

## Economic Assessment of Small Ruminant Farms in Gap Region of Turkey

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**Abstract:** The aim of this study was to conduct an economic analysis and determine sustainability of sheep and goat farms in the Southeastern Anatolian Project (GAP) region of Turkey. The GAP covers 9 provinces in Southeastern of Turkey and it is an integrated socioeconomic development project of the region. One of the goal of the project is to boost the agricultural production potential of Turkey not only in terms of crop production but also animal production so as to contribute to the socioeconomic development of the region. The bulk of the data used to achieve the aims was collected from 251 farms distributed into 3 separate size groups, which were selected from farms in the research area by stratified sampling method. In the research area, it was determined that the share of milk value was 30.7% in sheep and 55.7% in goat breeding. The share of plant production value was 43.3% and animal production value was 55.7% in Gross Production Value (GPV). The biggest share was from sheep breeding (39.9%) into GPV. The percentage of agricultural income was 96.3% and non-agricultural income was 3.7% in the total household income in the studied farms.

**Key words:** Sheep and goat farms, economic analysis, marketing

### INTRODUCTION

There is 3 million farms in Turkey and 73% of farms was carry out both plant and livestock production, while 3.5% of them was only engaged with livestock production according to last agricultural Census (Tuik, 2001).

Small ruminant production is generally carry out at the meadows, pastures, fallow land, stubbles and unsuitable areas for crop production and obtain such products as meat, milk, wool, hair, mohair and skin. Turkey's natural resources, geographical conditions and climatic conditions provide an appropriate setting for small ruminant production. While, sheep and goat production in Turkey conduct extensive in most cases, the obtained animal products constitute the staple food resources of farms with low income, contribute to farm revenues and create employment opportunities for the labor force (Açıl and Demirci, 1976; Erkuş 1976, 1979; Polat, 1994; Kaymakçı and Sönmez, 1996; Dellal, 1996).

In Turkey, the 80.6% of small ruminant number was sheep, 19.4% was goat. The milk from small ruminant was 10.3% of total milk production, mutton was 30.5% of total meat production, hide from small ruminant was 80.4% of total hide and skins.

The GAP project covers 9 provinces in South-Eastern Turkey and it is an integrated socio-economic

development project of the region. One of the goals of project is to boost the agricultural production potential of Turkey not only in terms of crop production but also animal production so as to contribute to the socio-economic development of the region.

GAP region is an important share in terms of livestock number, production value in the small ruminant production in Turkey. In the country level 76.9% of total livestock (except poultry) was small ruminant, but in the GAP region it was 89.5%. While, 21.5% of livestock production value was from small ruminant in the country, it was 49.8% in the region.

It is important that to determine existing conditions, problems to solve these and get sustainability of agricultural activities. This study aims to conduct an economic analysis of farms carrying out small ruminant production in the Southeastern Anatolian Project (GAP) Region of Turkey.

### MATERIALS AND METHODS

The aim of this study is to conduct an economic assessment of the small ruminant farms in GAP region. The research material gathered by surveys from sample farms selected by stratified sampling method. The previous

scientific literature records of various public and private sector institutions and organizations were also utilized as materials of the study.

The provinces of Gaziantep, Sanliurfa, Adiyaman and Diyarbakir were determined that representing the GAP Region, in terms of natural factors, small ruminant numbers and production techniques. In terms of the same criteria, the sub-provinces of the four selected provinces and then their villages were selected. Thus, the farms which have more than 10 heads of small ruminants among the all farms in all selected villages were constituted as population.

The data were collected from 251 small ruminant farms selected by stratified random sampling method in the selected villages. The stratified random sampling method was used in order to determine the sample farms size. The following formula was used for this purpose (Gunes and Arkan, 1988):

$$n = \frac{N \cdot \sigma^2}{(N-1)D + \sigma^2}$$

In the formula:

n : Represents sample volume.

$\sigma^2$  : Represents population variance.

N : Represents population.

D : Represents the allowed error rate from the population average and  $D = (E/t)^2$ .

As a confidence limit of 90% was envisaged for the study, the t-table value was taken as 1.645.

