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SHEEP FARMING IN THE PAST AND AT PRESENT" AN ECONOMIC ALTERNATIVE FOR GRASSLAND FARMERS IN AUSTRIA?

1. Introduction

Because of the country's agro-climatic conditions, grassland-based farming activities prevail in Austrian agriculture. This is evidenced by the fact that 28% of total production value originated from cattle farming in 2009, with dairy farming being the most important branch (BMLFUW, 2010a). Nevertheless, the number of dairy cows and number of dairy farmers have both dropped continuously during the last few decades. Over this same period, sheep farming has gained increasing importance in grassland regions; on the one hand because of similar animal feed requirements and on the other due to its important role in maintaining landscapes in mountainous areas. In addition, consumer demand for sheep products – predominately lamb meat and sheep milk – has increased. As a result, a number of dairies have been established that process sheep milk to cheese, yoghurt and other products (BMLFUW, 2008a).

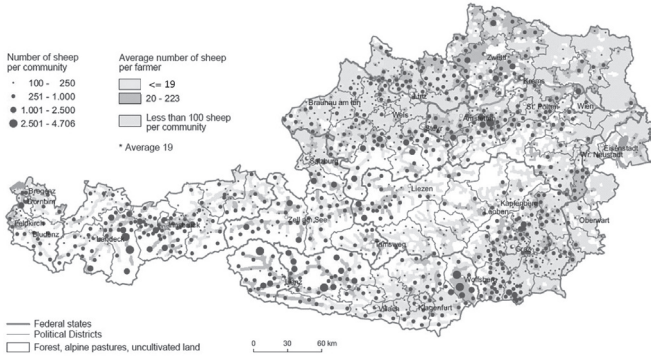
In the past, sheep farming played only a minor role in Austrian agriculture from an economic point of view. According to data from the Austrian Green Report, even in 2009 less than 0.5% of total agricultural production value (6,138m Euros) originated from sheep farming (BMLFUW, 2010a). However, unlike cattle, the number of sheep has remained quite stable during the last five years. The supply balance sheets of Statistics Austria (2011a) confirm that sheep products certainly have the character of niche products: Only 1.2% of total domestic meat consumption and 0.1% of total milk production in 2009 can be attributed to sheep. Nevertheless, due to changing nutrition habits of consumers, but also because of an increasing number of people suffering from cow milk intolerance, a further increase in the demand for sheep products can be expected.

The few figures and statistics available underscore the niche character of sheep farming within Austrian agriculture. Unfortunately, this means economic calculations regarding sheep production are neither available in the Austrian Farm Accountancy Data Network nor in the federal comparison of specialised farms. However, in 2010 several newly established working groups on specialised sheep farms did publish their initial results. The study presented herein thus focuses on the economic performance of sheep farms and attempts to answer the question of whether sheep farming represents an attractive alternative to cattle farming from an economic standpoint. On the basis of model farms, key figures have been calculated to compare the profitability of the two main sheep farming activities. In addition, the contribution of these activities to agricultural income has been calculated to allow comparisons between sheep and cattle farming in terms of the utilisation of land and labour. A final aspect addressed by the study and presented herein is the optimal sheep flock size needed to obtain an adequate agricultural income.

2. Several general aspects of sheep farming in Austria

Sheep farming in Austria is closely associated with the mountainous grassland regions. Figure 1 displays the distribution of sheep in Austrian communities. Especially in remote areas, prevailing activities are the processing of raw products on farms in combination with direct marketing activities. On the other hand, in some regions co-operatives between farmers and processors (e.g. dairies) have been established.

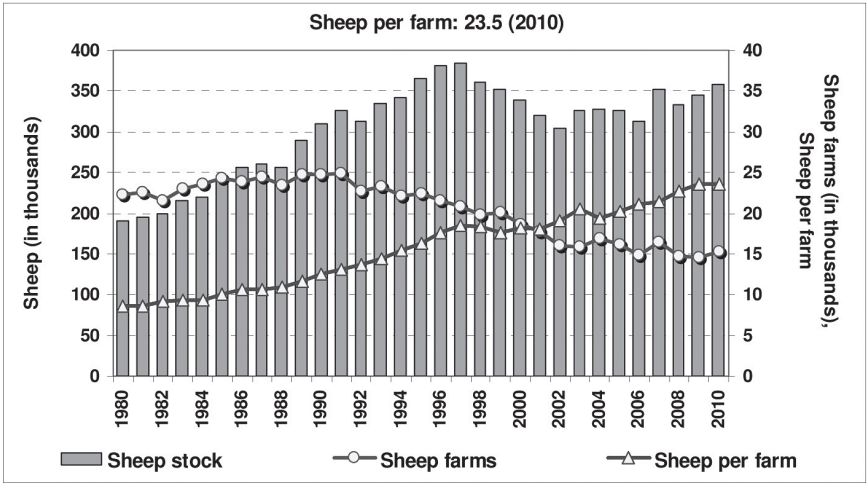
Figure 1: Location of sheep in Austria



Source: Statistics Austria, 2011b.

