table 1.

Wheat production elasticity

Wheat production elasticity in relation to price level was positive in NW, SE, Bucharest-Ilfov and SW Oltenia regions both in 2017 and 2018 reflecting a good impact of price increase. In 2018, production growth exceeded price increase rate only in Bucharest Ilfov region, in all the other regions was lower than the price growth rate in the micro-regions mentioned before.

In the Center, NE and West micro regions, in 2017, the wheat production elasticity was negative, reflecting that price increase did not favor the output, but in 2018, the price increase had a relatively good impact, the price growth being higher than the production performance.

The S Muntenia region is the only one where the wheat production elasticity had negative values both in 2017 and 2018, reflecting that the price and, for sure other factors such as climate change, had not a good impact (Table 1).

Maize production elasticity

In 2017, the maize production elasticity had negative values in almost all the micro-regions, except S Muntenia were it had the value zero, and Bucharest Ilfov region where production increased with a higher growth rate than price increase rate. In 2018, the maize price increase had a very good impact on production performance except Bucharest Ilfov and W micro-regions (Table 1).

Sunflower production elasticity

In 2017, the elasticity of sunflower registered negative values in almost all the micro-regions, except the NW region where it had a positive value and West were its value was

zero. In 2018, the price increase did not favor sunflower output in many micro-regions: NW, C, SE, S Muntenia and W, but it had a slight positive influence in NW, and was zero in W region (Table 1).

Table 1. Price elasticity of production for Wheat, Maize and Sunflower by micro-region of Romania in 2017 and 2018

	Wheat production elasticity		Maize production elasticity		Sunflower production elasticity	
	2017	2018	2017	2018	2017	2018
NW	7.17	0.17	-5.24	5.75	6.13	-0.27
C	-6.46	0.17	-3.22	2.77	-8.45	-8.09
NE	-1.36	0.20	-4.89	17.47	-6.35	0.68
SE	4.38	0.38	-21.00	4.96	-5.75	-3.26
SM	-8.70	-0.40	0	7.23	-12.55	-2.82
BIF	2.96	5.27	22.93	-4.21	-3.35	1.31
SWO	7.19	0.19	-6.32	1.34	-8.61	1.48
W	-1.47	0.76	-1.49	-10.75	0	-0.222

Source: Own results.

Pork and Beef price elasticity of production by micro-region is presented in Table 2.

In case of pork production, in 2017 and 2018, the micro regions where the price increase had a favorable influence were Center, SE, S Muntenia, and SW Oltenia. In the other micro regions: NW, NE and W, pork output was not positively influenced by the acquisition price increase (Table 2).

In case of beef production, in 2017, the regions with a good impact of price increase were: NW, NE, and SE, while in the Center, S Muntenia and SW Oltenia the price increase did not favor production which for sure was affected by other factors. In the W micro-region the elasticity was zero. In 2018, a weak positive impact of the price increase was noticed only in NW and NE micro-regions, and in all the other micro-regions the price growth did not have any good impact on production (Table 2).

Table 2. Price elasticity of production for Pork and Beef (Live weight) by micro-region of Romania in 2017 and 2018

	Pork elasticity		Beef elasticity	
	2017	2018	2017	2018
NW	-0.18	-1.92	22.70	0.93
C	0.51	12.56	-2.41	-0.09
NE	-1.37	-1.66	0.04	1.59
SE	0.08	1.14	0.67	-0.08
SM	0.06	2.14	-0.23	-0.88
BIF	Nd	Nd	Nd	Nd
SWO	0.12	1.90	-3.19	-0.44
W	-0.05	-0.55	0	0

Nd- No data.
Source: Own calculation.

Milk and Honey price elasticity of production by micro-region is presented in Table 3.

In case of milk production, the elasticity was in general positive and weak, except SE region, where it was very high compared to the price increase, and NE were it had a negative value. In 2018, only in the NW region, the elasticity was positive having a high value reflecting a higher growth rate of production compared to the price increase rate. In S Muntenia the elasticity was positive but very small, while in C, NE and SE it had negative values, reflecting that milk output was not influence by price, and its decline was caused by other factors, mainly by the reduction of the cow livestock and the drought which affected feed production (Table 3).

