ANALYSIS OF ECONOMIC VULNERABILITY DETERMINANTS OF GOAT FARMS

R. Chetroiu[1*]

[1]*Research Institute for Agriculture Economy and Rural Development, Bucharest, Romania*

Abstract

The livestock sectors, including goats breeding, face currently economic difficulties and a low level of specialization and integration of productions, in a challenging world. The objective of the paper is to evaluate the degree of economic vulnerability of different goat farms, based on the calculation of technical-economic indicators. The material studied is a sample of 33 goat farms of different sizes, from different regions of Romania, between 15.0 and 476.7 heads/farm (average size for the years 2017-2019), falling into the following categories: 3% subsistence farms, 27.3% semi-subsistence farms, 12.1% small farms, 57.6% medium farms. The goat breeds from the farms under study are Carpatina, Alba de Banat, as well as highly productive breeds, such as French Alpine and Saanen and their crossbreeds with Romanian breeds. The research results indicated that the mountain area would be the most vulnerable from an economic point of view in raising dairy goats. Also, the farms that are part of the smallest size segments, under 100 heads, have the highest degree of economic vulnerability and fail to adapt quickly to changes in the economic environment. In this context, the analysis of technical-economic indicators highlights the characteristics of the processes and becomes an important tool in their assessment, in adopting decisions and transforming the economic reality.

Key words: *indicators; breeds; dairy; efficiency*

INTRODUCTION

Goat breeding is an important zootechnical sector for the realization of sustainable agricultural activities. Raising of goats in Romania has been on an upward trend in the last 10 years, their number increasing in 2022 by 17.2% compared to 2012 and reaching 1,483.2 thousand heads. Integrating this species into farm systems can increase economic and environmental diversity, making important contributions to farm sustainability. Goats fit well into biological and economic niches that are not exploited in any other way [13]. This species contributes to the diversification of the economy, do not require large capital, and can support the transition to more profitable production, considering that, due to their prolificity and hardiness, they produce high yields, which makes them one of the best investments [16].

It is necessary to evaluate the operating conditions, the feeding regime, and the adoption of the appropriate technology in the farm, with the aim of maximizing the profit resulting from the production activities [2]. One of the ways farmers could increase profitability is by reducing feeding costs per animal [11]. The economic role of goats is useful for rural households that have limited access to credit and few opportunities for off-farm income [17].

In many Eastern European areas, there is a new trend in market-oriented goat breeding, intensively exploited throughout the year, with the aim of increasing the level of milk production. This system made a significant difference, allowing to obtain

[*]Corresponding author: rodica.chetroiu@iceadr.ro
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specialized productions with a certain degree of milk processing [6].

By supplying processing industries with raw materials, livestock farms fulfill an important function, that of satisfying the growing consumption requirements of the population [4].

The objectives of this study are to assess the degree of economic vulnerability of different categories of goat farms in different areas of the country, based on the data from 33 case studies, through the calculation and comparative analysis of technical-economic and synthesis indicators, as well as of some risk indicators.

MATERIAL AND METHOD

The research was conducted based on average data from the years 2017-2019 from case studies carried out on 33 goat farms situated in different geographical regions, landforms and sizes. Of these, 16 farms are located in plain areas, 13 farms in hilly areas and 4 farms in mountain areas. From the point of view of the regions where they were carried out, the case studies come from farms located in Moldova, Crisana, Transylvania, Oltenia, Muntenia, Dobrogea. The counties where the farms are located are: Bihor, Bacău, Buzău, Bistrita-Năsăud, Brașov, Călărași, Constanța, Dolj, Gorj, Ialomița, Mehedinți, Teleorman, Prahova, Vâlcea, Dâmbovița, Olt, Mureș, Giurgiu, Sălaj. Regarding the farm size, they were between 15.0 - 476.7 heads (1,694.7 - 53,853.8 standard output), falling into the following categories: 3% subsistence farms, 27.3% semi-subsistence farms, 12.1% small farms, 57.6% medium farms. The goat breeds exploited in the farms in these case studies were Carpatina, Alba de Banat, as well as highly productive breeds, such as French Alpine and Saanen and their crossbreeds with Romanian breeds.

The economic efficiency indicators of the goat farms that are the subject of the 33 case studies were calculated and analyzed. The calculation of technical-economic indicators was carried out using the established relations from the specialty economic literature:

Production value VQ = VQp + VQs, in which: VQp - the value of the main production; VQs - secondary pro-duction value.

Total expenses ChT = ChV + ChF, in which: ChV – variable expenses; ChF – fixed expenses

Main production costs Chp = ChT – VQs

Variable expenses Chv = Chf + Chec + Chmed + Cham + Chap, in which: Chf - feed expenses; Chec - energy and fuel expenses; Chmed - medicine expenses; Cham - other material expenses; Chap - supply costs.

Fixed expenses ChF = Chfm + Chg, in which: Chfm - labor costs; Chg - general expenses.

Unit cost Cu = Chp/Qp, in which: Chp - expenses for the main production; Qp – main production.

