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Contributions to the development of the pig sector in Romania

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CONTRIBUTIONS TO THE DEVELOPMENT OF THE PIG SECTOR IN ROMANIA

AURELIAN BULIGA-ȘTEFĂNESCU¹, RALUCA ALEXANDRA RĂDOI², MANEA DRĂGHICI³

Abstract

In Romania, pork represents 50% of the total types of meat consumed per capita, which places it in the first place in the hierarchical distribution of the most consumed types of meat nationally. These data underline the importance of the pig sector and the relevance of studying the economic actors in this field of activity, which is essential for meeting the consumption needs of the population. This article aims to obtain a correct and general picture of the pig sector in Romania, by determining the variables involved in the productivity of the most important pig farms on the domestic market. The approach, based on the analysis of financial results, analyzes indicators of the trend generated by the average (average, standard deviation, standard error, coefficient of variation, growth rate, etc.) and the function Cobb-Douglas, used to know the productivity of the production factors involved. The analysis also seeks to determine how and how much labor and capital, as production factors influence the turnover and other economic indicators.

Keywords: pork, producers, Cobb-Douglas, Romania

JEL classification: Q11, Q12

INTRODUCTION

The pig farming sector is a dynamic sector that has undergone enormous changes in recent years. Pork is one of the significant sources of animal protein, being appreciated globally for its characteristics, an aspect also revealed by the widespread consumption. This fact is also highlighted by the Food and Agriculture Organization of the United Nations (FAO), which, in a hierarchy of the most consumed types of meat, ranks it first. [16, 28]

Through its gastronomic valences, pork enjoys a special popularity all over the globe, but especially in Romania, where it is part of the traditional culinary culture. Thus, of all types of meat, it is the most consumed by Romanians, the average annual consumption being 38 kg / capita in 2019, according to INSSE, close to the EU average, but well below the average consumption in Germany (58.05 kg / capita / Portugal (44 kg / capita / year), as shown by Eurostat data. [32, 33]

Despite the increased consumption of pork, the number of pigs in Romania had a downward trend, reaching 57.13% in 2020 compared to 2007, the year 2020 registering a total number of 3750 thousand heads. [33]

Pig farmers have had to adapt to market demands, and their efforts have been aimed at increasing efficiency, reducing costs and preventing potential pathologies. These challenges have been doubled by the new European directives, which have required farmers to reorganize their production process in order to reduce ammonia emissions and waste management. Particular attention has been paid in European regulations to the living conditions of animals, to ensuring their welfare and safety, and to limit the actions of stressors. [5]

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Since 2017, farmers have had to face a new challenge amid the spread of the African swine fever virus (ASF). This affects the entire process of production and distribution of pork, representing a serious problem especially on the Romanian market, already dominated by the challenges mentioned above. [16]

In this context, imports have become the main means of meeting consumer needs at the national level. ITC data (International Trade Center) show an increase of over 20.55% in the quantities of imported pork and 23.86% in its value between the reference years 2017, the year of the spread of African swine fever, and 2020, the year of the new coronavirus spread. [34]

The most important countries of pork origin were Spain (with 27.18% of total imports; 161.5 million euros), Hungary (20.26%; 120.4 million euros) and Germany (18, 58%; 110.4 million euros). The report from 2020 to 2007, as the moment of Romania's accession to the European Union, indicates an increase in value by 84.94%, from 321.3 million euros to 594.1 million euros, and quantitative by 45.96% in quantity, from 191.9 thousand tons to 280 thousand tons. [34]

THE STAGE OF KNOWLEDGE

1. Market situation

The main factors that produced significant negative effects on the activity of Romanian pig farmers were the African swine fever (ASF), which has reached alarming proportions since 2017, and the Covid-19 pandemic, which caused major problems in 2020 and 2021. [1.5]

The ASF epidemic has resulted in losses of more than 900 million euros for pig farmers, the problems being exacerbated by the virulent spread of Covid-19 and the restrictions imposed by the authorities to stop the pandemic. [22, 36] The pandemic has left a strong mark on the pig sector, already fragile at the beginning of the pandemic, after more than 2 years (2017-2019) in which it had to face the challenges imposed by the ASF. [5]