The determined population was classified into 3 groups based on the distribution of the number of small ruminant as 1-100 head (small farms), 101-200 head (medium farms) and more than 200 head (large farms). The sampled farms were distributed into groups as to their percentage in total ( $n_h = N_h/N_n$ ).

## RESULTS

**General characteristics of the studied farms:** The economic lifespan in the farms on average were 6.7 years for cattle, 5.7 years for sheep and 6.1 years for goats. The birth rates were 93.9% for cattle, 95.8% for sheep and 105.1% for goats. The death rates were 11.1, 12.8 and 19.0% k, respectively. Pasture times were 6.6 months for cattle, 7.5 months for sheep and 7.7 months for goats. The amounts of milk obtained throughout the lactation periods were 1042.7 L for cattle, 49.2 L for sheep and 82.8 L for goats (Table 1).

**Land:** Although, the studied farms focus intensively on small ruminant production, land asset was the most important factor as well. In the studied farms, the size of

Table 1: Technical coefficients in the studied farms

Technical coefficients	Farm size			
	Small	Medium	Large	Average
<b>Cattle</b>				
Economic life (years)	6.7	6.6	7.3	6.7
Birth rate (%)	98.6	83.3	93.8	93.9
Death rate (%)	11.2	12.5	5.9	11.1
Pasture time (months)	6.7	6.6	6.2	6.6
Milk production (lt/Lactation period)	1126.8	979.7	656.5	1042.7
<b>Sheep</b>				
Economic life (years)	5.9	5.5	5.8	5.7
Birth rate (%)	96.9	92.4	97.8	95.8
Death rate (%)	14.6	8.4	13.9	12.8
Pasture time (months)	7.5	7.7	7.4	7.5
Milk production (lt/Lactation period)	32.9	74.7	83.2	49.2
<b>Goat</b>				
Economic life (years)	6.1	5.9	6.0	6.1
Birth rate (%)	105.2	102.8	111.4	105.1
Death rate (%)	21.0	15.6	15.4	19.0
Pasture time (months)	7.7	7.8	7.4	7.7
Milk production (lt/Lactation period)	64.3	112.7	118.1	82.8

farm land varies between 101.6 and 111.4 decares (da) within the farm size groups and 107.8 da in the average. Of the farm land, 82.6% was owned land, 12.2% was shared land and 6.7% was rented land. The percentage of owned land was getting decreasing, while the farm size was increasing. The rate of owned land in the small farms was 92.5%, while this was 61.9% in the large farms.

The farm land in the studied farms was mainly constituted of crop land. Of the 107.8 da of farm land in the average, 91.3% was crop land, 0.4% was vegetable 6.3% was fruits and 2.0% was vineyards. Of the crop land 18.4% was irrigated land whereas 81.6% was comprised of dry land. Irrigated land were mostly owned by the large farms (31.0%). Vegetable land were barely adequate to meet the self requirements of the farms. Hence, the share of vegetable land per farm was 0.4 da in the average (Table 2).

**Population and labor force:** The population of farms constitutes the labor force of the farms as well. In the studied farms, the average population per farm gradually increases with the size of the farm and varies between 7.6 and 11.1. In the average the population was 10.8 people, 53.2% of which was male and 46.9% was female population.

In the studied farms, the 15-49 age group was constitute the main source of labor force as the share of 45.9%, followed by the 7-14 age group as 35.2% and the 0-6 age group as 10.2%. The rate of the people within the 50 and higher age group was only 8.7%. This figure shows that 81.1% of the farm population belongs to 7-49 age group and that was significant labor force in the region (Table 3).

The average labor force in the farms was 4.3 Annual Work Unit (AWU). AWU was calculated based on age

Table 2: The structure of farm land

Farm size	Crop land													
	Irrigated		Arid		Total		Vegetable		Fruits		Vineyard		Total	
	da	(%)	da	(%)	da	(%)	da	(%)	da	(%)	da	(%)	da	(%)
Small	20.4	20.2	80.5	79.8	100.9	90.6	0.6	0.6	7.2	6.4	2.7	2.4	111.4	100.0
Medium	9.3	10.1	82.9	89.9	92.3	90.8	0.1	0.1	7.9	7.8	1.3	1.3	101.6	100.0
Large	30.7	31.0	68.1	68.9	98.8	96.8	0.3	0.3	1.5	1.5	1.5	1.5	102.1	100.0
Average	18.3	18.4	80.1	81.6	98.3	91.3	0.5	0.4	6.8	6.3	2.2	2.0	107.8	100.0