In comparison to other livestock branches, sheep farming shows a quite stable pattern during the last ten years. There has only been a moderate decrease in the number of farms since 2002, accompanied by increasing farm sizes. The last agricultural census in 2010 revealed a further increase in sheep stocks, primarily due to a rise in lamb production. At the end of 2010 almost 15,250 farms kept 358,400 sheep (see Figure 2).

Figure 2: Number of sheep and sheep farms in Austria from 1980 to 2010



Source: Statistics Austria (2011b).

Despite increasing stocks, domestic production of lamb meat does not cover demand. In 2009 the degree of self-sufficiency was only 72% (Statistics Austria, 2011a). Consequently, imports of mostly frozen lamb meat filled this gap, with Germany, Great Britain and New Zealand being the most important countries of origin (Priplata, 2010). In contrast to many other agricultural products, the producer prices for sheep milk and lamb meat remained quite stable. According to Kirner (2010), in 2009 the average price for one kg of lamb meat was 4.70 Euros (carcass weight basis) which corresponds to 2.20 Euros per kg live weight. The price of sheep milk depends largely on the fat and protein content, but also on several other quality criteria (e.g. content of cells, seasonal surplus – higher prices in winter). Based on interviews with farmers, dairies paid 0.95 Euros per litre of sheep milk.

Table 1 provides the distribution of farm sizes differentiated by the production of meat and sheep milk based on 2009 IACS data (Integrated Administration and Control System). The majority of sheep are kept for lamb meat production. Only 11% of all female sheep were milk sheep. The average number of ewes per farm indicates small-structured production. On average, farms focusing on lamb meat production kept 16 ewes each whilst milk sheep farms kept roughly 27 ewes. But these average figures are distorted by the larger farms. The median farm size is only 9 and 10 ewes per farm respectively (for lamb meat production and sheep milk production). For both farm types, more than 50% of the farms kept up to 10 mother sheep, but this group only accounted for around 10% of the total stock. At the other end of the scale, roughly 1% of all lamb meat producers and 8% of milk sheep farmers kept more than 100 mother sheep, but these comprised 15% and 51% of total stocks respectively for larger farms.

Table 1: Structure of sheep farms in Austria (2009)

	Lamb meat production					Sheep milk production				
Farm size	Farms		Mother sheep			Farms		Mother sheep		
Mother sheep	Number	%	Ewes	%	Ewes/farm	Number	%	Ewes	%	Ewes/farm
<= 5	3,453	33	10,429	6	3.0	303	39	842	4	2.8
> 5 <= 10	2,261	22	18,407	11	8.1	125	16	1,003	5	8.0
> 10 <= 15	1,702	16	21,975	13	12.9	90	12	1,174	6	13.0
> 15 <= 20	975	9	17,555	11	18.0	43	6	788	4	18.3
> 20 <= 30	923	9	23,207	14	25.1	63	8	1,572	7	25.0
> 30 <= 50	656	6	25,472	15	38.8	39	5	1,564	7	40.1
> 50 <= 100	356	3	24,512	15	68.9	49	6	3,336	16	68.1
> 100 <= 200	103	1	13,981	8	135.7	47	6	6,814	32	145.0
> 200	34	0	10,803	7	317.7	16	2	4,008	19	250.5
Austria	10,463	100	166,341	100	15.9	775	100	21,101	100	27.2

Source: Own calculation based on IACS data (2009).

3. Production and marketing of sheep milk and lamb meat in Austria

Two different systems of sheep farming can be distinguished based on the level of intensification. On smaller, less intensive farms several other reasons besides milk production alone account for the keeping of sheep (e.g. prese-

rvation of the species or conservation of the landscape). On these types of farms flocks are rarely housed during summer, but feeding small quantities of supplements such as hay and silage is convenient. Housing and technical equipment is rather simple in order to keep the costs low. The second type of farm focuses on the production of milk or lamb meat, and other reasons for keeping sheep are secondary. These farms are characterised by larger flocks, the feeding of concentrate and higher investments in equipment and stables. Meanwhile, cooperatives between sheep farms and dairies, but also between lamb producers and processors or retailers, have been established in some regions. Important milk processors are located in Lower Austria (Waidhofen/Thaya), Styria (Weiz) and Upper Austria (Schlierbach). Due to the absence of processors, further processing of milk by the farms themselves has gained in importance – especially for smaller farms.