Labor productivity in physical expression Wf = Co / Qp, in which: Co - total consumption of man-hours; Qp – main production

Labor productivity in value expression Wv = VQp / Co

Labor costs per 1000 lei total production Chfm/VQ = (Chfm:VQ) x 1000

Expenses per 1000 lei total production Chp/VQ = (Chp:VQ) x1000

Expenses per 1000 lei of main production Chp/VQp = (Chp:VQp) x1000

Profit or loss per product unit Pr/l = Pr / Qp, in which: Pr – total profit

Net rate of return Rrn = (Pr/Chp) x100

Margin on variable expenses MCV = VQ – ChV

Margin on variable expenses MCV% = MCV/VQ x 100

The profitability threshold in value units PRv = (ChF /MCV%) x 100

The profitability threshold in physical units PRf = PRv/Pu, in which: Pu – the unit price.

The exploitation risk rate Rr = PRv/VQp

Security index Is = (VQp – PRv) / VQp.

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The farms were grouped on three 3 landforms (plain, hill, mountain), in order of their size (subsistence, semi-subsistence, small, medium farms), also specifying the geographical region of origin. Each farm has been named with a symbol that includes landform, size and county.

For statistic indicators, as average, standard error of the average, minimum, maximum, correlation coefficient, the applications in Excel were used.

RESULTS

The average size of goat farms in the case studies ranged from 15.0 heads to 476.7 heads, with an average of 159.7 heads/farm (Figure 1).

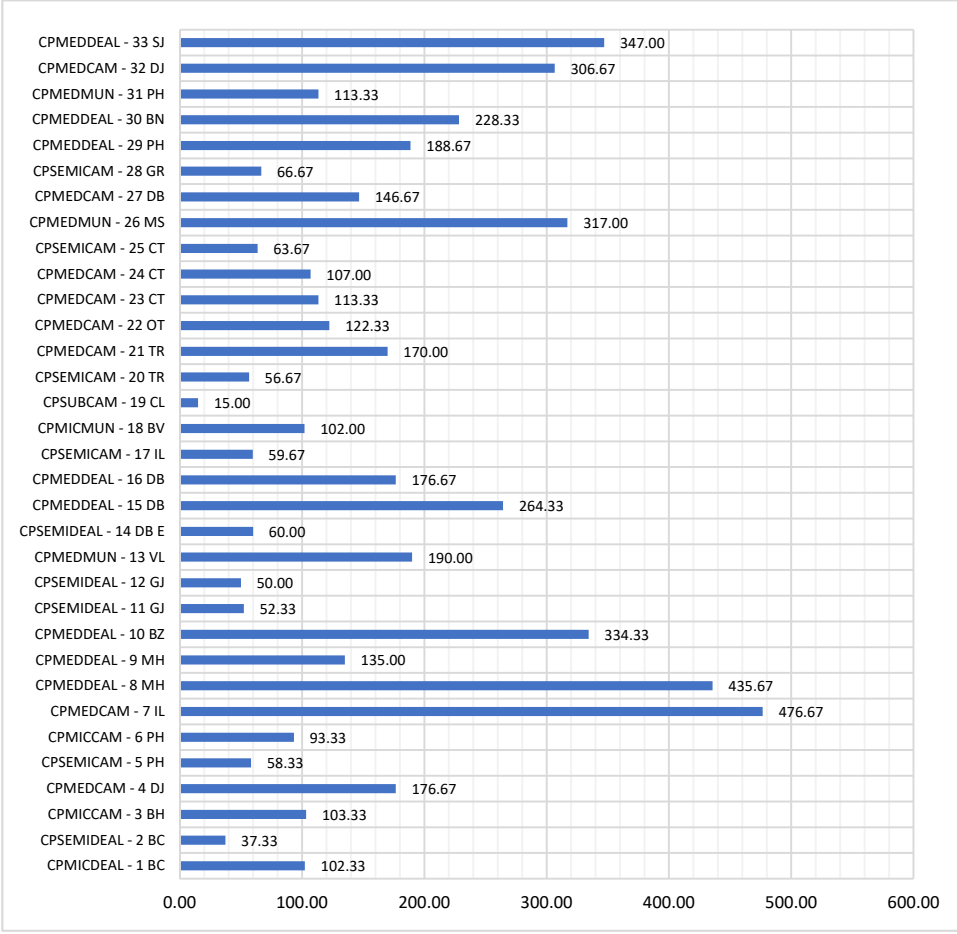

Figure 1 - Farm sizes in the case studies
Source: own illustration based on case studies data

The average milk production was 340.25±39.55 l/head and between 100 l/head in the area of Dobrogea, at Carpathian breed and crossbreeds, in household system, and 901.67 l/head in the southern part of Muntenia, in plain area, at French Alpine goats crossed with Saanen (Figure 2).

