Economics of Extensive Beef Cattle Farming in Greece

GEORGE I. KITSOPANIDIS*

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1. Introduction

The extensive beef cattle farming is an important branch of the Greek livestock economy. Indeed, it contributes directly to the increase in the domestic beef meat production and indirectly to the decrease in the beef meat imports, and also to the improvement in the farmers' income, especially in the semi-mountainous and mountainous regions.

There is no doubt that this branch of our livestock production faces certain problems relating to the existence of abundant pasture, to the lack of workers especially during the summer period in the mountains, to the high feed costs and the low beef meat price. The Greek Government and the European Union being aware of the aforementioned difficulties allocate subsidies to support this type of livestock farming whose viability can contribute to the survival of the corresponding farmers.

The investigation undertaken is based on a sample of 106 extensive beef cattle farms or 9304 beef cows, namely 7.6% of the total beef cows (122.024) of the regions studied and 4.8% of the total beef cows (194.616) of the whole country for the year 2002. The physical and economic da-

Abstract

The aim of this paper is to illustrate the possibilities and presuppositions which may allow the Greek extensive beef cattle farming to become viable and much more profitable. The investigation carried out is based on a sample of 106 farms located in various semi-mountainous and mountainous regions of Central and Northern Greece, which are the most important ones for beef meat production.

The analysis of the above beef cattle farms showed that the gross return of a beef cow without subsidies, amounting to € 374, cannot cover its total cost (€ 676), whereas with three subsidies (for cow, calf and slaughtering), amounting to € 699/cow, it is slightly higher (€ 23/cow) than its total cost. Therefore, it is impossible to ensure the viability of the extensive beef cattle farming under the present technical and economic conditions of our country without subsidies. Increasing the productivity of beef cows, by decreasing the feeding costs and by increasing the beef meat price, can generate an improvement of the economic position of this type of livestock farming. Apart from this improvement, the allocation of subsidies by the European Union and the Greek Government is deemed to be still necessary for beef cattle farming to become profitable and viable.

Résumé

Le but de ce travail est d'illustrer les possibilités et les conditions qui peuvent permettre à l'élevage bovin extensif en Grèce de devenir viable et beaucoup plus rentable. La recherche est basée sur un échantillon de 106 exploitations agricoles situées dans différentes régions semi-montagneuses et montagneuses de la Grèce centrale et septentrionale, et qui sont les plus importantes pour la production de la viande de bœuf.

De l'analyse de ces exploitations agricoles, il ressort que le bénéfice brut d'une vache à viande sans subventions, s'élevant à € 374, ne réussit pas à couvrir son coût total (€ 676), alors qu'avec trois subventions, s'élevant à € 699 /vache, il est légèrement supérieur (€ 23/vache) à son coût total.

Les résultats de cette analyse mènent à conclure que la viabilité de l'élevage bovin extensif est impossible dans les conditions techniques et économiques actuelles de notre pays en l'absence de subventions. Une amélioration de la situation économique de ce type d'élevage est possible si l'on augmente la productivité des vaches à viande, en réduisant les coûts de l'alimentation et en augmentant le prix de la viande de bœuf. A part cette amélioration, il faut encore compter sur les subventions de l'Union européenne et du gouvernement grec pour que ce type d'élevage puisse devenir rentable et compétitif.

ta were collected personally by using a special questionnaire. The following analysis refers to the gross return without and with subsidies in comparison with total costs, to the loss or profit, to the farm family income, to the return on capital, to the marginal value products of the resources used and to the marginal rate of substitution between concentrates and forages for estimating the least cost rations.

This investigation illustrates the present economic position of the extensive beef cattle farming and prescribes its future position in our livestock economy.