At present, we can talk about a real decline in the pig sector, which is based on a multitude of factors. It should be borne in mind that the two moments of crisis (ASF in 2017 and Covid-19 in 2020) only exacerbated pre-existing structural deficiencies, which were based on causes such as:

1. Significant price differences between meat supplied by domestic producers and that imported from the European Union, the latter being sold at much better prices for consumers. [27] Market inequities make it virtually impossible for fair competition between local and foreign producers. [36]
2. The data presented by roaliment.ro indicate a significant decrease in the price of pork, reaching 1.52 euro / kg live in 2020, which translates into a decrease of 7% compared to 2019. [23] Moreover, the cumulation of adjustments negative value in the case of the animal stock reached -10.7 million euros. [2. 3]
3. Romania's dependence on the European Union in terms of purchasing piglets, their prices being particularly high. [14, 15]
4. High prices for fodder and breeding sows, respectively. [14,15]
5. In addition to the high costs of imports, the costs involved in the production process make the activity even less profitable. [15]
6. The fluctuating nature of the market translates into the unpredictability of the sector, with significant price fluctuations. [18]

The two major epidemiological crises, namely the African swine fever crisis (ASF) and the Covid-19 pandemic, overlapped with these causes related to the way the market is structured and functions in this field of activity, making production and capitalization of porkeven more difficult.

1.1. African swine fever (ASF)

Data provided by ANSVSA (National Sanitary Veterinary and Food Safety Authority) for 2020 indicate that 24 commercial holdings and 610 households were forced to slaughter pigs on the ASF fund, receiving compensation from the authorities. [35] According to the same institution, the costs generated by the ASF amounted to 190.2 million lei in 2020, their value since the outbreak of the crisis, so for the period 2017-2020, being not less than 600.4 million lei. [35] On the other hand, estimates provided by the Association of Romanian Pork Producers (APCPR) indicate losses of more than one billion euros during the ASF crisis, i.e. in the period 2017-2020. [17, 36]

African swine fever has once again raised the issue of the profitability and predictability of the activity of pig farms and has necessitated the development of innovative solutions to stop the epidemic and prevent such events in the future. Among the most frequently cited measures were biosecurity, which would have the ability to limit the spread of ASF and mitigate its devastating effects. Even if such measures cannot be categorized as salutary, we must not lose sight of the fact that, in the case of ASF, we are not only talking about a health problem related to the contagious disease, but also an economic problem involving complex structural mechanisms. Firms implementing biosecurity strategies are and will continue to be affected by overcrowding as a result of restricting the movement of livestock. [12]

1.2. Covid Pandemic 19

The effects of the pandemic crisis have overlapped with the effects of the swine fever epidemic crisis, but also by the structural problems of the market, mentioned above, which make pig farming an activity that is too unprofitable. It is not surprising that, in the absence of regular subsidies received from the European Union, many Romanian farmers would not be able to carry out their activity, given the differences in market prices and their variability, as well as the high costs involved in production. Romanian pig farmers could not function in a self-sustaining way anyway, and the Covid-19 pandemic meant the failure of some of them [21,24] and the danger of bankruptcy for others. [10, 25]

The financial support received from the authorities is an important but not sufficient support for the revitalization of the sector, which has been hit successively by the two crises. In this context, OUG 150 / 27.08.2020 is published in September 2020, by which the state undertakes to financially support pig farmers to correct the devastating economic effects of the spread of the new coronavirus. The amounts allocated in 2020 reached the value of 100 euro / UVM, at a conversion rate equal to 0.3 UVM – „fat pig” and 0.5 UVM – „*breeding animals*”. The number of beneficiaries was 292 in 2020, with an average allocation of 62,940.75 Euro / farm, according to information published by APIA. The maximum amount available for a farmer was 100,000 euros, with the possibility of cumulation with various other sources of financial allocations to support the activity and reduce the effects of the pandemic. [31]

The Covid-19 pandemic has had and continues to have a detrimental effect on economic life as a whole, but especially in the pig sector, where consumption needs have outpaced domestic production capacity. The increase in imports has increased significantly, with the vicious circle

leading to an increase in the difficulties faced by domestic producers [16]. A crisis in the pig sector would result in a significant food crisis.