In case of honey production, in 2017, the price increase had a positive and high impact on honey output in the C, NE, S Muntenia and SW Oltenia micro-regions, while in NW, SE and W it had a negative impact. In 2018, in almost all the micro regions the price increase had a negative impact on honey production, except W region (Table 3).

Table 3. Price elasticity of production for Milk and Honey by micro-region of Romania in 2017 and 2018

	Milk elasticity		Honey elasticity	
	2017	2018	2017	2018
NW	0.05	4.25	-2.46	-0.79
C	0.11	-0.04	1.27	-88.00
NE	-0.65	-0.08	1.22	-0.04
SE	11.62	-0.15	-20.15	-2.42
SM	0.8	0.008	1.19	-0.06
BIF	Nd	Nd	Nd	Nd
SWO	Nd	Nd	9.09	-0.07
W	Nd	Nd	-6.34	2.09

Note: Nd- No data.
Source: Own calculation.

CONCLUSIONS

The paper analyzed the situation of production and acquisition price, and the relationship between these two indicators by means of elasticity coefficient, considering that price level has a deep influence on production level.

For short run, more exactly for the period 2016-2018, price elasticity of production was analyzed both at the country level and at each micro-region level for the main agricultural products: wheat, maize, sunflower seeds, milk, pork and beef in terms of live weight, and honey.

At Romania's level, it was noticed that the price increase by 1 % will determine production growth in case of wheat, maize, milk, and pork, but the growth rate of production remains behind the increase rate of price. In case of sunflower, beef and honey, the increase of price has a negative impact on production.

In 2018, for an increase of 1 % acquisition price, wheat production raised by 0.24%, maize output by 9.18%, milk production by 0.11%, and pork production by 0.51%, while the production decline was - 1.42% for sunflower, -0.25% for beef and -1 % for honey.

The level of price elasticity at the country level is blurring the differences existing in the territory among the micro-regions.

In case of wheat, in 2017 and 2018, the price increase by 1% has stimulated the production growth only in the NW, SE, Bucharest Ilfov and S W Oltenia micro-regions. However, price elasticity variations were noticed in the other regions from a year to another, where in 2017 the price increase did not stimulate production, and this means that other factors have affected it. In 2018, in these micro regions it was possible as price increase by 1% to lead to a production increase but with a lower growth rate than price increase rate.

In case of maize, in 2017, the price growth by 1 % did not stimulated production, on the contrary, it declined by various percentages, reflecting that other factors had a deeper impact. But, in 2018, the price increase stimulated production in almost all the regions, except Bucharest Ilfov and West.

In case of sunflower, the price increase had a negative influence on production in almost all the regions, except NW in 2017 and NE, BIF and SW Oltenia in 2018.

In case of pork, in 2017 and 2018, the price increase by 1% stimulated production in the Center part, SE, S Muntenia, SW Oltenia and West regions even by more than 1 %. In the other micro-regions, pork production is negatively influenced by price increase.

In case of beef, the price growth had a positive influence on output only in the NW and NE regions both in 2017 and 2018.

In case of milk, the price increase by 1% sustained production mainly in the NW and a

little S Muntenia, in all the other regions it had a negative impact, reflecting that other factors have a deeper influence on milk output than price.

In 2017, honey production registered a higher growth rate than the price increase by 1% in the Center region, NE, S Muntenia, and SW Oltenia. But, in 2018, in almost all the regions except West region, the increased price had a negative impact on honey output because climate extreme phenomena affected the pickings and caused important damages to beekeepers.

As a final conclusion, if the other factors of influence are considered stable, the growth of production is sustained by the increase of the acquisition price in the following micro-regions:

- for wheat in NW, SE, Bucharest Ilfov and S W Oltenia micro-regions;

-for maize in almost all the micro-regions except Bucharest-Ilfov and West;

-for sunflower in BIF and SW Oltenia in 2018;

- for pork, in the Center, SE, S Muntenia, SW Oltenia and West regions;

- for beef only in NW and NE regions;

-for milk in NW and S Muntenia;

-for honey in the Center, NE, S Muntenia, and SW Oltenia.

If other factors have a deeper influence on production, either the farmers have to manage much better their business or the level of the acquisition price has to be much higher.

REFERENCES

[1]Anonymous, 2020a, Farm-gate milk prices, Romania, CLAL, https://www.clal.it/en/index.php?section=latte_romania Accessed on Jan.30, 2020.

