

## TRENDS IN SHEEP AND GOAT LIVESTOCK AND MEAT PRODUCTION CONCENTRATION AND THEIR ECONOMIC IMPACT IN ROMANIA IN THE PERIOD 2009-2018

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**Abstract.** *The concentration of sheep and goats livestock and meat production were studied in Romania in the period 2009-2018 using the data provided by the National Institute of Statistics, Herfindhal-Hirschman (HHI) and Gini-Struck (GSI) indices, trend analysis, and structural changes. The results pointed out both the livestock and the live weight for slaughtering increase by 16.5 %, and, respectively, by 10.9%. Sheep and goats livestock is moderately concentrated in five micro-regions: Centre, South East, North West, North East, and West (81%), while meat production in terms of live weight is concentrated mainly in South East, Centre, South Muntenia, North West and North East as proved by HHI (0.1494-0.1654) and GSI(0.4132-0.4467) values. The concentration growth has a positive influence on export which accounted of 93% of production and on export/import ratio which reflected that Romania has an efficient international trade with this product, being a net exporting country.*

**Keywords:** sheep and goats, livestock, meat production, concentration, economic impact, Romania

### 1. Introduction

Sheep and goat meat are high value sources of nutrients and energy which could nourish our body and maintain its health.

In 100 g of sheep meat, there are: 20 g proteins, 6.5 g fats, water 72 %, and 144 kilocalories, while in 100 g of lamb meat there are: 18 g proteins, 20 g fats, vitamins (B and C), minerals (calcium, iron), 62 % water, and 260 kilocalories (Damian, 2017)[1]. In 100 g goat meat, there are: 27 g proteins, 30.5 g fats (linoleic acid, a lower content of saturated fatty acids), vitamins (A, B6, B12, C, D, E, K) and minerals (calcium, potassium, selenium, iron, a lower content of sodium) and 143 calories, and for this reason it is a healthy meat preventing cancer, anemia, osteoporosis, heart diseases, stimulating brain activity and sustaining immunity (Vasiliu Alina, 2020) [18].

Sheep and goat meat consumption is not so high, but it is continuously growing in the recent decade due to the changes in consumer's new orientation for a healthy diet, the better quality of meat products from these two species resulting from the

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progress in animal science and technology, production systems, animal slaughtering and meat processing, carcass grading which determine a high food quality and safety (Teixeira et al, 2019) [17].

Sheep meat is preferred and consumed especially in Australia, New Zealand, United Kingdom, Argentina and in the Arabian and African countries with a long tradition in production and consumption (Skapetas and Bampidis, 2016) [16].

Despite that goat meat is an important source of food for a growing human population, demand and offer are still low, being higher in the developing countries. However, in the Western countries, consumers look to be more and more aware of goat meat benefits for health because it is a lean meat with a low fat and cholesterol content compared to other meat types (Webb, 2014)[19].

At present, of the total global goat meat output, China produces 39%, followed by India 9%, Pakistan 6%, Nigeria 4%, Bangladesh 4%, Australia 1%, others 38% (Meat and Livestock Australia, Global Snapshot I Goat meat, 2020)[5].

The global total meat production (in carcass equivalent) is expected to reach 357.4 million tons by the year 2025. Sheep and goat meat output will also increase and is expected to be 17.5 million tons in 2025. The main contributors will be China by 45 % and Sub Saharian Africa by 27% (FAO, OECD, 2016) [4].

In the EU, the sheep and goat livestock increased reaching a peak in 2016 of 99.8 million sheep and 97.8 million goats, but then it started to decline to 97.8 million sheep and 94 million goats in 2018.

In this year, the main EU countries raising sheep were Greece (15.85 million), United Kingdom (22.28 million) and Romania (10,176 million). The main countries growing goats were: Spain (2,76 million) and Romania (1.54 million).

Sheep and goats bring an important contribution to the EU milk and meat production besides poultry, pigs and bovines (Popescu Agatha, 2013b)[11].

The EU-28 sheep and goat meat production accounted for 776 thousand tons carcass, the same level like in 2017, of which: United Kingdom 37.2%, Spain 16.8%, France 11.3%, Greece 9 % and Ireland 8.8%. Of the 0.8 million tons meat from the both species, sheep meat accounts for 90%. (Eurostat, 2020; Popescu Agatha, 2017) [ 3, 14 ].