Despite the relatively small number of sheep in Austria, 25 different breeds are registered in the herd books. The main breeds of milk sheep farmed in Austria are East-Friesian and Lacaune. On average, sheep farms registered in the herd books achieve a lactation performance of around 500 kg per ewe and year (Ringdorfer, 2005).

Due to the niche character of sheep farming, complete housing solutions are hardly available. Hence, self-made constructions are often the standard, whereas equipment like waterers, racks and gates are available. In this context, open barns in combination with loose housing systems are most convenient. Straw serves as litter and causes additional costs, for the majority of sheep farms are located in mountainous areas that are either devoid of arable land or have little of it available.

4. Data and methodology

Various sources of data were used for the calculations. In addition to conducting a literature review (e.g. BMLFUW 2008b, BMLFUW 2010b), additional information was gained on site via a survey of several sheep farmers. The oral interviews provided specific information on the characteristics of each farm, including details about production techniques, marketing, input costs (e.g. feed, straw) and output prices (e.g. raw milk, lamb meat). Together, all of this information was used to model two types of sheep farms – milk producing and lamb meat producing – in order to reflect the most important production systems in practise.

Based on the interviews, it is assumed that the model sheep farm is located in a mountainous region (200 farm cadastre points) and manages 20 ha of grassland which can be used for milk or lamb meat production. In addition, for each of these farm types two different production levels with various shares of sold breeding lambs are calculated (Table 2). The more intensive farms sell 20% (as opposed to 10%) of their lambs for breeding purposes. According to the interviews, on specialised milk farms the animals are often kept mostly indoors, whereas grazing management is very common on farms with a focus on lamb meat production. This distinction was incorporated in the two types of model farms.

Table 2: Characteristics of the model farms

Key figure	Lamb meat production		Sheep milk production	
	LM-2.0	LM-2.3	SM-440	SM-480
Born lambs per ewe	2	2.3	2	2
Milk yield per sheep	–	–	440kg	480kg
Share of sold breeding lambs	10%	20%	10%	20%

Source: Own assumptions based on farm interviews.

Table 2 summarises the most important figures used in the calculations according to farm type and production levels. Based on an average milk yield of 460 kg per milk sheep per year in Austria (BMLFUW, 2008a) two scenarios were calculated: 440 kg and 480 kg. For the second farm type (lamb meat production) it was assumed that 2 and 2.3 lambs per ewe per year are born. Other important differences pertain to the feeding of animals with respect to the varying demand for forage and concentrate feed. The latter is needed for a high quality of lamb carcasses, but also for higher milk yields. In contrast to sheep milk farms, no milk substitutes are used for lamb rearing on specialised lamb meat farms. An average production cycle of 5 years per mother sheep is assumed for all farm types. The applied prices represent an average of the last several years based on the simplified assumption that the total production is sold to dairies or meat dealers. As already mentioned, fat and protein content largely determine the price of sheep milk. In the case of meat production, a high quality of lamb carcasses is crucial for achieving high prices. The lambs are conventionally marketed to meat dealers or slaughter houses. Revenues from other by-products (e.g. culling of ewes, wool) play only a minor role.

Table 3: Key data used to calculate gross margins

Key Figure	Unit	Lamb meat		Sheep milk	
		LM-2.0	LM-2.3	SM-440	SM-480
Production figures					
Ewes	No.	140	140	146	146
Livestock units per ha	units/ha	7.0	7.0	7.3	7.3
Market lambs (meat)	No./ewe	1.26	1.24	1.26	1.08
Sold with .... kg live weight	kg	42	42	15	15
Market breeding lambs	No./ewe	0.18	0.41	0.18	0.36
Milk sales	kg/ewe	–	–	431	470
Milk substitute	kg	–	–	15	15
Concentrate	kg/ewe	110	122	240	270
Labour	Hours/ewe	9	9.5	24	26
Prices					
Milk	€/kg	–	–	0.95	0.95
Lamb (meat)	€/kg*	2.20	2.20	1.70	1.70
Lamb (breeding)	€/lamb	190	190	190	190
Cull ewes	€/ewe	55	55	32	32
Milk substitute	€/kg	–	–	2.18	2.18
Concentrate, lamb	€/kg	0.28	0.28	0.28	0.28
Concentrate, ewe	€/kg	0.26	0.26	0.26	0.26
Litter	€/kg	0.07	0.07	0.07	0.07

* live weight
Source: Assumptions based on farm surveys and BMLFUW (2008b).

For all further considerations the standard gross margins per ewe represent the starting point, with gross margins calculated as the difference between variable returns and variable costs. Usually these margins cover the fixed costs and contribute to a profit. The gross margin per ha can be calculated by taking into consideration the variable costs for forage production, the demand for forage of the animals and the yield per ha grassland. This figure enables a comparison between different farm types based on the economic utilisation of one ha of grassland (e.g. milk production versus meat production).