[2]Anonymous, 2020b, Less dairy cows in the EU, but more productive/The European farms produce the highest milk amount worldwide (Vaci de lapte mai puține în Uniunea Europeană, dar mai productive / Fermele europene produc cea mai mare cantitate de lapte la nivel mondial, 2020), https://www.g4media.ro/vaci-de-lapte-mai-putine-in-uniunea-europeana-dar-mai-productive-fermele-europene-produc-cea-mai-mare-cantitate-de-lapte-la-nivel-mondial.html, Accessed on Jan.30, 2020.

[3]Anonymous, 2020c, Meat consumption per inhabitant reached in 2018 a historical record in Romania. The phenomenon is associated with the wages growth (Consumul de carne pe cap de locuitor a atins in 2018 un record istoric in Romania, Fenomenul asociat cu cresterea veniturilor,), Mediafax, https://www.mediafax.ro/social/consumul-de-carne-pe-cap-de-locuitor-a-atins-in-2018-un-record-istoric-in-romania-fenomenul-asociat-cu-cresterea-veniturilor-18740070, Accessed on Jan.30, 2020.

[4]Cook, S.J., 2009, The intellectual Foundation of Alfred Marshall's Economic Science. A Rounded Scientific and Encyclopaedic Publishing House, Bucharest, pp.35.

[5]Dobra, I.B., Șandru, F.L., 2016, Analytical Overview on the Romanian Dairy Market in the Context of Economic Changes, Academic Journal of Economic Studies Vol. 2, No.4, December 2016, pp. 172–186, http://www.ajes.ro/wp-content/uploads/AJES_article_1_82_3.pdf, Accessed on Jan.30, 2020.

[6]Hanf, C.H., 1981, Relationship between milk production and price variations in the EC, European Commission, Agricultural Studies, pp.12-13, http://aei.pitt.edu/36837/1/A67.pdf, Accessed on Jan.30, 2020.

[7]Havlicek, J., 1989, Waugh, Frederick V. Demand and Price Analysis—Some Examples from Agriculture. Washington DC: U.S. Department of Agriculture, Econ. Res. Serv., Econ. and Statist. Anal. Div. Tech. Bull. No. 1316, Nov. 1964, vi + 94pp., American Journal of Agricultural Economics, Vol.71(3), 820–821, https://academic.oup.com/ajae/article-abstract/71/3/820/154521, Accessed on Jan.30, 2020.

[8]INSSE, 2019, Animal production obtained in the year 2018 (Producția animală obținută în anul 2018), OPress Release No.160, June 28, 2019), Comunicat de presa nr.160/28 iunie 2019, http://www.insse.ro/cms/sites/default/files/com_presa/com_pdf/prod_anim18r.pdf, Accessed on Jan.30, 2020

[9]MADR, 2020a, Wheat (Grau), Ministry of Agriculture and Rural Development, https://www.madr.ro/culturi-de-camp/cereale/grau.html,Accessed on Jan.30, 2020.

[10]MADR, 2020b, Maize (Porumb), Ministry of Agriculture and Rural Development, https://www.madr.ro/culturi-de-camp/cereale/porumb.html, Accessed on Jan. 30, 2020.

[11]MADR, 2020c, Sunflower (Floarea soarelui), Ministry of Agriculture and Rural Development, https://www.madr.ro/culturi-de-camp/plante-tehnice/floarea-soarelui.html, Accessed on Jan. 30, 2020.

[12]MADR, 2020d, Bovines, 2007-2013, Livestock and production (Bovine: Efective si productii), Technical and Operative Report regarding productions in Bovines on June 30,2017, (Raport tehnic-operativ privind productiile la bovine la data de 30 iunie 2017), https://www.madr.ro/cresterea-animalelor/bovine.html, Accessed on Jan. 30, 2020.

[13]NIS, 2019, Press Release No.163/28 June 2019, Meat, Milk and Dairy products Production achieved in industrialized units in the year 2018.

[14]NIS, 2020, Tempo Online, http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table, Accessed on Jan.30, 2020.