2. Economic analysis of this type of livestock farming

2.1 Physical and economic data referring to beef cows

The total capital invested per beef cow is € 675. This capital includes values of land, land improvements, buildings, machinery and farm truck. The annual wages of a worker per cow is €134. The number of cows per bull is 44. The value of a cow as productive animal is € 880, while for a bull it is estimated at € 1,467. The average productive life of a cow is 13.5 years, while it equals 3.5 years in the bull. The number of calves weaned from 100 cows per year was found to be 75 or 0.75 per cow. The average

* Emeritus Professor of Agricultural Economics University of Thessaloniki, Greece.

value of a calf at the age of 9 months is estimated to be €499 (table 1).

Table 1. *Physical and economic data referring to beef cows*	
Total capital invested (including farm truck) per cow	675 €
Annual wages of a worker per cow	134 €
Number of cows per bull	44
Value of a cow as productive animal	880 €
Value of a bull as productive animal	1467 €
Average productive life of a cow	13.5 years
Average productive life of a bull	3.5 years
Number of calves weaned per cow	0.75
Average value of a calf at the age of 9 months	499 €
Days of feeding animals during the winter period	150
Concentrates per cow (including bull and calf until 9 months)	682 kgs
Forages " " (" " " " ")	1625 kgs
Average price of concentrates per 100 kgs	18 €
Average price of forages per 100 kgs	7 €
Days of grazing in pasture areas in summer and autumn	215
Cost of using pasture per cow (including bull and calf)	18 €
Interest rate (for long and short-term loans)	% 10

The cows, bulls and calves are fed during the winter period for 150 days, while in the remaining period (spring, summer, autumn for 215 days) they are grazed in pasture areas. In the winter time the above-mentioned animals are given 682 kgs of concentrates and 1625 kgs of forages per cow (including bull and calf until 9 months). The prices of these kinds of feedingstuffs are € 18 per 100 kgs for the former and € 7 per 100 kgs for the latter. The grazing cost in pasture areas is estimated to be € 18 per cow (including bull and calf).

2.2 Economic analysis of beef cows

The gross return per cow is € 374 without subsidies, while with three subsidies (for cow, calf and slaughtering of them), it increases from€ 374 to €699 per cow. Finally, with two more subsidies (for extensification and compensatory allowances) the gross return increases from € 699 to € 843 per cow (table 2).

Among the various items of the total expenses per cow (including bull and calf until the age of 9 months), the most important one is feed (40,6%) and labour wages (19,8%), annual expenses (depreciation, mortality, interest) of cow and bull (18.7%), annual expenses (depreciation, repairs, insurance, interest) of buildings, machinery, farm truck, etc. (16.1%) and veterinary services and interest of variable capital and value of calf from 6 (period of weaning) to 9 months (period during which subsidies are received) (4,8%). The fact that 72,0% of the total costs are covered by fixed costs and the remaining 28.0% by variable costs means

that it is necessary to increase the number of calves weaned per cow and the fattening period.

Comparing gross return without subsidies with total costs, it may be highlighted that the former cannot cover the latter. This means that there is a loss of € 302 per cow and a negative farm family income and return on capital. The gross return with three subsidies covers the total costs and it gives a profit of € 23 per cow and a positive farm family income (€ 158/cow) and return on capital (12.7%). Finally the gross return with five subsidies not only covers the total costs but also determines a very high profit (€ 167 /cow) and a similar family income (€ 302/cow) and return on capital (26.2%). Given that the farm size of 70% of the farms investigated fluctuates between 50 and 100 cows, the farm family income received in 2002 fluctuated between € 7,900 and € 15,800 per year with three subsidies and between € 15,100 and € 30,200 per year with five subsidies.