Table 3: Population and labor force in the studied farms

Age groups	Farm size							
	Small		Medium		Large		Average	
	People	(%)	People	(%)	People	(%)	People	(%)
0-6	0.9	12.9	1.3	14.9	1.4	12.5	1.1	10.2
7-14	2.1	27.3	1.9	21.7	3.1	27.4	3.8	35.2
15-49	3.6	47.4	4.6	53.9	6.0	54.3	4.9	45.9
50+	0.9	12.4	0.8	9.6	0.7	5.8	0.9	8.7
Total	7.6	100.0	8.6	100.0	11.1	100.0	10.8	100.0

and gender. Based on the values obtained, the labor force in the household as in days was calculated as 1118.4 in the small farms, 1348.8 in the medium farms, 1376.9 in the large farms and 1205.5 in the average by multiplying working days (281 days) and calculated AWU for each farm.

In the studied farms temporary workers constitutes the majority of external labor force. In terms of farm average, 13.8% of the total working labor force was external labor force. The external labor force was bigger in the large farms.

**Asset:** The asset was divided into two main parts namely farm asset and working asset. The farm asset in the average was US\$ 63,037, of which 75.3% was comprised of land asset, 11.9% was buildings assets, 11.5% was perennials assets and 1.4% was land improvement investment.

The average working asset of the studied farms was US\$ 12,348 per farm. Of this, 60.1% was comprised by livestock, 28.2% by machinery and equipments, 9.5% by auxiliary assets including the total of seedlings, fodders, manures, pesticides as well as foods, fuels, product assets spared for selling and 2.2% by financial asset.

The livestock asset per farm in the average was 11.94 Large Animal Unit (LAU). About 78.1% was comprised by small ruminants and 21.9% was comprised by cattle. The number of sheep per farm in the studied farms was 86.6 and goat was 2.3 (Table 4).

#### Annual return

**Gross Production Value (GPV):** On the average of the studied farms, crop production value was US\$ 3.406, of which 23.9% was from cereals, 9.8% from fruits, 4.9% from

Table 4: Livestock in the studied farms

	Ratios for Lau	Farm size			
		Small	Medium	Large	Average
Cattle		2.36	3.68	1.05	2.60
Small ruminant		4.60	12.82	31.19	9.34
Ram	0.12	0.09	0.24	0.90	0.21
Sheep	0.10	2.47	7.46	19.68	5.44
Yearling	0.08	0.27	0.80	2.43	0.62
Lamb	0.05	0.61	1.50	3.69	1.14
Buck	0.12	0.06	0.06	0.09	0.06
Goat	0.1	0.81	1.81	2.21	1.22
Goat kids	0.08	0.05	0.42	1.59	0.30
Kid	0.05	0.23	0.52	0.60	0.35
Total		6.96	16.50	32.24	11.94

Table 5: Livestock production value (%)

	Farm size			
	Small	Medium	Large	Average
Dairy	18.5	16.8	3.0	16.6
Milk	13.4	11.8	2.0	11.9
Purchased manure	0.1	0.1	-	0.1
Growth value by age	5.1	4.9	0.9	4.7
Sheep	66.7	64.7	86.0	67.9
Milk	16.4	21.4	31.3	19.2
Wool	0.6	0.9	2.7	0.9
Hide and skin	0.01	0.01	0.05	0.02
Growth value by age	49.6	42.4	52.1	47.8
Goats	14.8	18.5	10.9	15.5
Milk	9.0	9.5	5.9	8.9
Fiber	-	-	-	-
Hide and skin	-	-	-	-
Purchased manure	-	-	-	-
Growth value by age	5.8	8.9	5.0	6.6
Livestock production value	100.0	100.0	100.0	100.0

industrial crops, 0.5% from vineyards and 4.3% from pulses. The mostly produced products among cereals were wheat. Cotton and tobacco from among industrial crops and chickpea and lentils were produced from among pulses.