[15]Pana, M., 2019, Agriculture Balance in 2018-Contribution to GDP, Generalized decline in animal husbandry, increase for vegetal sector in the West (Bilantul agriculturii in 2018-Contributia la PIB, Scadere generalizata in zootehnie, cresteri la vegetale in vest), https://cursdeguvernare.ro/bilantul-agriculturii-2018-contributia-la-pib-scadere-generalizata-in-zootehnie-cresteri-la-vegetale-in-vest.html, Accessed on Jan.30, 2020.

[16]Petre, I.L., 2017, The effect of maize production and consumption on prices in Romania. Agrarian Economy and Rural Development - Realities and Perspectives for Romania, Vol. 8, 45-52.

[17]Pirvutoiu I., Popescu Agatha, 2011, Study on the Trends in Romania's Meat Market, 11th International Symposium on "Prospects of Agriculture and Rural Areas in the Context of Durable Development", UASVM Bucharest, June -23, 2001, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.11, Issue 2/2011, p.133-139.

[18]Popescu Agatha, 2003, Financial Analysis in Dairy Farming, The 2nd International Symposium on "Prospects for the 3rd Millenium Agriculture", USAMV Cluj-Napoca, 9-11 oct.2003, Bulletin of UASVM Cluj-Napoca, Animal Science and Biotechnologies, (Zootehnie si Biotehnologii), Vol.59, p.11-1.

[19]Popescu Agatha, 2004a, Prospects for dairy farm management under milk quota. The International symposium on"Prospects for the 3rd Millenium Agriculture", USAMV Cluj-Napoca, 20-23 oct.2003, Bulletin of UASVM Cluj-Napoca, Animal Science and Biotechnologies, (Zootehnie si Biotehnologii), Vol.60, p.14 - 20.

[20]Popescu Agatha, 2004b, Financial Statement - a tool in decision making in dairy farming. The International symposium on"Prospects for the 3rd Millenium Agriculture", USAMV Cluj-napoca, 20-23 Oct.2003, Bulletin of UASVM Cluj-Napoca, Animal Science and Biotechnologies, (Zootehnie si Biotehnologii), Vol.60, p.384 - 389.

[21]Popescu Agatha, Muresan, G., 2004, Analysis in dairy farming in Arad County achievements and prospects under the background of Romania's entry into the E.U. The International symposium on "Prospects for the 3rd Millenium Agriculture", USAMV Cluj-Napoca, 20-23 Oct.2003, Bulletin of UASVM Cluj-Napoca, Animal Science and Biotechnologies, (Zootehnie si Biotehnologii), Vol.60, p.385.

[22]Popescu Agatha, 2005a, Researches concerning the increase of profitability in beekeeping by creating of commercial apiaries, Bulletin of the University of Agricultural Science and Veterinary Medicine, Animal Husbandry and Biotechnology, Vol. 61, 188-191.

[23]Popescu Agatha, 2005b, Research concerning dairy cows, farm structure and milk performances in the proximity of the capital, The 4th International Symposium "Prospects of the 3rd Millennium Agriculture, 6-7 Oct.2005, Bulletin of UASVM Cluj-Napoca, Romania, Series Animal Science, Biotechnologies and Veterinary Medicine, (Zootehnie si Biotehnologii si Medicina Veterinara), Vol.61, p.399-403.

[24]Popescu Agatha, 2005c, Research on the possibility to increase profitability in an apiary of 50 bee families, The 4th International Symposium "Prospects of the 3rd Millennium Agriculture, 6-7 Oct.2005, Bulletin of UASVM Cluj-Napoca, Romania, Series Animal Science, Biotechnologies and Veterinary Medicine, (Zootehnie si Biotehnologii si Medicina Veterinara), Vol.61, p.404-407.

[25]Popescu Agatha, 2006a, Research concerning the economic impact of investments in dairy farms of various size, International Symposium "Prospects of Agriculture in the 3rd Millennium", UASVM Cluj-Napoca, 5-6 October 2006, Bulletin of UASVN Cluj-Napoca, Romania, Series Animal Science, Biotechnologies and Veterinary Medicine, (Zootehnie si Biotehnologii si Medicina Veterinara), No.62, p.8-12.

[26]Popescu Agatha, 2006b, Study upon milk market in the EU countries, International Symposium "Prospects of Agriculture in the 3rd Millennium", UASVM Cluj-Napoca, 5-6 October 2006, Bulletin of UASVN Cluj-Napoca, Romania, Series Animal Science, Biotechnologies and Veterinary Medicine, (Zootehnie si Biotehnologii si Medicina Veterinara), No.62, p.214.