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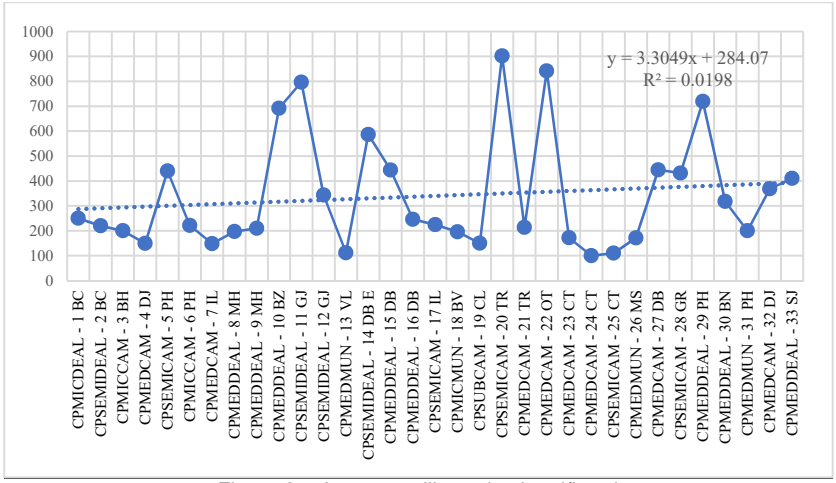

Figure 2 – Average milk production, l/head
Source: own calculations, based on case studies data

The value of production was between 0.58 €/l and 1.23 €/l, at the top being farms that process milk, transforming it into specialties, such as cheese, thus creating added value, or those that sell youth for reproduction (Figure 3).

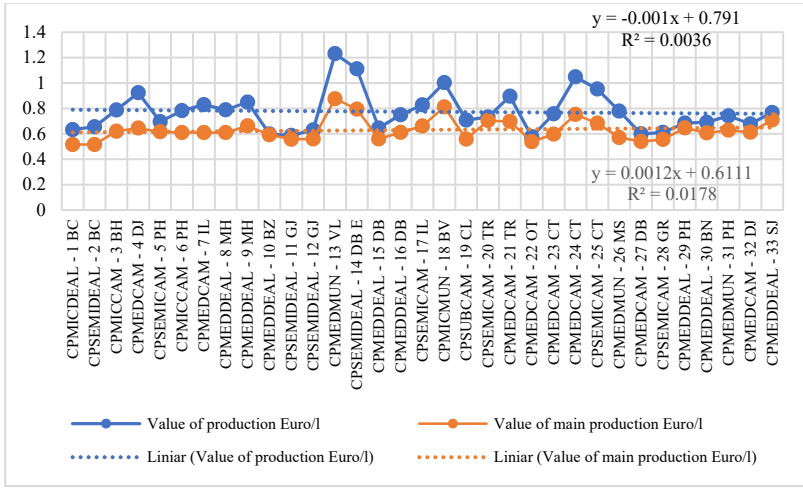

Figure 3 – Value of production
Source: own calculations, based on case studies data

Total expenses ranged between 0.34 €/l and 1.12 €/l, the higher values being in the case of farms with small milk production (around 100 liters/head). The expenses for the main production (milk) were between 0.30 €/l and 0.76 €/l, the increased values also being in the case of females with low milk production. Variable expenses ranged between 0.17 €/l and 0.81€/l, and the fixed ones between 0.09 €/l and 0.47 €/l (Figure 4).

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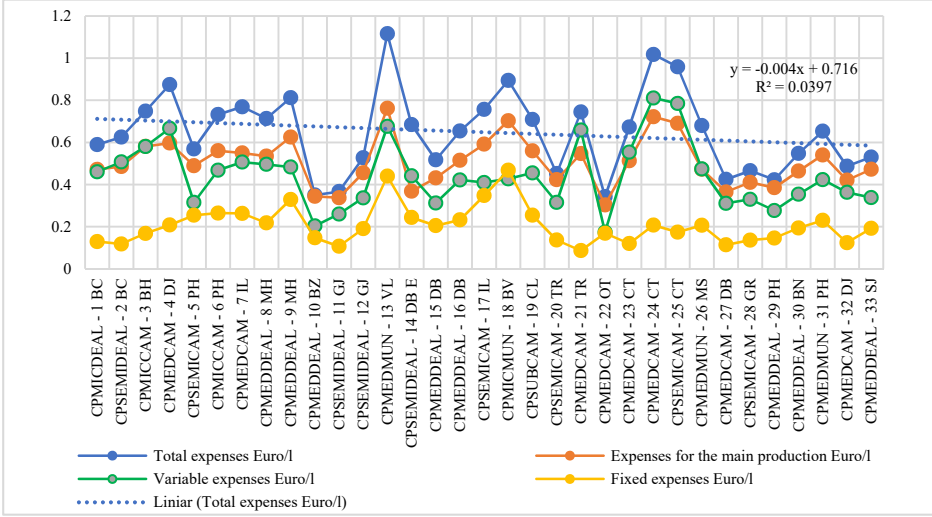

Figure 4 – Categories of expenses
Source: own calculations, based on case studies data

The unitary cost was between 0.30 €/l and 0.76 €/l, the higher values being generally in farms with low average milk productions, or with small productions and low livestock. The calculated price of milk was between 0.52 €/l and 0.88 €/l, the highest being found, in general, in farms where the milk is marketed as different categories of cheeses (Figure 5).