Romania has a long tradition in raising sheep and goats and occupies an important position in the EU for its livestock. Sheep and goats are raised in Romania for milk, meat and wool. Sheep and goats contribute by 3.6 % to milk production and by 8 % to meat production ( Popescu Agatha, 2017, Popescu Agatha et al, 2020) [14, 15].

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However, sheep and goat meat is ranked the fourth in meat consumption after pork, poultry meat and beef (Pirvutoiu and Popescu, 2013; Popescu, 2013a, Popsecu Agatha, 2016) [7, 10, 13].

In this context, the purpose of the study was to analyze the trends in the livestock and meat production concentration during the period 2009-2018 and to assess their economic impact.

## 2. Materials and Methods

### 2.1. Data collection

The empirical data have been picked up from various sources such as: National Institute of Statistics, Eurostat Statistics Explained, FAO, etc for the period 2009-2018 [3, 4, 6].

### 2.2. The main specific indicators taken into consideration

The main indicators taken into account have been: sheep and goat livestock at the national level and by micro-region, livestock structure by micro region, sheep and goat meat production in terms of live weight for slaughtering for consumption at the national level and in the territory by micro-region, the contribution of the micro-regions to the meat output, the concentration degree of the sheep and goat livestock and meat production, the economic impact in terms of the share of export in the meat output and the export/import ratio as main indicators reflecting the international trade efficiency of the country.

### 2.3. Methodological aspects

The dynamics of the indicators reflecting increase or decline on the whole interval was analyzed using the Fixed Index,  $IFB = (X_n / X_1) * 100$ , where:  $X$  = the variable taken into consideration,  $n = 1, 2, 3, \dots, i$ , the years of the chronological series, the year 2009 was considered equal to 100 as being term of reference, regression polynomial equation  $Y = ax^2 + bx + c$ , for reflecting the sinuous dynamics of meat production, concentration degree was evaluated based on the use of the well known Herfindhal-Hirschman Index (HHI), having the formula:  $HHI = \sum_{i=1}^n (g_i)^2$  and Gin-Struck Index (GSI) having the formula:

$$GSI = \sqrt{\frac{n \sum_{i=1}^n g_i^2 - 1}{n-1}}$$

$$\text{where: } g_i = \frac{X_i}{\sum_{i=1}^n X_i} = \frac{X_i}{X_j}$$

$i$  = the micro-region of development,  $i = 1, 2, \dots, 8$

$X_i$  = the analyzed indicator in the micro-region  $i$

$X_j$  = the total level of the indicator at the national level

$g_i$  = the share of the micro -region  $i$  in the total national level,  $X_j$

Meat Food Balance was determined as follows: Production (P) plus Import (I) minus Export (E) = Offer (O), according to the formula:  $O = P + I - E$ .

The ratio Export/Production, E/P was calculated dividing the export amount by meat production.

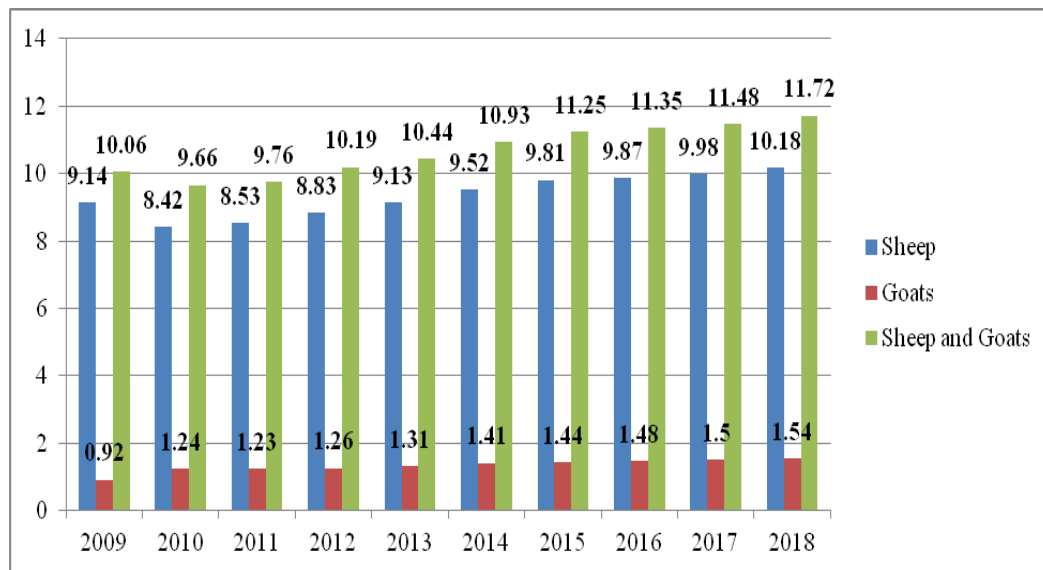
The Export/Import ratio was determined dividing the exported amount by the imported amount (Popescu Agatha, 2010) [8].