2.3 Price and costs of produced beef meat

The average price of beef meat received by the farmers received during 2002 is € 3.668 per kg. In contrast, the average costs of beef meat produced is estimated to be

Table 2. *Economic analysis of beef cows*		
1. Gross return per cow		
Value of 0.75 calf at the age of 9 months	€ 374	
Subsidies for cow, calf and slaughtering	€ 325	
Subsidies for extensification and compensatory Allowances	€ 144	
Total		€ 843
2. Total costs per cow (including bull and calf)		
Labour wages	% 19.8	
Feed	" 40.6	
Annual expenses (depreciation, mortality, interest) of cow and bull	" 18.7	
Annual expenses (depreciation, repairs, insurance, interest) of buildings, machinery, farm truck, etc.	" 16.1	
Veterinary services, interest on variable capital and value of calf from 6 to 9 months	" 4.8	
Total		€ 676
3. Kinds of total costs		
Fixed	% 72.0	
Variable	" 28.0	
4. Profit or loss per cow		
Without subsidies		€ -302
With three subsidies		" 23
With five subsidies		" 167
5. Farm family income per cow		
Without subsidies		€ negative
With three subsidies		" 158
With five subsidies		" 302
6. Return on capital		
Without subsidies		% negative
With three subsidies		" 12.7
With five subsidies		" 26.2

Table 3. *Price and production costs of beef meat produced by a calf slaughtered at the age of 17 months and 256 kgs. of meat*

1. Beef meat price received by farmers		3.668 /kg
2. Beef meat production costs		5.132 »
Labour wages	% 13,6	
Feed	» 55,5	
Annual expenses (depreciation, mortality, interest) of cow and bull	» 12,8	
Annual expenses (deprecation, repairs, insurance, interest) building, machinery, truck, etc.	» 11,1	
Veterinary services, interest of variable capital and calf, etc.	» 7,0	
3. Loss		1.464 »
4. Break-even price		5.132 »

€5.132 per kg (table 3). Of the various items of the total costs of produced meat, the most important is feed (55.5%) followed by labour wages (13.6%), annual expenses of cows and bulls (12.8%), annual expenses of buildings, machinery and farm truck (11.1%) and veterinary services, interest of variable capital and value of calves, etc. (7.0%). Comparing the meat price received and the meat production cost, we see that this price can not cover the cost. This entails a loss of € 1.464 per kg, which can be covered by increasing the meat price up to €5.132 per kg. without subsidies.

3. Productivity analysis of this type of livestock farming

The productivity of the resources used in beef meat production and that of the two main kinds of feed (concentrates and forages) are of special importance from an economic point of view, because they may lead to the solution of some problems in extensive beef cattle farming. These problems refer to: a) the contribution of each production factor to the gross return achieved, b) the marginal productivity of the resources used in relation to their opportunity costs and c) the marginal rate of substitution of concentrates by forages and vice versa to obtain the same amount of beef meat at the lowest feeding costs. The data used were analyzed by applying the well-known Cobb-Douglas production function.

3.1 Marginal value products of resources used and their opportunity costs

The three farm resources included in the production function are: Cows (depreciation, mortality and interest of cows and bulls in € per cow), b) Labour wages in € per cow, and c) Feed (cows, bulls and calves until the age of 9 months in € per cow). The gross return obtained from the beef produced and the subsidies is also expressed in € per cow.

The sum of production elasticities (1.000) shows that there is a rather constant ratio between input and output, namely when the former doubles the latter dou-

bles as well. On the other hand, the coefficient of multiple determination (0.905) indicates that the variation in the gross return achieved depends, by 90.5%, on the variation of the three farm resources used (table 4).

The marginal value product of cows is higher (€525/cow) than their opportunity costs (€129/cow) as demonstrated by comparing marginal return to opportunity costs ratio (4.07). This means that it is profitable to keep cows producing this quantity of beef meat with the existing subsidies.

The marginal value product of labour, amounting to €118 per cow, is lower than labour wages (€134 /cow) as shown by its ratio to opportunity costs (0,88). The low marginal productivity of labour is due to the fact that labour is not organized efficiently in extensive beef cattle farming. This is confirmed by the fact that labour is used in large quantities and it is mainly based on foreign low-productivity workers.