MATERIAL AND WORKING METHOD

1. Profitability of production factors in the pig farming sector

The economic concept of combination refers to the fact that the same result can be achieved by different ways of combining factors of production. In the case of the pig sector, the combination of factors of production aims to identify the most efficient combination in order to maximize productivity and profit. The combined action must consider both markets demands and available resources, understood as the totality of the means and tools that can be used to increase productivity in the services provided or the goods produced. [7, 26]

Substitution, on the other hand, is about replacing factors. Productivity is analyzed, from the perspective of substitution, in relation to labor and capital, according to the formula:

$$Q = f(L, K)$$

Productivity (Q) is the result of the combination of labor (L) and capital (K). This function mathematically expresses the relationship between productivity and how the two determinants were combined (the amount of labor and the amount of capital) in order to maximize profit, to connect to market requirements and reduce costs. [7, 26]

In economic theory, there are many ways to combine these variables to get the best results. Among the extremely complex theoretical models, we mention the model proposed by Cobb-Douglas, which sees the correlation between capital and labor as one of the important sources of productivity. [3,4,11] In times of crisis and economic unpredictability, such as the Covid-19 pandemic, it becomes imperative to study the various ways of combining them to determine their effectiveness in specific sectors of economic activity, such as pig farming. [11]

2. REFERENCES, methods and indicators used

The study is based on data available from the National Institute of Statistics (INSSE), Eurostat and data obtained from the Ministry of Finance for the period 2005-2020.

The following were used as statistical indicators for analysis and projection: mean, standard deviation, annual growth rate [2] , and second degree trend equations and correlation coefficients (R and r) [19]. The **Cobb-Douglas function of the form** $Q = A * K^{\alpha} * L^{\beta} * e^{\lambda t}$ was used to calculate the coefficients of elasticity, **where:** [7,8]

Q = turnover of the company;

A = scale parameter;

α, β, λ = coefficients of elasticity of real gross value added in relation to each of the influencing factors used

t = time variable (1, 2, 3,... n)

In the technical progress Cobb-Douglas model, the parameters α and β represent the coefficients of elasticity of the real value in relation to the two factors, capital (K) and average number of employees (L), which measure the relative variation of real value added in depending on the relative variation of the factors of production, and λ expresses the influence of the technical progress on the increase of the turnover. [7,8,20]

RESULTS AND DISCUSSIONS

The following tables show various indicators that characterize the situation of the pig sector, from the beneficiaries of subsidies to the determination with the help of the Cobb Douglas function of the increase in production factors.

Table 1 shows the first 30 beneficiaries of grants, out of a total of 219, according to the amount paid for measure 215/14 - Animal welfare payments - package a) - pigs for the 2020 Campaign. [31] As it can be seen, these companies managed to absorb 32.12 million euros in 2020 (66.54% of the total amounts paid by APIA for this measure: 48.27 million euros) (APIA, 2021). Among the companies presented in table 1, Smithfield Romania SRL is the only one that has CAEN declared at the Ministry of Finance as 1011 „*Meat processing and preservation*” (Caen mainly, from which most of the revenues are obtained). The rest of the companies under analysis declared CAEN Code 0146 – „*Pig breeding*”. [29]

For the calculation of the profitability rate, the indicator of *net profit* results was reported to an indicator that reflects a „*net turnover*” activity flow . [6] The financial indicators of the companies have been extracted from the website of the Ministry of Finance. The calculations show that subsidies play an important role in the profitability of the sector. Of the 30 companies, seven reported financial losses in 2020 compared to 2013 when only two companies reported losses.

Through a simulation we deducted from the realized profit the amount of the subsidy and we found that another 13 companies out of 30 would pass on the loss (66.67%). [9, 29] We find that subsidies received by farmers are vital both for animal welfare and for improving financial performance.

