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Sayadi S., Calatrava J.

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Future prospects and maintenance of goat farming in mountainous areas: A quantitative analysis

S. Sayadi and J. Calatrava
Andalusian Institute for Agricultural Research and Training (IFAPA)
Dept. Agricultural Economics and Rural Sociology, Apdo. 2027 - 18080 Granada, Spain
e-mail: ssayadi@arrakis.es / javier.calatrava@juntadeanladucia.es

SUMMARY – Based on a survey of 170 goat stockbreeders in the mountainous rural areas of the Spanish Betic Massif, this study aims to identify which herd and farmer characteristics are related to future prospects and the likelihood of goat farming continuing, by fitting an ordered multinomial probit model. Some conclusions and recommendations are finally drawn both for improving the operation of these farms as well as for taking full advantage of the potential of the goat farming sector in the design of sustainable development policies for south-eastern Spain's mountainous areas.

Keywords: Goat-farming sector, future prospects, Murciano-Granadina breed, maintenance of goat farming, Mediterranean mountainous areas.

RESUME – *"Perspectives de futur et continuité de l'élevage caprin dans des régions montagneuses : Analyse quantitative". Dans cette étude, à partir d'une enquête sur 170 exploitations d'élevage caprin dans les régions rurales de montagne du Massif Bétique espagnol, on présente les résultats d'un modèle probit multinomial ordonné, pour identifier les facteurs, en relation avec l'exploitation et l'éleveur, qui déterminent les perspectives de futur et de continuité de l'activité caprine. Finalement, des conclusions et des recommandations ont été présentées pour l'amélioration du fonctionnement de ces exploitations, ainsi que pour profiter du potentiel du secteur caprin dans l'élaboration des politiques de développement durable des zones de montagnes méditerranéennes.*

Mots-clés **:** *Secteur caprin, perspectives de futur, race Murciano-Granadina, continuité de l'activité caprine, zones de montagnes méditerranéennes.*

Introduction

According to the 2003 Livestock Census, Andalusia is the region with the biggest goat population in Spain, accounting for only 18% of total Spanish area, just under 50% of all Spanish goats (totalling 1,349,811 goats) and generating almost 60% of national milk production (259,132 million litres in 2002) (MAPA, 2003). The opportunities for the goat milk sector in Andalusia are sizeable, as there are several autochthonous breeds. Of these the "Murciano-Granadina" and the "Malagueña" breeds stand out. They are the predominant pure breeds, accounting for over 70% of total population. Their excellent milk-producing ability, as well as their outstanding adaptation to all climates, have meant that these breeds are expanding throughout the whole country and are even well-known internationally.

The eastern Andalusian mountains are a typical example of areas in which the goat-producing system, still quite closely tied to rural culture, has in many cases been an important component of local economies. The depopulation of mountainous areas over the last few decades, as well as the changes in cultural patterns within rural populations, has led to far-reaching transformations of goat management systems (splitting of herds, disappearance of traditional grazing patterns, emigration-induced shortages of herdsmen, etc.). This sank goat farming into a crisis from which it showed no signs of recovery until recently. This upturn was not unconnected with European aid and rural development policies.

Furthermore, it is worth mentioning that a major problem facing anyone undertaking an analysis of goat farming systems is that there is not very much information about the economic structure and problems of farms particularly in less favoured mountainous areas. This shortage of information

largely limits the analysis of what effect rural development and farming policies are likely to have in these areas. The generation of economic information about goat production is generally quite unsatisfactory, there being almost no studies that are linked to mountain goat farming. There is, on the other hand, plenty of scientific literature on a range of technological issues concerning management and production systems.