[27]Popescu Agatha, 2006c, Study upon Honey Market in the EU Countries, International Symposium "Prospects of Agriculture in the 3rd Millennium", UASVM Cluj-Napoca, 5-6 October 2006, Bulletin of UASVN Cluj-Napoca, Romania, Series Animal Science, Biotechnologies and Veterinary Medicine, (Zootehnie si Biotehnologii si Medicina Veterinara), No.62, p.2015.

[28]Popescu Agatha, 2006d, Financial management in dairy farms, Dominor Publishing House, Bucharest, (Managementul financiar in fermele de vaci, Ed. Dominor, Bucuresti), p.69.

[29]Popescu Agatha, 2007, Considerations upon economic efficiency in dairy farms by gross margin assessment, International Scientific Symposium "Performance and Competitiveness in Animal Production", UASVM Iasi, May 4-5, 2007, Scientific Papers Series Animal Science (Lucrari stiintifice Seria Zootehnie), Iasi, Vol.50, p. 670-672.

[30]Popescu Agatha, 2009a, A comparative study concerning economic efficiency for various levels of milk yield, International Symposium "Modern Animal Production – Science, Creativeness and Innovation, UASVM Iasi, Faculty of Animal Science, April 9-10, 2009, UASVM Iasi Sientific Papers Series Animal Science (Lucrari stiintifice Seria Zootehnie), Iasi, Vol.52 (14), p.525-530.

[31]Popescu Agatha, 2009b, Analysis of Milk Production and Economic Efficiency in Dairy Farms, Lucrari stiintifice Zootehnie si Biotehnologii

(Scientifical Papers: Animal Sciences and Biotechnologies), Timişoara,Vol.42(1):507-513.

[32]Popescu Agatha, 2010a, Research concerning Gross Margin Forecast based on Milk Yield using the Least Square Method of Regression Analysis, International Symposium on "Prospects of Agriculture and Rural Areas Development in the context of Global Climate Change", 5-6 May, 2010, UASVM Bucuresti, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.10(2)/2010, p.173-178.

[33]Popescu Agatha, 2010b, Research concerning the Use of Regression Function in Gross Margin Forecast, The 9th International Symposium on The Prospects of the 3rd Millennium Agriculture, Cluj Napoca Sept. 30-Oct. 2, 2010, Bulletin of UASVM Cluj-Napoca, Romania, Horticulture-Management, Vol.67(2):197-202.

[34]Popescu Agatha, 2011, Research concerning the Correlation between Demand and Offer in the Romanian Milk Market, International Symposium "Bioengineering of Animal Productions", Timisoara, May 26-27, 2011, Scientific Papers: Animal Sciences and Biotechnologies, Timisoara, Vol.44(2):504-507.

[35]Popescu Agatha, 2012a, Study concerning the Economic Efficiency in Pig Fattening, International Symposium " Modern Animal Science, factor of sustainable development" ("Zootehnia moderna, factor la dezvoltarii durabile"), April 26-27, 2012, UASVM Iasi, Scientific Papers Series Animal Science (Lucrari stiinifice-Seria Zootehnie), Iasi, Vol. 58(2):179-183.

[36]Popescu Agatha, 2012b, Economia productiei in ferma de vaci Ed.EIKON Cluj Napoca, coeditare cu Ed.RawexComs, (Production economy in dairy farms, EIKON publishing House in co-editing with Rawex-Coms Publishing House), Bucharest, p. 155.

[37]Popescu Agatha, 2012c, Marja bruta in fermele vegetale si animale, Ed.EIKON Cluj Napoca, coeditare cu Ed.RawexComs, Bucuresti, (Gross margin in the vegetal and animal farms, EIKON publishing House in co-editing with Rawex-Coms Publishing House), Bucharest, p.146.

[38]Popescu Agatha, 2012d, Study concerning the Trends in Pork Market in Romania, International Symposium " Modern Anamal Science, factor of sustainable development" (Zootehnia moderna, factor la dezvoltarii durabile"), April. 26-27, 2012, UASVM Iasi, Scientific Papers Series Animal Science, (Lucrari stiinifice-Seria Zootehnie Iasi), Vol.57(2), p.184-188.