All calculations and graphic illustrations were made using the Excel facilities.

### 3. Results and discussions

#### 3.1. Dynamics of sheep and goats livestock

In 2018, Romania had 11,715,717 sheep and goats, of which 10,176,400 sheep (86.86%) and 1,539,317 goats (13.14%), all together meaning a surplus of 16.5% compared to 2009 (Fig.1).



**Fig.1.** Dynamic of sheep and goats livestock, Romania ( Million heads)  
Source: Own design based on NIS data, 2020.

#### 3.2. Number of agricultural holdings growing sheep and goats

In general, the farms raising sheep have also goats. In 2018, there were 287,865 holdings growing sheep and taking into account the number of animals, this means 35.3 heads average flock size per farm. About 63% of the sheep farms are raising about 12 % of the whole sheep livestock, they are small individual farms with an average flock below 10 heads, grown in an extensive system. About 6.5 %

of the livestock is grown in larger farms whose average flock size is about 15,5 heads, where also the extensive system is practiced. Only about 10,850 sheep, representing 3.8% of the total sheep farms are raising over 200 heads, with an average flock size of about 400 heads.

### 3.3. Dispersion of sheep and goat livestock in the territory

The distribution of the sheep and goats livestock in the territory is not equal. In 2018, the regions with the highest number of sheep were the following ones: Centre (22.7%), North West (16.8%), South East (15.1%), West (15%) and North East (13.9%), summing 83.5%.

The highest number of goats was raised in South East (25.3%), South West Oltenia (19.8%), South Muntenia (17.5%), and North East (15.3%), totalling 76.9% of the goat livestock.

The largest sheep and goat livestock was found in the Central part (21%), South East (16.4%), North West (15.6%), North East (14.2%) and West (13.5%) (Table 1).

**Table 1.** The share of micro regions in sheep and goat livestock in 2018 versus 2009 (%)

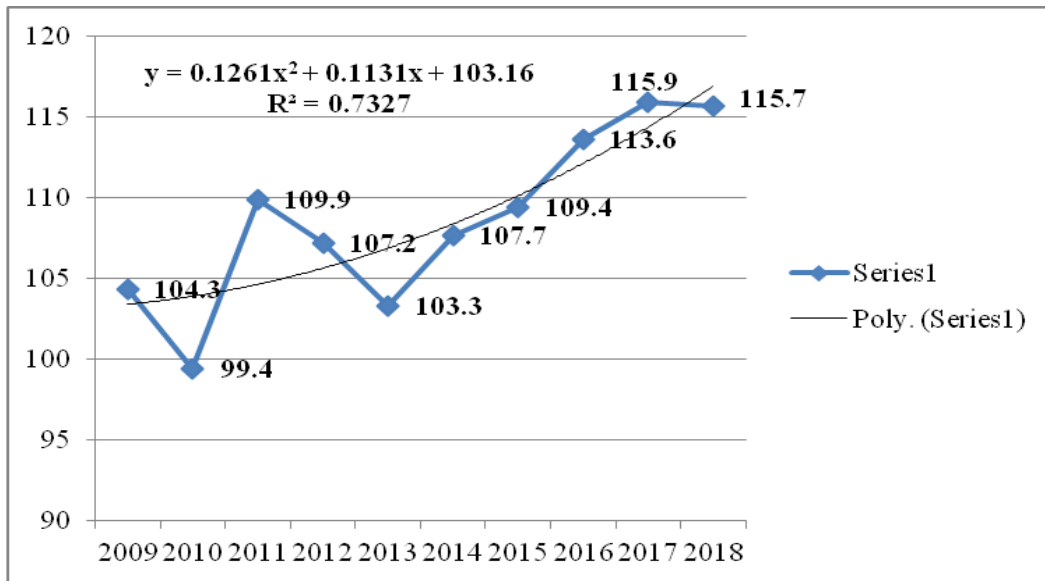
	Sheep by micro region (%)		Goats by micro region (%)		Sheep and goats by micro region (%)	
	2009	2018	2009	2018	2009	2018
NW	15.2	16.8	8.7	7.7	14.6	15.6
C	19.5	22.7	9.5	9.2	18.6	21.0
NE	17.3	13.9	14.1	15.3	17.0	14.2
SE	16.4	15.1	24.5	25.3	17.2	16.4
S Munt.	10.1	9.6	16.9	17.5	10.8	10.6
B If	0.3	0.2	0.9	0.8	0.3	0.3
SW Olt.	7.8	6.7	20.0	18.8	8.9	8.3
W	13.4	15	5.4	5.4	12.5	13.5