The inclusion of area-based direct payments and fixed costs (e.g. depreciation) results in the key figure "contribution to agricultural income" for a given farm activity (see BMLFUW, 2006). The direct payments comprise the Single Farm Payment (SFP), payments from the agri-environmental programme

ÖPUL and natural handicap payments to farmers in less-favoured areas (200 mountain farm cadastre points). With the decoupling of direct payments as part of recent CAP reforms, most animal related payments like the sheep or slaughter premium have become part of the SFP and are no longer assignable to individual farm activities. The fixed costs cover depreciation for machines and buildings, building maintenance costs, energy costs, taxes and insurance, as well as administration costs. Expenditures for own labour, land and capital are not covered. Hence, the contribution to farm income represents the remuneration of farmers for providing such production factors as land, labour and capital, and it ultimately enables direct comparisons between enterprises with different farm activities and labour structures.

5. Results

5.1 Gross margins per ewe

Table 4 summarises the results of the gross margin calculations and shows significant differences in the structure of variable returns and variable costs. Only milk sheep farms obtain returns from milk sales, which account for more than 80% of total returns. On the other hand, returns derived from lamb sales are only of minor importance. The lamb meat producers show a completely different picture, with returns from lamb sales dominating the total returns. The results also indicate the importance of breeding lamb sales. In the case of the model farm LM-2.3, only one fifth of all reared lambs are sold for breeding but these returns account for almost 70% of the returns from slaughter lamb sales. For both farm types (milk, meat) it is shown that the level of production has a significant impact on total returns. In the case of lamb meat production a difference of 21 Euros was calculated, whilst it was an even higher 37 Euros for the milk-producing sheep farms. After decoupling the "mother sheep premium," direct payments need not be taken into consideration at the gross margin level.

With a share of more than 30% of the total variable costs, (feed) concentrate costs represent the most important cost factor. Especially the figures for milk sheep mirror a higher demand. For the replacement of ewes, own offspring is used. Hence, costs arise only for the rearing period starting with the date of sale of lambs and ending with the integration of the young sheep into the flock. On the other hand, this replacement practise reduces the number of lambs to

be sold by 20% in the case of a 5–year service life. Expenses for milk substitutes arise only at milk sheep farms (33 Euros). Because of the shorter grazing periods milk sheep farms show a higher demand for litter. Animal health costs and the costs for rams are quite homogenous between the model farms. Costs for the production and marketing of milk are relevant only for milk-producing sheep farms. These costs comprise various positions like cleaning agents and disinfectants, but also contributions and fees. The costs for energy, water, losses, earmarks, repairs and fencing are summed up under other variable costs.

Table 4: Gross margin per ewe by farm type (Euros/ewe)

Denotation	Unit	LM-2.0	LM-2.3	SM-440	SM-480
Variable returns					
Milk	€/Ewe	–	–	410	448
Cull lambs	„	117	115	28	24
Breeding lambs	„	34	79	34	68
Cull ewe	„	11	11	6	6
Wool	„	2	2	2	2
Total variable returns	„	164	207	480	548
Variable Costs					
Ewe replacement	€/Ewe	6	6	6	6
Milk substitute	„	–	–	33	33
Concentrate, ewe	„	20	22	8	8
Concentrate, lamb		10	11	55	62
Mineral feed	„	5	5	10	10
Animal health	„	7	7	8	8
Costs for ram	„	6	6	7	7
Litter	„	10	11	15	15
Shearing	„	5	5	5	5
Cost of sheep milk production		–	–	48	52
Other variable costs	„	17	18	13	13
Total variable costs	€/Ewe	85	90	208	219
Gross margin (GM) per ewe	€/Ewe	79	116	272	329
Gross margin: + 10% milk, lamb price	„	94	136	319	383
Gross margin: – 10% milk, lamb price	„	64	97	225	275
Gross margin: + 10% variable costs	„	70	107	251	307
Gross margin: – 10% variable costs	„	87	125	293	351

Source: Own calculation.

Depending on the farm type and production level, the gross margins per ewe range from 79 to 329 Euros. Comparisons within a single farm type (milk or lamb meat) clearly show that at farms with higher production levels the additional returns by far exceed the additional costs. To a certain extent, farmers are able to influence not only the level of the variable costs but also their product prices – e.g. by improving milk quality in terms of a reduced cell content, a sheep milk producer could increase his milk price. The production of winter milk furthermore results in an additional price surplus. The situation for lamb meat producers is similar: Optimal feeding management serves as the basis for a high quality of slaughter carcasses and thus higher prices.