[39]Popescu Agatha, 2012e, Research concerning the Use of Gross Margin in the Profitability Analysis in Wheat and Barley Cropping, Scientific Papers Agricultural Management, Series I, Vol.XIV (2):155-162.

[40]Popescu Agatha, 2012f, Research regarding Gross Margin Forecast based on Average Production in Wheat Cropping, Scientific Papers Agricultural Management, Series I, Vol.XIV (2):163-170.

[41]Popescu Agatha, 2012g, Considerations on the Importance of Sunflower among the Oil Seed Crops in Romania in the period 1990-2009, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.12(2):117-122.

[42]Popescu Agatha, 2012h, Considerations on the Importance of Maize among Cereal Crops in Romania in the period 1990-2009, 12th International Symposium on "Prospects of Agriculture and Rural Areas in the Context of Durable Development", UASVM Bucharest, May 17-18, 2012, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.12, Issue 2/2012, p.123-128,

[43]Popescu Agatha, 2012i, Research regarding oilseeds crops development in Romania in the EU context, Journal of Agricultural Economics, Ekonomika Poljoprivrede, Vol.1/2012 Institute for Agricultural Economics, Belgrade, Serbia, UDC 633.85(498):EU, p.129-138.

[44]Popescu Agatha, 2012j, Research regarding Apiaries Structure and its Relationship with Honey Production, The 11th International Symposium on The Prospects of the 3rd Millennium Agriculture Cluj Napoca, Sept 27-29, 2012, Bulletin of UASVM Cluj-Napoca, Romania, Animal Science and Biotechnology, Vol.69(1-2)/2012, p.332-334.

[45]Popescu Agatha, 2012k, Research on Beekeepers Income Estimation based on Honey Production. The 9th International Symposium on The Prospects of the 3rd Millennium Agriculture Cluj Napoca, Sept 27-29, 2012, Bulletin of UASVM Cluj-Napoca, Romania, Animal Science and Biotechnology, Vol.69(1-2)/2012, p.185-191.

[46]Popescu Agatha, 2012l, Research concerning the Economic Efficiency in Pig Fattening in Farms of Various Sizes. Scientific Papers: Animal Science and Biotechnologies, 45(2):397-403.

[47]Popescu Agatha, 2013a, Study concerning the Trends in Romania's Honey Market, Scientificc Papers Series Animal Science (Lucrari stiinifice-Seria Zootehnie), Iasi, Vol. 59, p.153-158.

[48]Popescu Agatha, 2013b, Research concerning Apiary Size, Honey Yield and Beekeepers' income in Teleorman County, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.13(1):293-300.

[49]Popescu Agatha, 2013c, Research on Consumer Behaviour on Bucharest Meat Market, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.13(1):301-308.

[50]Popescu Agatha, 2013d, Research concerning the Actual Statement of Apiculture in Calarasi County, Scientific Papers: Animal Sciences and Biotechnologies, Timisoara, Vol.46 (1):397-403.

[51]Popescu Agatha, 2014a, Research on milk cost, return and profitability in dairy farming, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14(2):219-222.

[52]Popescu Agatha, 2014b, Research on profit variation depending on marketed milk and production

cost in dairy farming, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14(2):223-230.

[53]Popescu Agatha, 2015a, Research on the trends in milking livestock and milk production in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.15(1):377-386.

[54]Popescu Agatha, 2015b, Research on the trends in milk production and consumption in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.15(1):387-392.

[55]Popescu Agatha, 2015c, Research on the distribution and concentration of the farms cultivating maize for grains in Romania using the Gini Coefficient, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.15(3):253-260.

[56]Popescu Agatha, 2015d, Analysis of the evolution and distribution of maize cultivated area and production in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.15(3):261-264.

[57]Popescu Agatha, 2015e, Research on the Pork Production Trends in the EU-28, the CEECs and Romania, Proceedings of 25th IBIMA Conference Innovation Vision 2020: from Regional Development Sustainability to Global Economic Growth, Amsterdam, The Netherlands, May 7-8, 2015, pp.1407-1422.

[58]Popescu Agatha, 2015f, Regression and Elasticity of Maize Price and Production in Romania, Proceedings of 26th IBIMA Conference Innovation Management and Sustainable Economic Competitive Advantage: From Regional Development to Global Growth, Madrid, Spain, November 11-2, 2015, pp.2205-2213.