The marginal value product of feed, amounting to €226 per cow, is lower than its opportunity costs estimated at €260 per cow. This is also confirmed by comparing marginal return to opportunity costs ratio (0,87). This means that cows producing the above quantity of beef meat per year can profitably utilize feed in lower amount or at cheaper costs than that used at present. However, the feed needed to reach the maximum total profit depends on the

Table 4. *Marginal productivity analysis of resources used in extensive beef cattle farming*

Number of farms	106
Period in year	2002
Y= Gross return (including five subsidies) in	
X_1= Cows (depreciation, mortality, interest including bull) in	b_1=0,604[a]
X_2= Labour (wages in per cow including bull and calf)	b_2=0,136[b]
X_3= Feed (in per cow including bull and calf until 9 months)	b_3=0,260[a]
Sum of b's	=1,000
R^2	=0,905
Marginal value products	
Cows in per cow	525
Labour in per cow	118
Feed in per cow	226
Opportunity costs	
Cows in per cow	129
Labour in per cow	134
Feed in per cow	260
Marginal return to opportunity cost ratios	
Cows	4,07
Labour	0,88
Feed	0,87
Level of probability for t	
a) 0,000>P>0,001	
b) 0,0001>P>0,072	

Table 5. *Marginal productivity analysis of concentrates and forages in extensive beef cattle farming*

Number of extensive beef cattle farms	106
Period in year	2002
Y= Beef meat production in Kgs	
X_1= Concentrates in kgs per cow (including bull and calf)	$b_1 = 0,221^a$
X_2= Forages in kgs per cow (including bull and calf)	$b_2 = 0,714^a$
Sum of b's	$= 0,935$
Marginal value products	
Concentrates per kg.	0,138
Forages per kg.	0,091
Opportunity costs	
Concentrates per Kg.	0,181
Forages per Kg.	0,071
Marginal return to opportunity cost ratios	
Concentrates	0,763
Forages	1,282
Level of probability	
a) 0,000>P>0,001	

capacity of the cows kept, on the price or cost of producing feedingstuffs and on the beef meat price.

The reliability of marginal productivity of farm resources is confirmed by the fact that most production elasticities were found statistically significant at 0.001 per cent level of probability.

3.2 Marginal value products of concentrates and forages and marginal rate of substitution between them to achieve the least cost ration

The feed supplied is divided into two main kinds i.e. concentrates and forages. Both kinds of feed are given in kgs converting meadow and pasture into quantities of hay. The marginal value product of concentrates, amounting to €0.138 per kg, is lower than its opportunity cost (€0.181/kg). In contrast, the marginal value product of forages, amounting to €0.091 per kg is higher than its opportunity cost (0,071 /kg). This is confirmed by the marginal return to opportunity cost ratios which is below 1 (0.763) for concentrates and exceeds 1 (1.282) for forages (table 5). The fact that the above ratio is higher than one for forages and lower than one for concentrates leads to increase the former and to decrease the latter to achieve a more economical ration. Indeed, the existing combination of these two kinds of feed in the actual ration is not the most profitable one since it does not lead to the least-cost ration to produce the same amount of beef meat. This may be reached by estimating the marginal rate of substitution of concentrates by forages.

The general equation of the marginal rate of substitution is:

$$\frac{dX_1}{dX_2} = \frac{b_2 X_1}{b_1 X_2}$$

which shows the amount saved on feed X1 (concentrates), by supplying one additional unit of feed X2 (forages) to produce the same amount of beef meat. The marginal rate of substitution leads to a decrease in the total feeding costs per cow. However, the least-cost ration is achieved when this rate of substitution becomes 0.393 kgs per 1 kg: or €1 per €1. As a matter of fact, the marginal rate of substitution decreases progressively when feed X1 decreases and feed X2 increases. The total amount of feed X1, which corresponds to a certain total amount of feed X2, is estimated by the following equation:

$$X_1 = \left[\frac{Y}{\alpha X_2^{b_2}} \right]^{1/b_1}$$

As a result, the marginal rate of substitution becomes 1 €/€ when 458.7 kgs of concentrates and 3775 kgs of forages per cow are combined. Indeed, at this level of concentrates and forages the lower possible feeding cost is achieved, namely €351,96 per cow instead of €361,63 per cow or 2.7% lower (table 6).