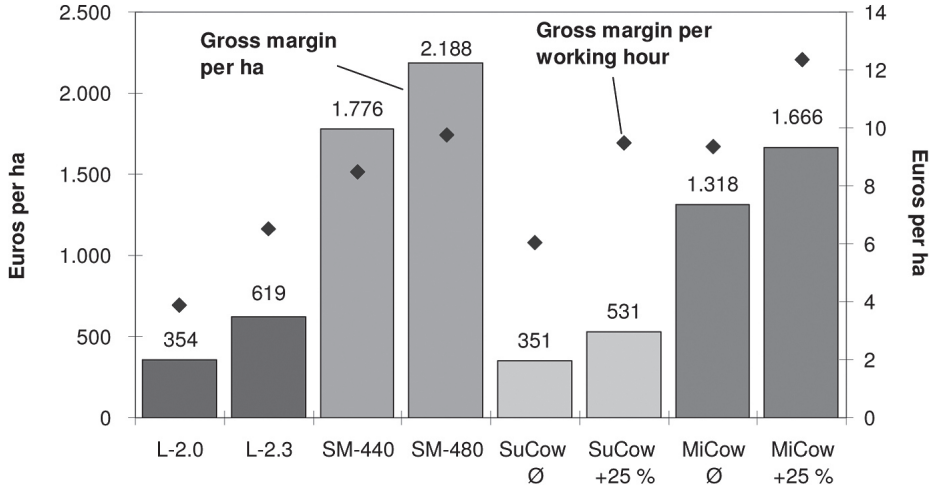
5.2 Aggregation of gross margins

The gross margin per ha is required to determine the best utilisation of one ha of grassland from among the different possible farm activities. Based on the demand for forage, average grass yield per ha and variable cost of forage production, one can calculate the livestock density (ewes per ha) and gross margin per ha. It is assumed that the model farms with lamb meat production keep 7 ewes per ha and those with milk production 7.3 ewes per ha. Because of the higher share of concentrate in feeding, the latter require less forage.

One arrives at the gross margin per ha by multiplying the gross margin per ewe times the stocking density (ewes per ha) and then subtracting the variable forage costs from this result. Figure 3 compares the gross margins per ha of the model sheep farms with those of dairy and suckler cow farms (BMLFUW, 2009).

From Figure 3 it can be deduced that the utilisation of one ha of grassland has quite similar economic results for the case of lamb meat production and suckler cow farming, and that both of the latter result in lower gross margins per ha than milk sheep farming. Depending on the milk yield and share of sold breeding lambs, milk sheep farms obtain a gross farm margin per ha ranging from 1,776 Euros to 2,188 Euros. According to these results, the production of sheep milk yields the highest gross margins per ha grassland. It is thus evident from an economic standpoint that sheep milk production describes an interesting alternative for farms with limited grassland. In fact, only dairy farms with a high milk performance (+25% of milk cow farms) can compete with sheep milk production, to a certain extent.

Figure 3: Gross margins per ha and working hour of different farm types



L...Lamb meat production (2.0 or 2.3 live born lambs per ewe)
SM...440 kg or 480 kg milk yield per ewe
SuCow... Suckler cows (average and 25% outperformers)
MiCow....Milk cows (average and 25% outperformers)
Source: Own calculation.

However, the picture changes when using labour hours (including forage production) as a reference. In this case, the ratio between the gross margin for producing sheep milk and the gross margins for the other types of farming move closer together, with cow milk production actually outperforming sheep milk production whilst farms producing lamb meat and suckler cow farms become more competitive as well.

5.3 Contribution to farm income

The contribution of a single farming activity to the farm's overall income was calculated by also taking into consideration area-based direct payments and fixed costs (see Table 5). For labour-intensive farm activities like sheep milk production labour often represents the limiting factor.

Table 5: Raw data for fixed costs, direct payments and working hours

Denotation		LM-2.0	LM-2.3	SM-440	SM-480
Depreciation, machines	€	5,137	5,137	5,137	5,137
Depreciation, buildings	€	4,060	4,060	4,453	4,453
Depreciation, milking parlour	€	–	–	2,333	2,333
Maintenance, buildings	€	1,200	1,200	1,350	1,350
Electricity	€	800	800	1,000	1,000
Car (proportion for farm use)	€	800	800	800	800
Other fixed costs (insurance, taxes, etc.)	€	1,500	1,500	2,000	2,000
Useful life, buildings	years	20	20	20	20
Useful life, milking parlour	years	–	–	15	15
Working hours (outdoor work)	hours	480	480	480	480
Direct payments					
Single farm payment	€/ha	180	180	180	180
Agri-environmental payments	€/ha	200	200	200	200
Compensation for less-favoured areas	€/farm	5,240	5,240	5,240	5,240

Source: Own calculation.