Table 5 shows that Livestock production value in the average farms was US\$ 4.452. The majority of the livestock production value was obtained from sheep and goat production in all the farm size groups. While, this ratio was 83.4% in the average, it was 81.5% in the small farms, 83.2% in the medium farms and 96.9% in the large farms. As the size of the farms increase, the share of the production value obtained from sheep and goat production gradually increases as well and in the largest farm size group, only 3% of the livestock production value was obtained from dairy cattle.

The majority of the livestock production value was obtained from Growth Value by Age (GVA). In the average, of the production value in dairy cattle production, 71% was obtained from milk, 0.4% was obtained from the purchased manure and 28.5% was obtained from GVA whereas in sheep production, these rates were 30.7% for milk, 1.7% for wool, 0.03% for skin and 67.6% for GVA and in hair goat production, of the production value, 55.7% was obtained from milk and 44.3% was obtained from GVA.

The average gross production value in farms was US\$ 7.858, of which 43.3% was comprised by crop production value and 56.7% was comprised by livestock production. In the average, the share of crop production within GPV decreases as the size of the farm increases. The share of crop production value in the largest farm size group was 27.9%. The share of livestock production within GPV increases as the sizes of farms increase and varies between 46.2 and 2.0% (Table 6).

Sheep production has the biggest share in gross production value. The average sheep production value of US\$ 3.137 in farms constitutes 39.9% of the gross production value and varies between 30.8 and 61.9% within farm size groups. Sheep production was followed by goat production value in the 2nd place with US\$ 678 (8.6%) and lastly, dairy cattle production comes with US\$ 637 and a ratio of 8.1%. In crop production, on the other hand, cereals (23.9%), fruits (9.8%), industrial crops (4.9%), pulses (4.3%) and vineyards (0.5%) were the activities constituting the production value.

**Farm expenditures:** Farm expenditures are the sum of all the expenditures, excluding the interest of the active asset, incurred in order to obtain the gross product. Farm expenditures were divided into 2 being variable expenditures increasing or decreasing depending on the regardless of the amount of production (Erkuş, 1979). Of the variable expenditures totaling to US\$ 4.156 on the average of the farms, 54.3 was comprised by fodders, 5.5%

by veterinary fees and medication costs, 8.5% by purchased fertilizers, 8.3% by changing machinery costs, 7.6% by seedling costs and the remaining 15.7 by other expenditures such as the pesticides used, water costs, procured services and temporary external works. Again, in all farm size groups and in the average, a great portion of the total variable costs was comprised by the variable costs incurred for livestock production value. This ratio changes between 53.0 and 78.6% within farm size groups and gets such a big share as 64.5% on the average of the farms. In livestock production, feed costs taking the biggest share with 84.2% and than, respectively veterinary-medication costs with 8.6%, workers' salary with 4.3% and other costs such as washing, shearing and water with 2.9%.

In the average, of the total farm expenditures, 63.9% was comprised by variable expenditures and 36.1% by fixed expenditures. Total expenditures increase in direct proportion with farm size.

**Gross Margin (GM):** For the studied farms, Gross Margin (GM) were calculated by subtracting variable expenditures per agricultural activity from the GPV obtained from these activity.

According to the obtained results, the value of GM in the average was US\$ 3.702, which amount gradually increases proportionally with farm sizes. Hence, it was US\$ 3.208 in the small farms, US\$ 3.406 in the medium farms and US\$ 7.997 in the largest farm size group. Gross margin per LAU in the farms was US\$ 310 and highest in the small farm size group (Table 7).

**Agricultural Income (AI):** Agricultural Income (AI) is a significant indicator in terms of shown success rate of the entrepreneur. It is calculated by adding of the labor wage of the manager and household members. Then the sum of the debt interests as well as the shares paid for rented and shared land from the net product subtracted from obtained value.

The average AI per farm among the studied farms increases in direct proportion with farm sizes. Varying between US\$ 7.051 and US\$ 11.699 per farm as of farm size groups, agricultural income in the average was US\$ 7.666 (Table 8).