Source: Own calculation based on NIS data, 2020.

The distribution of sheep and goat growing in the territory is closely linked to the favourable local conditions regarding soil and climate condition, forage resources, the existence of pastures and meadows, breed structure, technical aspects etc. (Popescu Agatha, 2012) [9].

### 3.4. Dynamics of live weight of sheep and goats for slaughtering for consumption

In the analyzed period 2009-2018, the live weight and the sheep and goats for slaughtering increased by 10.9% from 104.3 thousand tons in 2009 to 115.7 thousand tons in 2018. This was due to the growth registered in the number of sheep and goats and to the gain in the growing and fattening period (Fig.2).



**Fig.2.** Dynamic of sheep and goats live weight for slaughtering, Romania ( Thousand tons)  
Source: Own design based on NIS data, 2020.

The contribution of sheep and goats to the live weight of the slaughtered animals in Romania increased to 7.2 % in 2009 to 8 % in 2018, being situated on the 4th position after poultry (42.3%), pigs (37%) and bovines (12.6%) (Popescu Agatha, 2013c; NIS, 2020) [12, 6].

### 3.5. Dispersion of sheep and goats live weight in the territory

In 2018, the regions which recorded the highest live weight of sheep and goats for slaughtering were: South East (24.4%), Centre (18.6%), South Muntenia (15.1%), North West (12.3%) and North East (11.7%) (Table 2).

If we compare the dispersion of the live weight with the dispersion of the livestock by micro region, we may easily find out that:

- despite the Central region has the highest number of sheep and goats, being on the 1st position, it is situated on the 2nd position for the live weight;
- the South East micro region situated on the 2nd position for livestock is on the 1st position for live weight;

-the North West region ranked the 3rd for live stock comes on the 4th position for live weight;

-the North East region situated on the 4th position for livestock comes on the 5th position for live weight;

- finally, the West region ranked the 5th for live stock comes on the 6th position for live weight.

This is due to the breed structure existing in various regions, climate conditions, availability of forage resources, growing systems practiced in various farms.

**Table 2.** The share of micro regions in the sheep and goats live weight in 2018 versus 2009 (%)

	2009	2018
NW	12.5	12.3
C	17.9	18.6
NE	13.7	11.7
SE	11.4	24.4
S Munt.	12.8	15.1
B If	0.3	0.4
SW Olt.	8.4	6.3
W	11.9	11.2

Source: Own calculation based on NIS data, 2020.

### 3.6. Concentration degree in terms of HHI and GSI

The values of Herfindahl-Hirschman Index varied between 0.1496, the minimum level registered in 2009, and 0.1567 recorded in 2010, the maximum level. HHI characterized a modest concentration in 2009 (  $HHI < 0.15$ ), but a trend to a moderate concentration of the sheep and goats livestock in the other years (  $0.15 < HHI < 0.25$ ).

In case of the live weight, HHI had a smaller value than 0.15 only in the year 2010, reflecting a low concentration, but in the other years, its value was higher than 0.15, but it did not exceed 0.18, so that we may observe a trend to a moderate concentration in a few regions: South East, Centre, South Muntenia, North West and north East, while in the other areas the live weight had lower levels ( West, South West and Bucuresti-Ilfov).

Gini-Struck Index reflected similar trends, its values varying between 0.4134 and 0.4169 for livestock and between 0.4132 and 0.4467 for live weight. However, GSI had value situated between 3 and 5, therefore it shows a relative concentration in a few micro regions as mentioned above (Table 3).