Table 5 presents the basic data used for calculating fixed costs, as well as the required working hours. It is assumed that the fixed costs (e.g. machinery for forage production) for outdoor activities are the same for all model farms (same machinery inventory). The higher depreciation costs of milk sheep farms mirror the higher investment costs for sheds, which in turn are a consequence of the need for almost permanent housing of the animals. An additional cost of 35,000 Euros for a milking parlour arises only for milk sheep farms and this also results in higher other fixed costs (e.g. higher insurance costs for the buildings and milking parlour). The applied working hours are based on modern production techniques. Therefore, especially for older or simpler systems, larger deviations from the calculated figure may be observed. It is furthermore assumed that solely farm-owned production factors like land, family working units and own capital are used. The contribution to a farm's income ranges from 6,430 Euros (LM-2.0) to 39,532 Euros (SM-480) depending on farm type and production level (Table 6). The value for sheep milk production exceeds the value for lamb meat production by far (almost six times). But once again, when considering the required labour the ratio becomes much smaller (1:3). Because of similar fixed costs for all farms, the different production levels affecting the gross margins also have a significant impact on the ultimate contribution to farm income.

Table 6: Calculation of the contribution to farm income per farm and working hour

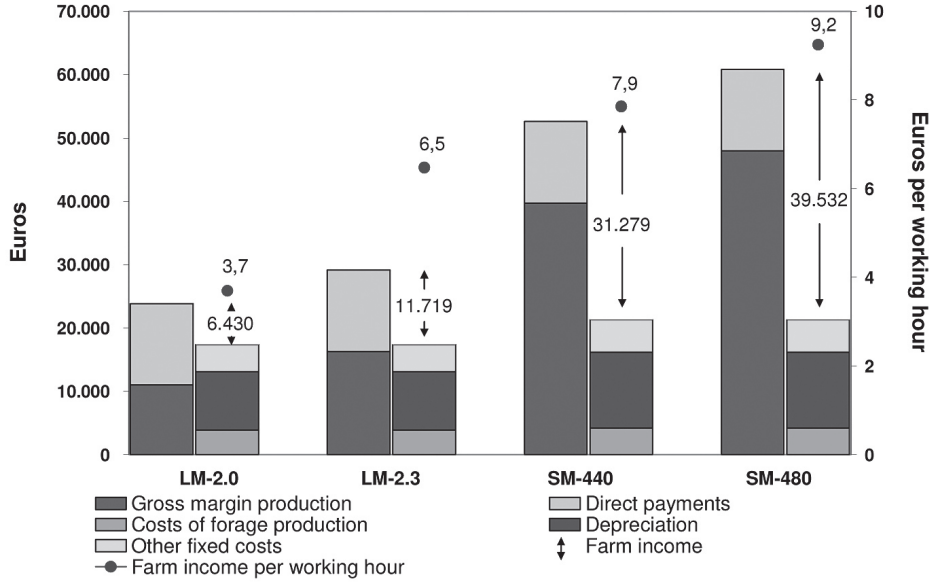
Denotation	Unit	LM-2.0	LM-2.3	SM-440	SM-480
Gross margin per ewe	€/Ewe	79	116	272	329
x Mother sheep	No.	140	140	146	146
Total gross margin	€/Farm	11,008	16,297	39,733	47,986
- Forage costs	€/Farm	3,920	3,920	4,220	4,220
= Gross margin minus forage costs	€/Farm	7,088	12,377	35,513	43,766
+ Direct payments	€/Farm	12,840	12,840	12,840	12,840
- Depreciation	€/Farm	9,197	9,197	11,924	11,924
- Other fixed costs	€/Farm	4,300	4,300	5,150	5,150
= Contribution to farm income	€/Farm	6,430	11,719	31,279	39,532
= Contribution to farm income*	€/Working hour	3.7	6.5	7.9	9.2

* including working hours for forage production
Source: Own calculation.

Figure 4 shows the detailed components of farm income for each model farm. For each farm type the bar on the left indicates the source of farm income, which fundamentally derives from production (gross margin per farm) or direct payments. Milk sheep farms obtain the main portion of their farm income from production whilst their lamb meat-producing counterparts depend more on direct payments. Hence, any changes of the support scheme would affect the latter more than sheep milk producers. The cost of depreciation, forage production and other fixed positions vary between 17,417 Euros (lamb meat production) and 21,294 Euros (sheep milk production). With a share between 49% and 68% of all costs, depreciation represents the major portion of fixed costs. In the event of already depreciated assets or more economic housing solutions, depreciation could be lower than the figures introduced in this study.

The income differences between the model farms are mainly determined by the farm type (milk vs. meat), but also by the individual production level of each farm – with the latter depending largely on the different gross margins per ewe. Differences in the cost of forage production and depreciation either extend or close the gap in income between the model farms. The comparisons within a single farm type reveal that differences in the farm income level originate from the differences in gross margins.