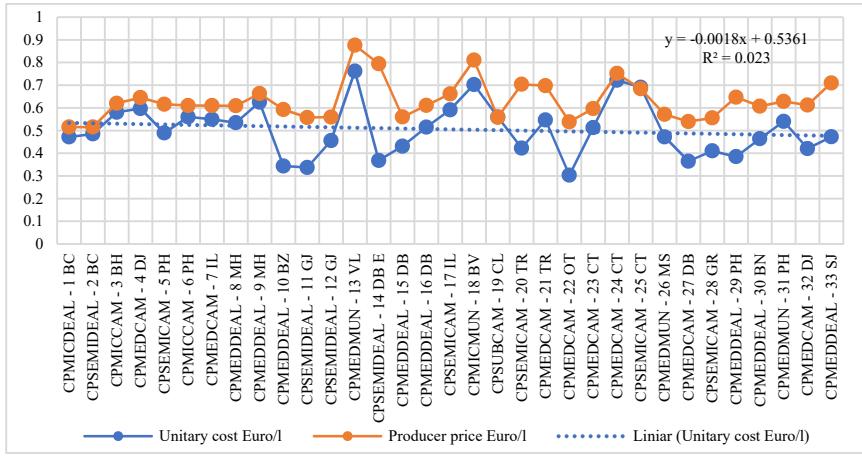

Figure 5 – Unitary cost and price
Source: own calculations, based on case studies data

The economic results of the farms studied were mostly positive, only 6% of the studied farms recorded losses. Thus, as illustrated in Figure 6, the losses were up to -0.01 €/l, and the profit was a maximum of 0.43 €/l. Losses were encountered in farms with low herds and low production.

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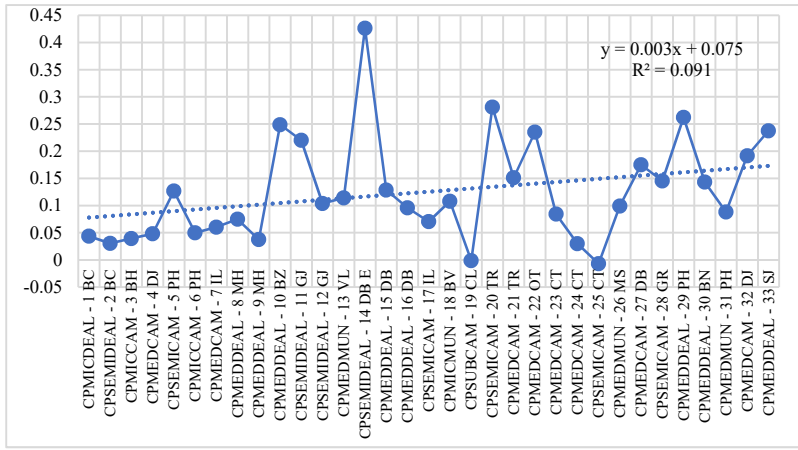

Figure 6 – Profit or loss, €/l
Source: own calculations, based on case studies data

The rate of net income without subsidies was between -1% and 104.18%, and the rate of net income with subsidies (Transitional National Aid) was between -0.2% and 106.46% (Figure 7).

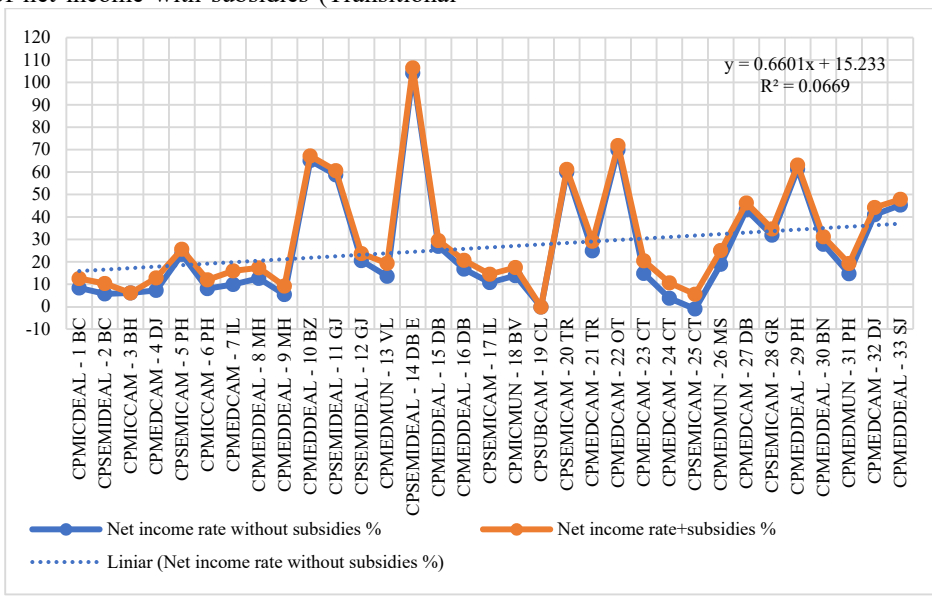

Figure 7 – Net income rates
Source: own calculations, based on case studies data

Breakeven point in physical units was 216.14 l/head, this representing the level of production at which revenues only ensure the recovery of expenses, being between 99.49 l/head and 377.01 l/head, and the value level between 69.43 €/head and 236.79 €/head (Figure 8).