Table 1. The beneficiaries top of subsidies for pigs sector welfare in 2020

No..	Company name	2020 grant	2020				2013				Evolution of the profit rate 2013-2020
			Turnover	Advantage	Loss	Profit rate	Turnover	Profit	Loss	Profit rate	
		Thousands €	Thousands €	Thousands €		%	Thousands €	Thousands €		%	
1	Smithfield România S.R.L.	8.54	269.5		-14.93	-	172.99	23.75		13.73	-
2	Degaro S.R.L.	2.34	36.43	1.83		5.03	13.91	1.98		14.23	↓
3	Suinprod S.A. Roman	1.72	18.27	2.45		13.43	10.88	0.07		0.63	↑
4	Premium Porc Sibiu S.R.L.	1.7	21.12		-3.49	-	-	-		-	-
5	Agrisol Internațional RO	1.52	59.28	22.49		37.94	63.8	0.69		1.08	↑
6	Nutricom S.A. Oltenița	1.31	17.95		-2.78	-	48.89	1.22		2.49	-
7	Landbruk S.R.L.	1.21	14.22	0.11		0.76	4.83	0.47		9.73	↓
8	Porcellino Grasso S.R.L.	1.15	15.54	0.93		5.98	14.9	0.85		5.74	↑
9	Premium Porc S.R.L.	0.87	21.14		-0.22	-	13.82	1.13		8.18	-
10	Latini Com S.R.L.	0.79	5.46	1.01		18.44	2.51			0.02	↑
11	Repro Farm S.R.L.	0.78	5.02	0.05		1.04	0			-	-
12	Agrikilti S.R.L.	0.78	9.03	0.02		0.24	0		-0.03	-	-
13	Veres Agro Prod Com S.R.L.	0.74	7.1	2.44		34.39	3.14	0.18		5.63	↑
14	Eurospațial S.R.L.	0.73	7.88	0.56		7.13	6.24	0.48		7.64	↓
15	Abo Mix S.A.	0.7	6.65	0.56		8.43	11.31	0	-6.46	-	-
16	Consinterfin S.R.L.	0.69	13.22		-0.86	-	12.17	1.97		16.18	-
17	Premium Porc Negreni S.R.L.	0.67	14.28		-3.43	-	0.59	0.03		5.45	-
18	Cirrus Comexim S.R.L.	0.58	8.86		-1.08	-	7.51	0.14		1.9	-

19	Europig S.A.	0.54	14.69	0.02		0.14	12.79	0.01		0.08	↑
20	FermaPorcul De Băilești S.R.L.	0.53	7.32	1.38		18.85	1.32	0.02		1.33	↑
21	CombinatulAgroindustrialCurtici S.A.	0.51	6.06	0.81		13.31	2.56	0.03		0.99	↑
22	Tebu Consult Invest S.R.L.	0.5	18.8	3.5		18.61	3.53	0.33		9.39	↑
2. 3	Agro Pig S.R.L.	0.44	4.4	0.08		1.77	5.4	0.31		5.7	↓
24	Porkprod S.R.L.	0.42	7.03	0.13		1.88	3.57	0.25		6.95	↓
25	Nutripig S.R.L.	0.42	3.86	0.04		1.06	3.08	0.04		1.36	↓
26	Fermeplus S.R.L.	0.42	4.18	0.31		7.51	5.71	0.68		12	↓
27	Zoosab S.R.L.	0.41	7.7	2.24		29.15	4.09	0.79		19.33	↑
28	SuinprodSiret S.R.L. Bacău	0.4	3.99	0.58		14.6	5.11	0.02		0.46	↑
29	Nutrisuin S.R.L.	0.37	5	0.04		0.89	8.66	0.03		0.36	↑
30	Agrova Pork Farm S.R.L.	0.34	4.25	0.04		0.91	-	-		-	-
TOTAL		32.12	638.23	41.62	-26.79		443.31	35.47	-6.49		

Source: Own calculation based on data obtained from APIA (personalized address no. 198 / SIIP / 10.092021) and the Ministry of Finance, <https://mfinante.gov.ro/persoane-juridice/informatii-fiscale-si-bilanturi>

In absolute figures, it can be seen that the profit obtained by the 30 companies increased in 2020 compared to 2013 from 35.47 million euros to 41.62 million euros (+ 17.33%). The recorded loss increased from -6.49 million euros in 2013 to -26.79 million euros in 2020 (+20.3 million euros). From table 1 it can be seen that the loss of 2020 is caused mainly by Smithfield Romania SRL (-14.93 million euros). [29]

Table 2. Evolution of CANE 0146 indicators – „Pig breeding”

Indicator	Turnover	Pr.	Profit rate	Loss	No employees	Fixed assets
MU	Thousands €	Thousands €	%	Thousands €	Nr.	Thousands €
2016	474.10	32.71	6.90	-4.60	3,590	336.92
2017	547.95	75.89	13.85	-4.44	4,021	389.44
2018	499.73	43.34	8.67	-9.00	4,339	411.73
2019	555.21	53.06	9.56	-12.20	3,931	425.54
2020	495.86	45.94	9.26	-18.26	3,562	452.11