Despite the above-mentioned shortage, there have been attempts at approximating an analysis of goat production systems from a very wide range of viewpoints. In this context, Falagan (1998), for example, studies the recent changes in milk goat-rearing systems in Spain, with emphasis on the "Murciano-Granadina" breed and the region of Murcia. Likewise, Morand-Fehr and Lamboley (2000) and Morand-Fehr *et al*. (2003) attempt to characterise the different goat milk production systems that are present in the Mediterranean. In this fashion, Calatrava (1982), De Maan (1998), Gousidos *et al*. (1998), Spathis *et al.* (1998), Matossian (2000), Pelant (2000) and Calatrava and Sayadi (2003, 2005a,b) are some of the few papers that analyse the socio-economic impact of goat-raising systems and related activities on rural development from different perspectives. In this context, the work by Calatrava (1982), De Maan (1998) and Pelant (2000), Calatrava and Sayadi (2003, 2005a,b), Sayadi and Calatrava (2005) and others attempts to illustrate what role goat farming and related activities play in local development.

Based on a survey of 170 goat farms in the mountainous rural areas of the provinces of Granada and Malaga (south-eastern Spain), we try to identify what farm and farmer characteristics are related to the future prospects and likelihood of goat farming being continued. For that purpose an ordered multinomial Probit model was assessed. Finally, some conclusions and recommendations are put forward to enable the design of future strategies for both improving the operation of these farms and to take full advantage of the potential of the goat sector in the design of sustainable development policies for the mountainous areas of the Mediterranean.

Methodology

The data used in this paper were collected from the information gathered in a survey of 170 goat farmers operating in the mountainous rural districts of the provinces of Granada and Malaga (south-eastern Spain). This survey was conducted in autumn 2005, the aim being for the surveyed farms to be representative of the different production systems and herd sizes in the area rather than forming a strictly representative sample of the population in terms of herd sizes.

The questionnaire used was divided into four major sections. The first was designed to ascertain general information about the technical characteristics of the farm (farm type, number of animals, area and land tenure system, infrastructures, etc.). The second section was intended to identify the goat production and management system (grazing, housing, feeding, reproductive cycle, etc.). The third section included questions related to the product type and marketing systems. Finally, the fourth section aimed to find out what the socio-demographic traits of the respondent farmers were (age, educational level, agricultural training, type of employment in farming, etc.), as well as their opinions and attitudes concerning the prospects for the continuation of farming in the future, reasons for keeping goats, receipt of European aids, etc. This paper presents only a reduced part of the information gathered by the survey.

Conventional statistical tests (χ^2, etc.) were used to analyse the data and an ordered multinomial probit model was fitted to identify which farm and/or farmer characteristics shape future expectations and prospects for the continuation of farming.

For this purpose, the "future continuation of stock farming" variable, CONTHERD, was considered as a qualitative dependent variable, the levels of which were coded as follows:

"CONTHERD" = 0: The farmer will abandon farming before retirement.
"CONTHERD" = 1: The farmer will not abandon farming, but envisages that the farm will go out of business in the future due to discontinuation.
"CONTHERD" = 2: The farmer will continue with goat farming in the long term and does not envisage that the farm will go out of business in the future.

The explanatory variables that the model specification accounted for initially were: farm type (Typefarm), making a distinction between goat only and mixed goat and sheep or other farms; goat breed (Breed); years employed in farming (Yearsfarming); employment type (Dedicafarm); farm size: no. of breeding females (Herdsize); access to land (Landpos); access to milking machine (Milkmach); housing (Housing); type of labour used in the production process: family/hired (Labour); farmer's age (Age); educational attainment (Educ); marital status (Mstate); no. of children (Child); attendance of agricultural training courses (Agrtrain) and membership of a milk marketing cooperative (Coop). Table 1 lists these variables, as well as the different levels taken by the multinomial variables.