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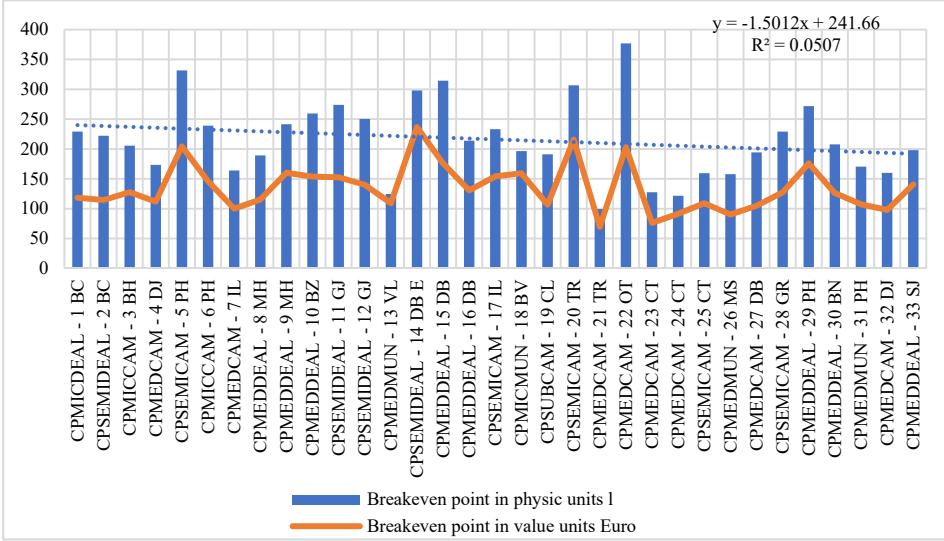

Figure 8 – Breakeven point
Source: own calculations, based on case studies data

Operating risk rate ranged between 34% and 144.94%, being higher in the farms with low herds and small productions, or even in the farms with high productions, but small herds (Figure 9). Security index was between -0.45 and 0.66, with negative values generally found in farms with small herds and small productions.

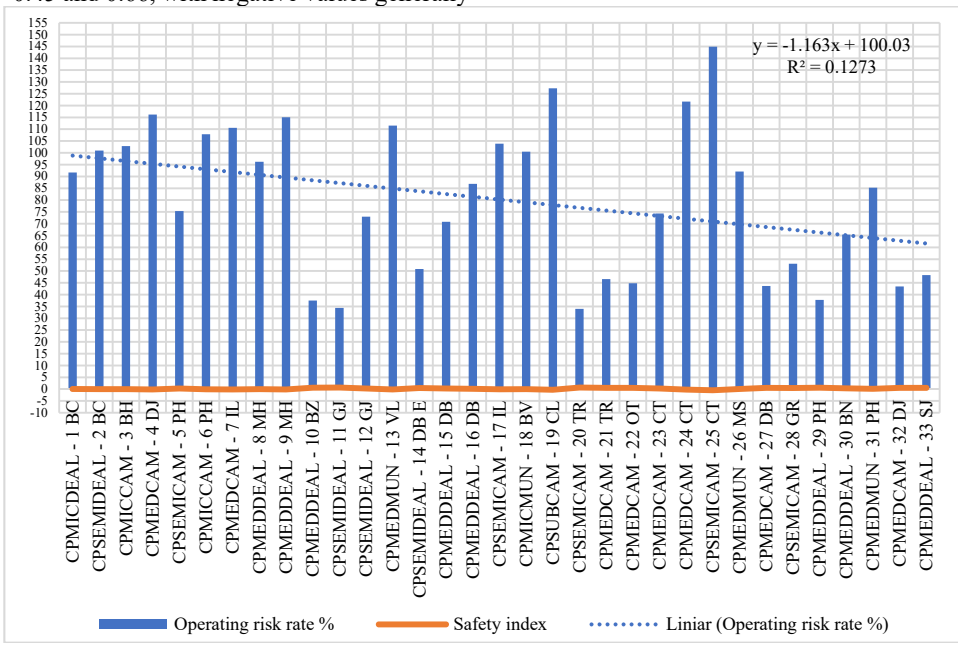

Figure 9 – Operating risk rate and safety index
Source: own calculations, based on case studies data

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The minimum, maximum and average of the economic synthesis indicators of the goat case studies were calculated (Table 1).