**Table 3.** Herfindahl-Hirschman and Gini-Struck Indices for sheep and goats livestock and live weight for slaughtering

	HHI		GSI	
	For Livestock	For Live weight	For Livestock	For Live weight
2009	0.1496	0.1544	0.4134	0.4201
2010	0.1567	0.1494	0.4232	0.4132
2011	0.1521	0.1529	0.4169	0.4180
2012	0.1514	0.1586	0.4160	0.4257
2013	0.1512	0.1552	0.4157	0.4212
2014	0.1509	0.1545	0.4153	0.4202
2015	0.1506	0.1654	0.4149	0.4348
2016	0.1505	0.1746	0.4147	0.4467
2017	0.1521	0.1646	0.4169	0.4337
2018	0.1520	0.1624	0.4168	0.4308

Source: Own calculation.

### **3.7. Factors stimulating concentration of sheep and goats livestock and meat production**

The trend to a moderate concentration in Romania regarding sheep and goat population and meat production in the recent years has been stimulated by:

- favourable geographic position of the country, soil and climate conditions, breed structure and adaptation to the local environment, practical experience and long tradition in sheep and goat growing;
- financial aids from the Romanian Government allotted to sheep breeders for stimulating the growth of livestock;
- the new orientation in the EU Common Agricultural Policy to stimulate sheep raising providing financial support (coupled aids) from European Agricultural Guarantee Fund (EAGF) destined to offer direct payments to farmers and sustain agricultural markets ( European Commission, Financing the PAC) [17].
- increased sheep meat demand on the Arab market.

### **3.8. Impact of the concentration in meat production on food balance**

Meat production growth has a good economic impact on demand/offer ratio and food balance. As sheep meat accounts for 90% in meat output resulting from sheep and goats species in Romania, the sheep meat balance in the period 2013-



2018 reflected the high level of production, the increase of export and efficiency on the country international trade (Table 4).

**Table 4.** Sheep meat food balance, Romania, 2013-2018 (Tons)

	2013	2014	2015	2016	2017	2018	2018/2013
Production	46,800	48,600	49,323	51,232	52,200	52,119	111.36
Import	1,381	605	974	1,189	690	1,820	131.78
Export	31,129	34,319	36,010	42,226	44,603	48,491	155.77
Offer	17,052	14,886	14,287	10,135	8,287	5,448	31.94
Export/Production	66.5	70.6	73.0	82.4	85.4	93.0	139.84
Export/Import	22.5	56.7	36.9	35.5	64.6	26.6	118.22

Source: Own calculations based on NIS, 2020.

As Romanians consume only 3 kg/year sheep meat in average, most of production is exported. In the interval 2013-2018, the quantitative export increased by 55.7% from 31,129 tons in 2013 to 48,491 tons in 2018.

The sheep meat export/production ratio increased by 39.8% from 66.5 in 2013 to 93 in the year 2018, reflecting that 93 % of sheep meat production is exported due to high demand and favourable price on the external market.

The export/import ratio is much higher than 1 in all the years reflecting that Romania is a net exporting country and has a high efficient international trade with sheep meat. However, the intensified export favoured the import of sheep meat to cover the domestic market requirements.

## Conclusions

- (1). The analysis emphasized an increased number of sheep and goats as well as of meat output from these two species in the period 2009-2018, stimulated by the financial aids to enlarge the livestock and production, increase offer and availabilities for export.
- (2). In 2018, Romania had 11,715 thousand sheep and goats, of which 99% are grown in the private sector and more than 68% belong to the individual agricultural small sized holdings.
- (3). Both sheep and goats livestock and live weight for slaughtering for consumption are not equally distributed in the territory of Romania.
- (4). About 81% of sheep and goats are mainly concentrated in the Central region, South East, North West, North East and West, while the highest live weight for

slaughtering is concentrated in South East, Centre, South Muntenia, North West and North East, accounting for 81.15 of total output.

(5). The moderate concentration in sheep and goats livestock and meat production was attested by HHI values which ranged between 0.1494 and 0.1654, and the GSI values which varied between 0.4132 and 0.4467.

(6). As a consequence of meat production growth the meat export raised by 55.7% and the share of export in meat output reached 93% in 2018.

(7). Therefore, the concentration growth had a positive impact on farmers' income and the trade balance, Romania being an exporting country of sheep and goat meat.

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