Source: Own calculation based on data obtained from the Ministry of Finance, <https://mfinante.gov.ro/persoane-juridice/informatii-fiscale-si-bilanturi>

The turnover (Q) registered on CAEN 0146 – „Pig breeding” at the level of 2020 was 495.86 million euros with \$ 59.35 million less than the value registered in 2019 (-10.69%). [29]

In 2020, the profit of the pig breeding sector in Romania was 45.94 million euros, 13.42% less than in 2019. Compared to 2017, the net profit decreased by 39.47% from 75.89 million in 2017 to € 45.94 million in 2020.

The net loss in 2020 was -18.26 million euros, 6.06 million euros more than in 2019 and four times higher than in 2017 (-4.44 million euros).

The number of employees (L) increased in the period 2016-2018 by 20.86% from 3,590 people to 4,339 people. African swine fever along with the Covid 19 pandemic caused the number of employees in the sector to fall below 2016 (-777 people).

Fixed assets (K) increased by 34.19% between 2016 and 2020, from 336.92 million euros to 452.11 million euros.

Only companies that were at least 15 years old were selected for the accuracy of the analysis of the coefficients of the **Cobb Douglas** function. Through this selection criterion the number of companies was reduced from 30 to 20.

When we talk about the dependence of turnover (Q) on certain factors, in this case the number of employees (L) and fixed assets (K), we are actually talking about the elasticity of the turnover of the fixed assets factor and the elasticity of turnover of the labor factor. [7]

We have the relationship of the type:

$$Q = A * K^{\alpha} * L^{\beta} * e^{\lambda t}$$

After performing logarithmic transformations, we obtain:

$$\ln(Q) = \ln(A) + \alpha \ln(K) + \beta \ln(L) + \lambda t$$

By estimating the regression model for each selected company, the results in Table 3 are obtained.

Thus, for Smithfield Romania SRL, the estimated model is:

$$\ln(Q) = 4.49 + 0.12 \ln(K) - 0.17 \ln(L) + 0.11 * t$$

Table 3. Cobb Douglas function estimated value for the companies analyzed

No.	Company name	A	K	L	λt	R^2	r	$F_{calc.}$	significance
			α	β					
1	Smithfield Romania SRL	4.49	0.12	-0.17	0.11	0.86	0.93	22.64	S
2	Degaro SRL	-6.76	-0.18	2.29	0.01	0.98	0.99	253.52	S
3	Suinprod SA Roman	-0.91	-0.52	0.77	0.08	0.7	0.84	9.44	S
5	Agrisol International RO	-9.57	-0.01	1.94	0.02	0.88	0.94	28.45	S
6	Nutricom SA Oltenita	-7.09	0.18	1.57	0.07	0.58	0.76	5.55	S
9	Premium Porc SRL	2.35	1.81	-1.44	0.16	0.89	0.94	28.91	S
10	Latini Com SRL	-4.72	-0.2	1.65	0.02	0.78	0.89	14.53	S
13	Veres Agro Prod Com SRL	-1.73	-0.6	-1.48	0.69	0.83	0.91	19.22	S
14	Eurospatial SRL	1.23	0.12	-0.06	0.07	0.77	0.88	13.18	S
15	Abo Mix SA	3.36	-0.32	0.14	-0.12	0.64	0.8	7.25	S
16	Consinterfin SRL	-4.85	1.31	0.93	0.1	0.82	0.91	18.4	S
17	Premium PorcNegreni SRL	-4.41	0.27	1.09	0.2	0.8	0.89	11.97	S
18	Cirrus Comexim SRL	-4.54	0.27	2.33	-0.17	0.96	0.98	104.62	S
19	Europig SA	-2.97	0.22	0.87	0.04	0.93	0.97	54.44	S
21	CurticiAgroindustrial Plant	-2.36	0.51	0.66	0.06	0.86	0.93	24.49	S
24	Porkprod SRL	0.47	0.02	-0.37	0.2	0.88	0.94	27.07	S
25	Nutripig SRL	0.08	0.07	0.2	0.02	0.44	0.66	3.13	S
27	Zoosab SRL	0.68	0.33	-0.19	0.12	0.81	0.9	17.34	S
28	SuinprodSiret SRL BACAU	-4.92	0.79	1.33	-0.01	0.9	0.95	34.51	S
29	Nutrisuin SRL	-8.43	1.14	3.33	0	0.59	0.77	5.76	S