Table 1 - Minimum, maximum, and average of the economic synthesis indicators

Economic synthesis indicators	Measure unit	AVERAGE ± Standard error of the average*	Minimum	Maximum
Farm size	heads	159.71	15.00	476.67
Average production	l/head	340.25±39.55	100.00	901.67
Total production	l/farm	52,033.15	2,250.00	231,358.67
Production value	€/l	0.77	0.58	1.23
The value of the main production	€/l	0.63	0.52	0.88
Total expenses	€/l	0.65	0.34	1.12
Main production expenses	€/l	0.51	0.30	0.76
Variable expenses	€/l	0.44	0.17	0.81
Material expenses	€/l	0.43	0.17	0.78
Fixed expenses	€/l	0.21	0.09	0.47
Labor costs	€/l	0.19	0.03	0.47
Unit cost	€/l	0.51	0.30	0.76
Price	€/l	0.63	0.52	0.88
Labor productivity in physical expression	man-hours/l	0.24	0.08	1.30
Labor productivity in value expression	€/man-hour	3.95	0.43	8.65
Labor costs per 1000 lei of total production	€	53.62	7.78	100.19
Material expenses per 1000 lei total production	€	116.86	62.61	169.70
Expenses per 1000 lei of main production	€	172.11	99.56	216.96
Profit or loss per product unit	€	0.13	-0.01	0.43
Rate of taxable income	%	29.40	-1.00	115.75
Rate of net income without subsidies	%	26.45	-1.00	104.18
Rate of net income + subsidies	%	30.03	-0.20	106.46
Breakeven point in value units	€	134.88	69.43	236.79
Breakeven point in physical units	l	216.14	99.49	377.01
Operating risk rate	%	80.26	34.00	144.94
Security Index		0.20	-0.45	0.66

Source: Own calculations; Average exchange rate of Romanian National Bank for 2017-2019: 4.6556 RON/Euro; *not calculated for economic indicators.

Average size of the 33 farms in the case studies was 159.71 heads, with an average milk production of 340.25±39.55 liters/head. Average production value was 0.77 €/liter, respectively 262 €/head, total expenses being 0.65 €/l, and 221.2 €/head.

Average value of the unit cost was 0.51 €/l, and average milk price was 0.63 €/l. Average labor productivity in physical expression was 0.24 man-hours/l, while the average labor productivity in value expression was 3.95 €/man-hour. Average profit/ loss per product unit: 0.13 €/l, rate of taxable income (rate of return) was 29.40%, rate of net income without subsidies was 26.45%, profitability threshold in physical units was 216.14 l/head, and the value one was 134.88 €/head. Average operating risk rate was high, of 80.26%, and the security index was low, 0.2.

Regarding the degree of economic stability, 42.5% of goat farms are economically unstable (income is 10% below the breakeven point), 9% are in a

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relatively stable economic situation (revenues are up to 20% above the breakeven point), and 48.5% are in a stable situation from an economic point of view (incomes are more than 20% higher than the value of breakeven point). Farms in economically unstable situation are structured as follows:
- 7.1% subsistence farms;
- 21.4% semi-subsistence farms;
- 12.1% small farms;
- 18.2% medium farms.

Analyzing the averages of synthetic indicators on landforms, it is found that the highest production value is found in mountain area (0.94 €/l), as well as the highest value of the main production - milk (0.72 €/l) (Table 2). This is due to the fact that the highest price was found in mountain area. The highest total expenses are also in the mountain area (0.84 €/l), as well as the highest expenses with the main production - milk (0.62 €/l), due to higher costs of fodder in the mountains, which have the greatest share. The highest operating risk rate is also in the mountain area, respectively the lowest security index, and the highest security index is found in the hilly area.

Table 2 - Synthetic indicators by landforms

Economic synthesis indicators	Measure unit	Plain area	Hilly area	Mountain area
Farm size	heads	133.50	185.54	180.58
Average production	l/head	319.81±61.30	417.90±59.02	169.67±20.34
Total production	l/farm	38,389.81	75,746.39	29,538.50
Production value	€/l	0.78	0.72	0.94
The value of the main production	€/l	0.63	0.61	0.72
Total expenses	€/l	0.67	0.56	0.84
Main production expenses	€/l	0.52	0.45	0.62
Variable expenses	€/l	0.48	0.38	0.50
Material expenses	€/l	0.46	0.36	0.48
Fixed expenses	€/l	0.19	0.19	0.34
Labor costs	€/l	0.17	0.18	0.34
Unit cost	€/l	0.52	0.45	0.62
Price	€/l	0.63	0.61	0.72
Labor productivity in physical expression	man-hours/l	0.28	0.20	0.23
Labor productivity in value expression	€/man-hour	3.60	4.53	3.43
Labor costs per 1000 lei of total production	€	47.45	54.64	75.10
Material expenses per 1000 lei total production	€	125.05	108.68	110.82
Expenses per 1000 lei of main production	€	177.84	161.54	183.79
Profit or loss per product unit	€	0.11	0.16	0.10
Rate of taxable income	%	24.55	39.20	16.92
Rate of net income without subsidies	%	22.09	35.28	15.22
Rate of net income + subsidies	%	25.66	38.42	20.24
Breakeven point in value units	€	127.85	149.29	116.43
Breakeven point in physical units	l	207.06	243.87	162.35
Operating risk rate	%	84.41	69.91	97.33
Security Index		0.16	0.30	0.03

Source: Own calculations

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The comparative analysis of synthetic indicators by farm size segments highlights the fact that the smallest farm size segments, under 100 heads and 101-200 heads, generally have the highest unitary costs, the lowest profit, the highest rates of operating risk and low security indexes (Table 3). They also have the lowest labor productivity.