Table 1. Definition of the explanatory variables of the ordered multinomial probit model (Dependent variable "CONTHERD": future continuation of goat farming)

Variables	Description
Constant	Constant term
Typefarm	1, if the farm is goat only (monoactivity) and 0, otherwise
Breed	1, if the breed is Murciano-Granadina, and 0, otherwise
Yearsfarming _1	1, if the goat farm has been in operation for less than five years, and 0, otherwise
Yearsfarming _2	1, if the goat farm has been in operation for 5 to 10 years and 0, otherwise
Yearsfarming _3	1, if the goat farm has been in operation for over 10 years and 0, otherwise
Yearsfarming _4	1, if stockbreeder has always kept goats, and 0, otherwise
Dedicafarm	1, if stockbreeder is only full-time employment, and 0, otherwise
Herdsize	Size of goat farm (no. of breeding females)
Landpos	1, if stockbreeder has land, and 0, otherwise
Milkmach	1, if stockbreeder has a milking machine, and 0, otherwise
Housing	1, if there is full housing, and 0, otherwise
Labour_1	1, if goat keeper has no hired labour (farmer only), and 0, otherwise
Labour_2	1, if goat keeper employs permanent or casual family labour, and 0, otherwise
Labour_3	1, if goat keeper employs permanent or casual hired labour, and 0, otherwise
Age_1	1, if aged $\leq$ 35 years and 0, otherwise
Age_2	1, if aged from 35 to 45 years and 0, otherwise
Age _3	1, if aged from 45 to 55 years and 0, otherwise
Age_4	1, if aged ≥ 55 years and 0, otherwise
Educ_1	1, if stockbreeder is unqualified or have primary education, and 0, otherwise
Educ_2	1, if stockbreeder has secondary education, and 0, otherwise
Educ_3	1, if stockbreeder has university education, and 0, otherwise
Mstate	1, if goat keeper is married and 0, otherwise
Child	Number of children
Agrtrain	1, if the farmer regularly attend agricultural training courses, and 0, otherwise
Coop	1, if the farmer is a member of a milk marketing cooperative and 0, otherwise

Results

A multinomial probit model has been fitted to identify the farm- and farmer-related characteristics that most influence the future maintenance and continuation of farming. The specification of this model is detailed in the methodology. The results of this model, confined to the significant variables, are shown in Table 2.

There is a logical direct relationship ($p = 0.0236$) between the size of the herd and the continuation of the farm business. Additionally, a higher stock housing level ($p = 0.0263$) implies a greater likelihood of farming continuing.

Attendance of agricultural training courses is also directly related to the future continuation of the farm business ($p = 0.0031$) in the sense that the continuation of farming is significantly greater among

farmers participating in agricultural training courses (goat operation start-up and modernisation, etc.) than those who do not regularly attend. In some cases, farmers participate in these courses to get European aids and subsidies for which they qualify by attending. These aids result in the modernisation of their farms and investments in plant and equipment, which means that they usually have bigger plans for the future with a view to amortising the incurred expenses.

Table 2. Results of the "Goat farming continuation" multinomial probit model

Variables	Coefficients	t	p
Constant	2.18049162	5.148	0.0000
Herdsize	0.490903954	2.264	0.0236
Housing	0.562464403	2.222	0.0263
Labour_1†	-2.64752081	-2.840	0.0045
Labour_2	-.295700614	-1.576	0.1151
Age-1††	0.906814958	3.999	0.0001
Age-2	0.541219281	2.325	0.0201
Age-3	-.397852398	1.185	0.2359
Agrtrain	0.826135	2.959	0.0031
Child	0.906814958	3.999	0.0001
Coop	0.438723	2,451	0.0142

† Labour_3 reference variable (farming with permanent and/or casual hired labour).
†† Age_4 reference variable (farmer > 55 years).
Log likelihood function: - 67.51221; Restricted log likelihood: - 116.1759; Chi-squared: 74.96863; Degrees of freedom: 10; Significance level: $p \leq 0.001$; PCC: 80.12%.

Additionally, the surveyed herds whose owners are members of a milk marketing cooperative are the farms that have greater prospects for continuing with the farm business ($p = 0.0142$). This is, without doubt, because of the high level of satisfaction, the commercial protection and/or greater added value afforded by this form of commercialisation, as well as the advice they receive from cooperative specialists.