Source: Own calculation based on data obtained from the Ministry of Finance, <https://mfinante.gov.ro/persoane-juridice/informatii-fiscale-si-bilanturi>

Based on the results obtained for Smithfield Romania SRL we can conclude the following:

- the dependence between turnover (Q) and the two factors (labor and capital) is about 86% ($R^2 = 0.86$), which attests to a functional link between the dependent variable (Q) and the independent variables (K, L, technical progress (λ)).
- The elasticity of turnover (Q) with respect to the fixed assets factor (K) is 0.12, respectively if the fixed assets factor increases by 1%, then the turnover will increase by 0.12%;
- The elasticity of turnover (Q) compared to the number of employees' factor (L) is -0.56, respectively if the number of employees' factor will change by 1%, then the turnover will change by -0.56%;

Theoretically, forecast production functions are used for the following purposes:

- „1. to calculate the activity result (Q / CA) that can be obtained at the forecast horizon based on the available factors of production under the allowed conditions of elasticity;
2. to determine the rate of increase of the factors necessary to obtain the predicted Q;
3. for the design of an efficient combination of factors of production.
4. to determine the differential efficiency of the factors of production;

5. to analyze the relationship between labor productivity, the endowment of fixed-capital labor and the efficiency of the use of fixed capital.” [13]

Table 4 Extrapolation of production factors by 1% according to the estimated Cobb-Douglas function

No.	Company name	Cobb-Douglas function	$\Delta 1\% K$	1% L	$\Delta 1\% \lambda t$	$\Delta 1\% K, L, \lambda t$
			thousand € / expl	thousand € / expl	thousand € / expl	thousand € / expl
1	Smithfield Romania SRL	$Q = e^{4,49} \cdot K^{0,12} \cdot L^{-0,56} \cdot e^{0,11}$	2.95	-3.45	-52.86	-54.24
2	Degaro SRL	$Q = e^{-6,76} \cdot K^{-0,18} \cdot L^{2,29} \cdot e^{0,01}$	-7.80	5.01	-0.55	4.11
3	Suinprod SA Roman	$Q = e^{-0,91} \cdot K^{-0,52} \cdot L^{0,77} \cdot e^{0,08}$	-0.29	0.70	-2.46	-2.12
5	Agrisol International RO	$Q = e^{-9,57} \cdot K^{-0,01} \cdot L^{1,94} \cdot e^{0,02}$	13.34	8.42	-1.78	6.37
6	Nutricom SA Oltenita	$Q = e^{-7,09} \cdot K^{0,18} \cdot L^{1,57} \cdot e^{0,07}$	-0.03	2.26	-3.22	-1.13
9	Premium Porc SRL	$Q = e^{2,35} \cdot K^{1,81} \cdot L^{-1,44} \cdot e^{0,16}$	7.14	-0.86	-3.66	-3.88
10	Latini Com SRL	$Q = e^{-4,72} \cdot K^{-0,2} \cdot L^{1,65} \cdot e^{0,02}$	-0.38	0.30	-0.22	0.06
13	Veres Agro Prod Com SRL	$Q = e^{-1,73} \cdot K^{0,6} \cdot L^{-1,48} \cdot e^{0,69}$	-2.98	-0.91	-14.19	-14.48
14	Eurospatial SRL	$Q = e^{1,23} \cdot K^{0,12} \cdot L^{-0,06} \cdot e^{0,07}$	0.12	-0.03	-1.14	-1.14
15	Abo Mix SA	$Q = e^{3,36} \cdot K^{-0,32} \cdot L^{0,14} \cdot e^{-0,12}$	0.04	0.03	1.43	1.45
16	Consinterfin SRL	$Q = e^{-4,85} \cdot K^{1,31} \cdot L^{0,93} \cdot e^{0,1}$	-0.66	0.74	-3.52	-2.45
17	Premium PorcNegreni SRL	$Q = e^{-4,41} \cdot K^{0,27} \cdot L^{1,09} \cdot e^{0,2}$	1.82	0.83	-7.46	-6.81
18	Cirrus Comexim SRL	$Q = e^{-4,54} \cdot K^{0,27} \cdot L^{2,33} \cdot e^{-0,17}$	-1.51	0.73	3.12	4.19
19	Europig SA	$Q = e^{-2,97} \cdot K^{0,22} \cdot L^{0,87} \cdot e^{0,04}$	4.05	0.70	-1.28	-0.56
21	CurticiAgroindustrial Plant	$Q = e^{-2,36} \cdot K^{0,51} \cdot L^{0,66} \cdot e^{0,06}$	-0.27	0.74	-2.13	-1.29
24	Porkprod SRL	$Q = e^{0,47} \cdot K^{0,02} \cdot L^{-0,37} \cdot e^{0,2}$	0.88	-0.12	-2.31	-2.39
25	Nutripig SRL	$Q = e^{0,08} \cdot K^{0,07} \cdot L^{0,2} \cdot e^{0,02}$	0.07	0.03	-0.15	-0.12
27	Zoosab SRL	$Q = e^{0,68} \cdot K^{0,33} \cdot L^{-0,19} \cdot e^{0,12}$	0.04	-0.07	-1.74	-1.77
28	SuinprodSiret SRL Bacau	$Q = e^{-4,92} \cdot K^{0,79} \cdot L^{1,33} \cdot e^{-0,01}$	0.16	0.21	0.11	0.35
29	Nutrisuin SRL	$Q = e^{-8,43} \cdot K^{1,14} \cdot L^{3,33} \cdot e^0$	1.66	0.27	0.01	0.27