Figure 4: Structure of the farm income of individual model farms



Source: Own calculation.

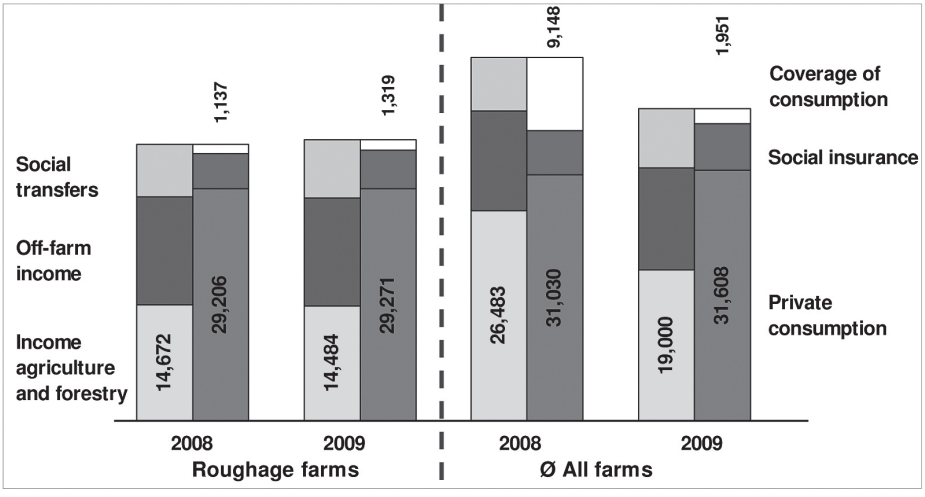
5.4 Flock size and farm income

The previous considerations are based on a fixed farm size with 20 ha of grassland. Especially in mountainous regions, tourism represents an important pillar of the economy and many farms obtain a significant share of their income from non-agricultural activities (e.g. farm holidays). Based on the calculated model results, the following analysis seeks to identify the optimal farm size for obtaining an adequate income from full-time farming. To provide initial insight into the income situation of grassland farmers, several results of the voluntary Farm Accountancy Data Network shall be presented.

The farm accounts of specialised farms with forage production (without milk cows) and those of the average of all bookkeeping farms in Austria are presented in Figure 5 (BMLFUW 2010a). The comparisons reveal a significantly lower income from agriculture and forestry for roughage farms. On the one hand revenues from cash crops play only a minor role for these types of farms, and on the other revenues from livestock production are below the average. This is not surprising, since the most capital-intensive livestock farm types,

such as dairy, pig and poultry, are not included in this farm group. With an average utilised agricultural area (UAA) of 26.2 ha, roughage farms are slightly below the average of 28.5 ha. Because of their location in mountainous regions the grassland area of these farms is above average. Furthermore, roughage farms obtain larger shares of their overall income from off-farm activities, which indicates higher shares of part-time farms. During the last two years the private consumption of roughage farms was roughly 29,000 Euros per farm. Including social transfers like pensions or allowances, the farms were able to cover the expenses for social insurance and private consumption.

Figure 5: Farm accounts of roughage farms in comparison to the average of bookkeeping farms in Austria (2008, 2009)



Source: BMLFUW 2010a.

Based on farm account data it is assumed that an agricultural income of 25,000 Euros is required in order to cover private consumption and social insurance in future. The results of the outperforming model farms (LM-2.3 and SM-480) serve as a basis for the calculations. In a first step, all relevant components (total gross margins including the costs for forage production, fixed costs and direct payments) were converted to ha-based figures (agricultural income per ha). Dividing the targeted income (25,000 Euros) by the calculated farm income per ha resulted in the required grassland area. Next, applying the stocking density per ha enabled computation of the adequate flock size.

It should be noted that all relevant calculation data were kept constant. This applies especially to the production technique and fixed costs. But this is a strong limitation, as there is a common understanding of increasing returns of scale for larger entities, to mean the cost per sheep for sheds, milking parlours and machinery decrease with increasing farm sizes. Additionally, as the results of working group data reveal, larger farms often outperform smaller ones in terms of biological performance – e.g. milk yields, carcass quality, fattening periods or feed conversion rates. This could be due to better education, more intensive vocational training and a stronger focus on the farm business. However, as already mentioned, smaller farms frequently have more sources of income.

To take into account these factors, three different scenarios were calculated. Scenario A is based on the original data. No changes were made with respect to the cost of depreciation per animal and performance per animal, but other fixed costs (e.g. insurance, energy, maintenance of buildings, etc.) were adapted to the larger flock sizes. In scenario B, however, the depreciation costs were reduced by 20% and the gross margins were increased by 5% due to improved performance (e.g. milk yield). Consequently, smaller flock sizes are needed to meet the income target. The analyses of farm accounts verify the increasing importance of farm activities that are not directly linked to plant or animal production. This form of activities can be summarised as services and, for example, comprise machinery services, municipal services or snow clearing for other enterprises. Hence, a third scenario – scenario C – was calculated. It is similar to scenario B, but due to an additional income of 4,000 Euros (from services) the new target income was reduced to only 21,000 Euros.