[59]Popescu Agatha, 2015g, Regression modeling in prediction milk production depending on the dairy bovine livestock, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.15(4):225-230.

[60]Popescu Agatha, 2015h, Multiple correlation and regression in predicting milk price, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.15(4):231-238.

[61]Popescu Agatha, 2016a, Research on concentration of pork production in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.16(1):405-410.

[62]Popescu Agatha, 2016b, The milk market concentration and competition thresholds in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.16(2):247-253.

[63]Popescu Agatha, 2016c, The effect of Honey Production on Beekeepers' Income. A Study Case in South Muntenia Development Region of Romania, Proceedings of 28th IBIMA Conference Vision 2020: Innovation Management, Development Sustainability, and Competitive Economic Growth, Sevilla, Spain, November 9-10, 2016, pp.919-934.

[64]Popescu Agatha, 2016d, Regression and Elasticity of the Average Delivery Price and Production of Honey in Romania, Proceedings of 28th IBIMA Conference Vision 2020: Innovation Management, Development Sustainability, and Competitive Economic Growth, Sevilla, Spain, November 9-10, 2016, pp.935-944.

[65]Popescu Agatha, 2016e, Considerations on beef production, consumption and trade balance in Romania (2007-2015), Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.16(4):267-277.

[66]Popescu Agatha, 2017a, Honey production in Romania, 2007-2015 and 2026-2020 forecast, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development,Vol.17(1):339-350.

[67]Popescu Agatha, 2017b, Maize culture- An intensive or extensive production system in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development,Vol.17(1):351-356.

[68]Popescu Agatha, 2017c, Trends in milk market and milk crisis impact in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development,Vol.17(2):281-290.

[69]Popescu Agatha, 2017d, Elasticity of apple price depending on offer in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development,Vol.17(3):333-337.

[70]Popescu Agatha, 2018a, Maize and Wheat - Top agricultural products produced, exported and imported by Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.18(3):339-352.

[71]Popescu Agatha, 2018b, Honey production and trade before and after Romania's accession into the European Union, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.18(4): 229-248.

[72]Popescu Agatha, 2018c, Romania's sunflower seeds production, export and import-Analysis of the 2007-2017 period and forecast for 2018-2022 horizon, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.18(4):261-270.

[73]Popescu Agatha, Angel Elena, 2009, Analysis of Milk Quality and its importance for milk processors, Scientifical Papers Animal Sciences and Biotechnologies), Vol. 42(1):501-506.

[74]Popescu Agatha, Rasmussen, S., Ciocan, H., 2010, Forecast of Dairy Cows based on Milk Yield under Milk Quota, Bulletin of UASVM Cluj-Napoca Romania, Horticulture-Management, No.67(2):p.287.

[75]Popescu Agatha, Condei Reta, 2014, Study on the average marketed milk as a measure of profitableness threshold in dairy farms, Scientific Papers Series

Management, Economic Engineering in Agriculture and Rural Development, Vol.14(4):219-222.

[76]PopescuAgatha, David Livia, 2014, Research on regression modeling of profit related to milk yield in dairy farming, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.14(4):211-218.

[77]Popescu Agatha, Angel Elena, 2019, Cow raw milk quality and its factors of influence in relationship with milk price, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.19(1):421-440.

[78]Popescu Agatha, Guresoaie Ion, 2019, Consumer's behaviour towards honey purchase- A case study in Romania, Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development, Vol.19(1): 451-470.

[79]Soare, B.E., Analysis of the situation of the wheat crop on macro-regions in Romania,142-149, http://cafee.ase.ro/wp-content/uploads/file201816.pdf, Accessed on Jan. 30, 2020.

[80]Ward, R.W., 2014, Honey Demand and the Impact of the National Honey Board's Generic Promotion Programs,
http://www.natureplica.com/wp-content/uploads/2014/06/National-Honey-Board-on-Honey-Demand.pdf, Accessed on Jan. 30, 2020.

[81]Waugh, F.Y., 1964, Demand and price analysis. Some examples from agriculture,
Washington DC: U.S. Department of Agriculture, Econ. Res. Serv., Econ. and Statist. Anal. Div. Tech. Bull. No. 1316, Nov. 1964, 94pp.