Source: Own calculation based on data obtained from the Ministry of Finance, <https://mfinante.gov.ro/persoane-juridice/informatii-fiscale-si-bilanturi>

Table 4 shows several situations:

1. The increase of only the *capital* production factor (K) by 1% determines the increase of the turnover for 12 companies (60%). For eight companies, the 1% capital increase leads to a decrease in turnover.

2. The increase of only 1% of the *labor* factor (L) determines the increase of the turnover for 14 companies (70%). For six companies, the increase in the number of employees by 1% leads to a decrease in turnover.

3. The increase by only 1% of the *technical progress* production factor (λt) determines the increase of the turnover only for 4 companies (20%). For 16 companies, the 1% increase in the production factor *technical progress* leads to a decrease in turnover.

1. The increase of all production factors determines a positive evolution for the turnover of three companies: Abo Mix SA, SuinprodSiret SRL Bacău, Nutrisuin SRL

E.g:

- in the case of Smithfield Romania SRL by increasing by 1% the *capital* production factor (K) the estimated Cobb-Douglas function, $Q = e^{4,49} \cdot K^{0,12} \cdot L^{-0,56} \cdot e^{0,11}$, returns an increase in turnover by 2.95 millionEuro;

- in the case of Degaro SRL by increasing by 1% the *capital* production factor (K) the estimated Cobb-Douglas function, $Q = e^{-6,76} \cdot K^{-0,18} \cdot L^{2,29} \cdot e^{0,01}$, returns a decrease in turnover by -7.80 million euros.

CONCLUSIONS

In 2020, Romanian pig farmers benefited from the following subsidies:

1. Measure 14 - Animal welfare, 219 beneficiaries, 48,268,517.76 euros.
2. The state aid scheme to support the activity of pig farmers in the context of the economic crisis generated by the COVID-19 pandemic, 292 beneficiaries, 18,378,700.00 euros.

Although were backed, companies operating in CAEN 0146 – „*Pig breeding*” have net loss in 2020 of -18.26 million euros, 6.06 million euros more than in 2019 and four times higher than in 2017 (-4.44 million euros).

The analysis shows the importance of the use of the Cobb-Douglas production function by farmers in the resource management process.

We have demonstrated with this function that the most important factors of production (labor and capital) generally have a positive effect on the turnover of the main companies studied.

However, technical progress, increasing by 1%, would lead to a decrease in most companies.

The uncertainty created by the African swine fever epidemic and the COVID-19 pandemic highlights the importance of analyzing, forecasting and planning on a farm in order to increase profits during periods of *economic boom* and reduce losses during periods of market contraction.

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