Table 6: Gross production value (%)

	Farm size			
	Small	Medium	Large	Average
<b>Plant production</b>				
Cereals	31.6	17.3	13.4	23.9
Legumes	6.1	2.7	1.9	4.3
Industrial crops	2.9	4.9	10.2	4.9
Fruits	12.6	9.9	2.2	9.8
Vineyards	0.7	0.4	0.3	0.5
Total	53.8	35.2	27.9	43.3
<b>Livestock production</b>				
Cattle	8.5	10.9	2.2	8.1
Sheep	30.8	41.9	61.9	39.9
Goats	6.9	11.9	7.9	8.6
Total	46.2	64.8	72.0	56.7
Total gross production value	100.0	100.0	100.0	100.0

Table 7: Gross production value and gross margin (\$)

	İşletme büyüklük grupları			
	Small	Medium	Large	Average
Gross production value	6.338	9.172	15.643	7.858
Variable cost	3.130	5.326	7.646	4.156
Gross margin	3.208	3.406	7.997	3.702
Gross margin per decare	29	34	78	34
Gross margin per head	461	206	248	310

Table 8: Agricultural income (\$)

Farm size	Net income	Laon interest, shared and rented value	Family labor wages	Agricultural income	Agricultural income per decare	Agricultural income per head
Small	1.608	478	5.921	7.051	63	1.013
Medium	1.638	1.036	7.141	7.743	76	469
Large	5.957	1.547	7.289	11.699	115	363
Average	2.015	731	6.382	7.666	71	642

Table 9: Rantability (%)

Farm size	Economic rantability	Financial rantability
Small	2.15	1.72
Medium	2.20	0.96
Large	7.22	6.70
Average	2.67	1.98

The amount of agricultural income per decare of the farm land was US\$ 71, whereas agricultural income per LAU was US\$ 642 and was highest in the small farms and reduces in reverse proportion with farm size.

In the studied farms, agricultural income constitutes 96.3% of the total household income. Non-agricultural income constitutes such a small share as 3.7%.

**Rate of return on investment:** The rate of return on investment factor, financial rate of return on investment and economic rate of return on investment have been calculated for the studied farms. As net product was the return of the active asset, net product was rated with active asset in the calculation of economic rate of return on investment whereas financial rate of return was subtracting debt interests plus lease and partnership shares from the gross product and rating this with the equity asset. Economic rate of return was the return of active asset and varies between 2.15 and 7.22%. This was 2.67% on the average of the farms. Financial Rate of Return, which was the return of the equity asset, varies between 0.96 and 6.70% and was 1.98% on the average of the farms. Greater farms were observed to operate more profitably (Table 9).

## CONCLUSION

Agricultural income per farm was US\$ 7.666. Of the household income, 96.3% was constituted by agricultural income and 3.7% by non-agricultural income. The highest non-agricultural income was observed in the smallest farm size group. Economical rate of return was 2.7% and financial rate of return was 1.9% and these ratios were rather low. In spite of the fact that the studied farms focus intensively on small ruminant production, land asset was the most important factor. Of the farms, 18.7% was landless agricultural farms. Farm land size was 107.8 da and of this 82.6% was owned land, 12.2% was shared land, 6.7% rented land and 1.5% was given as rented and shared to the other farms. Livestock in the farms were

comprised at a rate of 78.1% by small ruminants and at a rate of 21.9% by cattle. There was 109.9 heads of small ruminants per farm and 78.8% of these were sheep and 21.2% were goats. The following can be recommended in order to increase the amount of revenues obtained from small ruminant production in the Region:

- Provision of rough fodder was the most important problem in small ruminant production in this region. Therefore, increasing income will be possible by encouraging landless agricultural farms to cultivate land through shared and rented land increasing rough and concentrate feed resources and thus reducing production cost.
- Although, land sizes in the GAP Region were larger as compared with other regions and small ruminant production was more widespread, fodder crops were not included in production patterns. To include fodder crops into the production pattern can be ensured by extension activities of public organizations in the region.
- The preservation of the existing pastures and meadows in the region and opening them to the utilization can contribute to the development of livestock production in the region.
- To cover operating and investment cost in time and adequate a system should be developed and established. Although, GAP project is mainly focus on irrigated farming, the farmers in which settled in arid areas should also encourage and were subsidized. This is also important for sustainability of production.

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