There is also a very significant ($p = 0.0001$) and quite logical direct relationship between the number of children the farmer has and the likelihood of continuation of the farm business. This finding also ties in with what we observed in field work, as some farms remain in the hands of the same family for several generations. Additionally, many owners (27%) state in the questionnaire that they keep goats on the grounds of "tradition and inheritance".

With respect to the multinomial variables included as independent variables in the model (owner's age and farm type by labour) that turned out to be significant for explaining future prospects, and after making the respective adjustments by changing the reference levels, we found that: (i) more commercial farms (employing casual and/or permanent hired labour) have a significantly ($p \leq 0.01$) greater likelihood of continuation than farms that do not employ such labour (herds kept by just the farmer or possibly with family help); and (ii) farmers aged over 55 years are more pessimistic about the future of the farm than keepers aged under 35 years.

Apart from identifying the factors related to the future continuation of the farm, the estimated probit model can be used to calculate the likelihood of a given farmer and farm being optimistic about the future upkeep of the farm. Therefore, for example, the probabilities for a goat keeper aged over 55 years, who is not a member of a milk marketing cooperative, does not regularly participate in agricultural training courses, has an extensive farm with a herd of under 50 head, employs no labour apart from his or her own work and has no descendants, would be as follows:

P (abandonment of farming before retirement)	=	0.214
P (farming will not be abandoned, but the farm is likely to go out of business)	=	0.701
P (long-term continuation of goat farming with little likelihood of the farm going out of business)	=	0.085

On the other hand, the probabilities for a 35-year-old goat keeper, who is a member of a milk marketing cooperative, regularly participates in agricultural training courses, has a herd of over 500 fully housed goats, employs hired labour and has 4 children, are as follows:

P (abandonment of farming before retirement)	=	0.002
P (farming will not be abandoned, but the farm is likely to go out of business)	=	0.145
P (long-term continuation of goat farming with little likelihood of the farm going out of business)	=	0.853

Conclusions

There is a tradition of and experience in raising goats in the mountainous rural areas of south-eastern Spain, based on autochthonous stock farming, although it has been very much affected by the rural exodus and the resulting arable and stock farming crisis (land abandonment, shortage of grazing land, shortage of labour, etc.).

A direct scale effect on the prospects for continuation of farm businesses has been found.

Future prospects and the likelihood of continuation of goat farms in the area is linked to the size of the herd, the type of stock management and the type of labour used in the farms, the owner's level of agricultural training, milk marketing cooperative membership and the number of children in the family unit.

The farmer's age is indirectly linked to the maintenance of goat activity. Stockbreeders less than 35 years are more optimist about the future of the farm than keepers aged over 55 years.

Neither the type of herd (simple or multi-purpose), the breed, the length of time the farm has been in operation, part- or full-time employment in goat farming, mechanical or not milking, the owner's general educational level, influence the farmer's intentions of continuing with the goat farm business.

Generally, future expectations are not very optimistic, as the risk of disappearing goat farming has been detected to be very high.

Despite the above, it can be said that the sector does have some future potential, as a group of more dynamic young goat keepers have started up operations over the last few years. These stockbreeders have modernised their farm, improved stock management techniques and taken on hired labour.

To improve the future prospects of goat farms and assure their future continuation, rural and agricultural development strategies should aim to increase herd size, improve the qualifications and training of herdsmen and women and goat farmers, target available aids towards restructuring the sector and getting young goat keepers to start up market-oriented commercial farm businesses and towards promoting quality products, as well as supporting cooperatives in the sector. Apart from all this, these measures will maintain the rural population and the resulting local knowledge of stock farming management and utilization, as well as the tradition of goat farming and the area's autochthonous "Murciano-Granadina" and "Malagueña" milk-producing breeds.

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