The reliability of the marginal productivity of concentrates and forages is confirmed by the fact that production elasticities were found statistically significant at 0.001 per cent level of probability.

Consequently, of utmost importance are forages and especially meadow and pasture to decrease the feeding costs of beef cows located in mountainous and less developed areas.

4. Conclusions

In this work an attempt was made to illustrate the possibilities and the presuppositions which may allow the Greek extensive beef cattle to become viable and much more profitable. The investigation undertaken was based

Table 6. *Marginal rate of substitution of concentrates by forages to achieve the same quantity of beef meat (100 kgs/cow)*

Concentrates (kgs/cow)	Forages (kgs/cow)	Average marginal rate of substitution of concentrates by forages		Total costs of feeding
		in Kgs	in	(/cow)
682,0	3342	0,659	1,680	361,63
667,7	3361	0,642	1,635	360,39
632,4	3418	0,598	1,523	358,04
599,5	3475	0,557	1,420	356,13
568,8	3532	0,520	1,325	354,74
540,2	3589	0,486	1,239	353,49
513,4	3646	0,455	1,159	352,69
488,3	3703	0,422	1,085	352,20
464,8	3760	0,399	1,017	352,00
458,7	3775	0,393	1,000	351,96

on a sample of 106 farms for the year 2002. The physical and economic data of these farms were collected from various semi-mountainous and mountainous regions of Central and Northern Greece which are the most important for beef meat production.

The analysis of the above beef cattle farms showed that the gross return of a beef cow without subsidies, amounting to €374, can not cover its total costs (€676), while with three subsidies (for cow, calf and slaughtering), amounting to €699/cow, it proves to be slightly higher (€23/cow) than the total costs. On the other hand, the gross return per cow including two more subsidies (for extensification and compensatory allowances), amounting to €843, is €167 higher than the total costs. The loss or the profit affects the farm family income and the return on capital unfavourably or favourably respectively. Indeed, the farm family income and the return on capital without subsidies are negative, while with three subsidies they come up to €158 per cow and 12.7% respectively and with five subsidies they equal € 302 per cow and 26.2% respectively. This means that in the year 2002, an extensive beef cattle farm of 50 or 100 beef cows generated a farm family income of €7900 or €15.800 with three subsidies and of €15100 or 30200 with five subsidies.

On these grounds, it may be concluded that the viability of the extensive beef cattle farming can not be achieved under the present technical and economic conditions without subsidies. An improvement of the economic position of this type of livestock production can be envisaged by increasing the productivity of cows, by decreasing the feeding costs and by increasing the meat price. Apart from this improvement, the allocation of subsidies by the European Union and the Greek Government is deemed to be still necessary.

References

Dexter, W. and R. Hartwig (1973). "Beef Cow Farming in Michigan" Department of Agricultural Economics Michigan State University.

Heady, E. and J. Dillon (1961). "Agricultural Production Functions" Iowa State University Press.

Kitsopanidis, G., M. Martika, A. Phsychoudakis and E. Papanagiotou (1981). "Economics and Productivity of Beef Meat Production in Greece", (Greek text and English summary), Dept. of Agr. Econ. Research, University of Thessaloniki.

Kurta, J. (1972). "Beef Production", Agricultural Economic Unit, University of Cambridge.

Parvin, D. and M. McCullough (1974). "Animal and Feed Costs for Beef Production in Georgia" Research Report 194, Dept. of Agr. Economics.

Perrin, R. (1972). "A Survey of Beef Production Patterns in the Mountains of North Carolina" North Carolina State University.

Simpson, J. (1988). "The Economics of Livestock Systems in Developing Countries" Westview Press" Colorado U.S.A.