Table 3 - Synthetic indicators by farm size segments

Economic synthesis indicators	Measure unit	under 100 heads	101-200 heads	201-300 heads	over 300 heads
Farm size	heads	55.73	139.10	246.33	369.56
Average production	l/head	402.36±79.27	289.55±60.0	380.83±63.17	331.17±84.64
Total production	l/farm	22,830.78	41,332.74	94,948.94	116,233.20
Production value	€/l	0.75	0.82	0.67	3.45
The value of the main production	€/l	0.62	0.65	0.58	2.87
Total expenses	€/l	0.62	0.71	0.53	2.74
Main production expenses	€/l	0.49	0.54	0.45	2.17
Variable expenses	€/l	0.42	0.49	0.33	1.85
Material expenses	€/l	0.41	0.48	0.32	1.78
Fixed expenses	€/l	0.20	0.22	0.20	0.89
Labor costs	€/l	0.19	0.20	0.20	0.88
Unit cost	€/l	0.49	0.54	0.45	2.17
Price	€/l	0.62	0.65	0.58	2.87
Labor productivity in physical expression	man-hours/l	0.36	0.22	0.11	0.11
Labor productivity in value expression	€/man-hour	2.88	3.58	5.33	29.36
Labor costs per 1000 lei of total production	€	54.30	51.36	64.16	252.38
Material expenses per 1000 lei total production	€	116.00	122.80	103.25	508.39
Expenses per 1000 lei of main production	€	171.46	177.90	164.77	756.13
Profit or loss per product unit	€	0.13	0.11	0.14	0.71
Rate of taxable income	%	32.51	24.11	30.36	35.72
Rate of net income without subsidies	%	29.25	21.69	27.33	32.14
Rate of net income + subsidies	%	32.20	25.61	30.29	36.26
Breakeven point in value units	€	155.21	124.62	151.06	541.50
Breakeven point in physical units	l	248.60	196.23	261.09	188.13
Operating risk rate	%	82.33	84.19	68.11	71.35
Security Index		0.18	0.16	0.32	0.29

Source: Own calculations

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Correlations between indicators

The correlation coefficient of 0.87 calculated between total expenses and production value indicates a very good association between the two variables, and the coefficient of determination R^2 shows that 75.61% of the production value can be explained by linear relationship with total expenses (Figure 10).

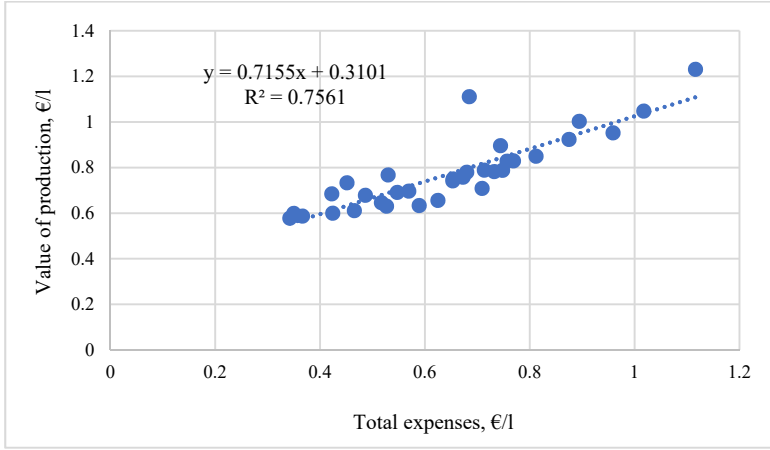

Figure 10 – Correlation between total expenses and value of production
Source: own calculations

Correlation between farm size and total production is a good one, the coefficient being 0.66, and the coefficient of determination R^2 shows that 43.15% of total production is explained by linear relationship with the farm size, the rest being other determinants (Figure 11).

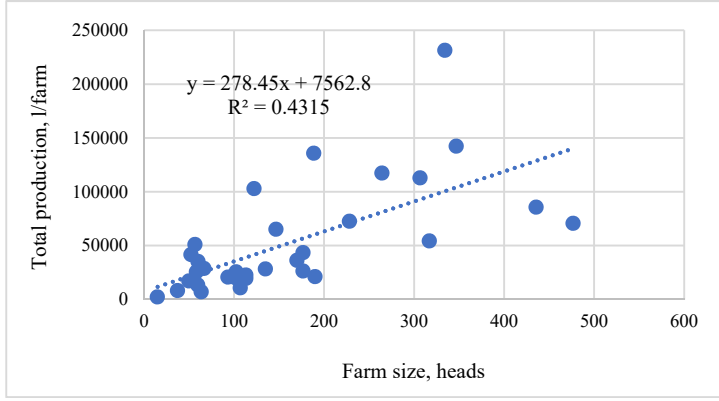

Figure 11 – Correlation between farm size and total production
Source: own calculations

The correlation coefficient of 0.55 calculated between total production and the rate of taxable income indicates a moderate correlation between the two variables, and the coefficient of determination R^2 shows that 30.74% of the rate of taxable income can be explained by the linear relationship with total milk production of farm (Figure 12).