Depending on the different scenarios, the required flock sizes vary considerably between and within farm types. Especially in the case of lamb meat farms, the number of born lambs has an enormous impact on the flock size. In scenario A, which serves as the benchmark, the more successful lamb meat producer (LM-2.3) obtains the target income with roughly 260 animals, whilst the sheep milk-producing farmers do so with only 130 and 107 animals respectively. A more realistic result is shown by scenario B, which introduces a 5% performance increase and 20% reduction in depreciation costs. As a result, the meat farmers required 305 and 221 ewes respectively to earn an agricultural income of 25,000 Euros. The needed flock sizes for the milk sheep farmers were calculated at 130 and 107 ewes (mother sheep) respectively. Additional

income from services contributes to a further reduction in the required farm sizes (scenario C).

As the results of Table 7 rely on a number of key assumptions, they must be treated with care. Minor changes in stocking densities, costs or return structures can significantly impact the required flock size. Hence, conclusions for individual farms can only be legitimate if the farm-specific data is known and applied.

Table 7: Necessary flock sizes to obtain a target income of 25,000 Euros (based on model farm results)

Scenario	Unit	LM-2.0	LM-2.3	SM-440	SM-480
Scenario A	Number of ewes	377	261	130	107
Scenario B	Number of ewes	305	221	113	94
Scenario C	Number of ewes	248	178	90	75

Scenario A: Original model farm data, + 30% other fixed costs
Scenario B: Reduction of depreciation costs by 20%, milk yield and reared lambs + 5%
Scenario C: Like scenario B but with a targeted farm income of 21,000 Euros
Source: Own calculation.

6. Summary and conclusions

The present study was unable to definitively clarify whether the production of sheep milk or lamb meat is profitable or not. But, as is the case for other types of agricultural activities, the study showed that profitability in these branches depends primarily on the economic framework (e.g. price of milk, costs), production conditions and production levels. Therefore, a variation in the results should not seem surprising. Importantly, above-average milk yields and numbers of reared lambs were both proven to be crucial factors for achieving a satisfying economic performance. For example, the farm type LM-2.3 (2.3 born lambs per ewe per year, 20% sold breeding lambs) obtained an agricultural income of more than 11,700 Euros. Conversely, with only 2 born lambs per ewe per year and 10% sold breeding lambs the agricultural income of the same farm decreased by almost 5,300 Euros. In addition, a similar pattern emerged for milk sheep farming based on the calculations performed for the study. Thus, the results indicate that even small differences in gross margins have a huge effect on agricultural income within these farming branches.

Despite the variation in results, several general tendencies can be unequivocally derived from the calculations. Above all, the selected farm activity (meat or milk) determines the economic potential. Milk sheep farming exhibits a high productivity of land far exceeding that of farms which focus on lamb meat production. Hence, sheep milk production can be recommended to farmers who operate their farms full time, have a relative shortage of land and have enough labour resources. Entering into the production of sheep milk could also be an interesting option for cow milk producers confronted with larger investments over the next few years. On the other hand, the production of sheep milk is very labour intensive and the economic figures per labour unit do not always yield a better performance than other agricultural activities. Lamb meat production is quite different to sheep milk production: The demand for labour is much lower, but so is productivity per ha grassland. Generally speaking, this farm activity is less intensive and could represent an interesting alternative for part-time farms. The effects of further processing the raw products and conducting direct marketing activities were not analysed separately. However, according to the interviewed farmers, direct marketing could enormously increase the profitability of these farms, including profitability per labour unit. In this case, many considerations would need to be taken into account (e.g. additional labour and investment, as well as new market opportunities).

The results of the study are based on a number of assumptions and hence only general conclusions can be drawn, to mean conclusions related to individual farms would necessitate knowing and applying the actual farm-specific data. In general, however, lower investment costs for buildings or due to already depreciated but still used assets would certainly contribute to a more positive farm income. Furthermore, alternative marketing strategies (e.g. direct marketing), farm management (e.g. organic farming) or methods of production (e.g. feeding strategies like the use of feed concentrate) could all have a significant impact on agricultural income. Importantly, the productivity of both activities – sheep milk production and lamb meat production – is strongly influenced by the gross margin per ewe. Even minor deviations in this key figure can result in huge differences in farm income. Thus, continuous monitoring and improvement of the farm-specific production situation is indispensable for the future success of sheep farming.

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