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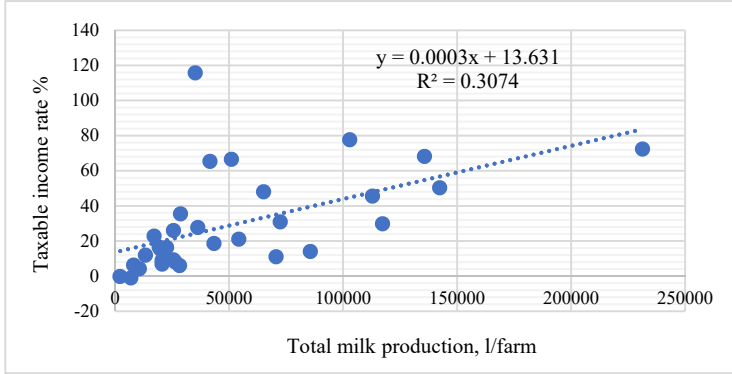

Figure 12 – Correlation between total production and taxable income rate
Source: own calculations

Between total production and operating risk rate resulted a correlation coefficient of -0.59, which indicates a good relation between the two variables, and the coefficient of determination R^2 shows that 34.92% of the operating risk rate can be explained by the linear relation with total milk production of farm (Figure 13).

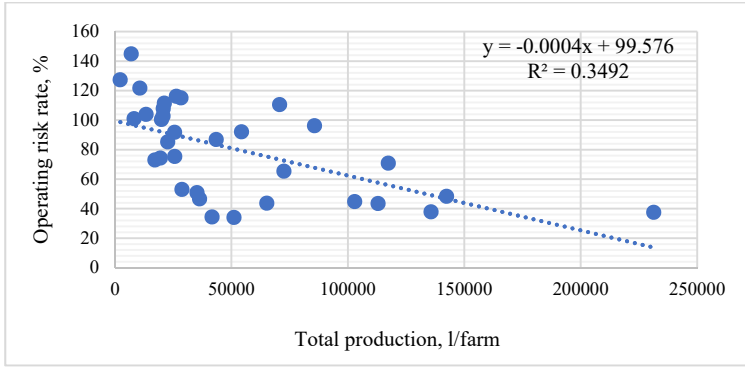

Figure 13 – Correlation between total production and operating risk rate
Source: own calculations

DISCUSSIONS

The analysis of different synthesis indicators highlighted the fact that there is a complexity of determinants that compete to obtain favorable economic results [3] in a goat farm and they refer to the farm size, average and total milk production, expenses incurred, market context for marketing the production, degree of processing production (primary processing, or creating added value through the delivery of superior varieties of cheese), farm general management etc. [10]. Apart from farm size, other determinants such as farmer experience and management practices influence the efficiency of goat rearing systems [7].

The results on landforms indicate that mountain area is more vulnerable in raising dairy goats, due to the problematic access of inputs, higher expenses, especially with transport. Economic zoning can be an important lever for the establishment of sectoral development strategies and policies, which respond to specific needs and which allow preserving the individuality of each area [8].

Farms in the smallest categories in these case studies are the most vulnerable from an

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economic point of view and fail to adapt quickly to changes in the economic environment, except in cases where the lower number of heads is compensated by a high average production. Increasing competition requires ways of knowing the economic environment and adapting the farm to its demands [18]. In the case of larger farms, even if the average production is not high, it is compensated by the number of animals, which will ensure that positive results are obtained. Selling value-added products at higher prices is an important factor for obtaining favorable economic results. The influence of the goat farm size on the efficiency and productivity of the activities is significant. Large and medium farms were more technically efficient than the small ones, which have the possibility to increase their competitiveness by increasing their size [15].

Keeping into account that feeding costs have the highest share, the forage management systems may result in the identification of the most efficient and profitable variants, which can be used by farmers to generate a favorable economic response [1]. Any measure to reduce costs must be based on the analysis of the dynamics and structure of expenses in correlation with the volume of activity [14]. The level of prices depends on the evolution of the supply-demand ratio, in which the level of competitiveness plays an important role [5]. A viable solution for farmers could be their integration in associative structures, to increase access to more efficient technologies, information on resources and market, as well as to ensure the valorization of productions and increase representativeness on the various markets [12].

CONCLUSIONS

Considering the results of the research and the levels of the economic efficiency indicators that were calculated, it can be stated that economic vulnerability and operational risk are manifested in all goat farms, but at different levels. But goat farms of small size (below 100 heads and 101-200 heads) and with low productions, which are engaged in the system of valorization of milk production on the market, constitute the most vulnerable sample from the economic point of view.

The most significant characteristic of small farmers is represented by low level of means at their disposal. On the other hand, they face difficulty to obtain credits, which leads to the impossibility of procuring inputs and other materials necessary for carrying out production processes. Market access is difficult and they face with price volatility. So, they are deprived of socio-economic power and often face a low level of income. That is why it is necessary for these farmers to use the means of production at their disposal as efficiently as possible, to cover their expenses.

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