Explaining farm succession: the impact of farm location and off-farm employment opportunities

A. M. Aldanondo Ochoa*, V. Casanovas Oliva and C. Almansa Sáez

Departamento de Gestión de Empresas. Universidad Pública de Navarra.
Arrosadía, s/n. 31006 Pamplona. Spain

Abstract

This paper studies the impact of farm location on family farm succession, using a sample of farm households located at different distances from the urban centre in a rural region of Spain. Aggregated household data and household/child cross section data are used to analyze farm succession from two different perspectives, the father's and that of each of the children. The research considers both the father's expectations for the transfer of the farm to the next generation and, also, the impact of the individual characteristics of each child on the likelihood of his/her entering agriculture. Two estimates, the probit and random parameter ordered probit model, suggest that farm location has a significant effect on the probability of one of the farm operator's children taking on the business. Other important factors that affect farm succession are firm size and farm children's level of education. Then, policy initiatives to foster qualified employment and structural change in agriculture may perhaps help to retain young people in farming.

Additional key words: agricultural household, econometric models, Navarra.

Resumen

**Análisis de la sucesión en agricultura: el impacto de la localización de la explotación
y de las oportunidades de empleo extra-agrícola**

En este trabajo se analiza el impacto de la localización de la explotación agrícola en la sucesión familiar. Para ello se utiliza una encuesta a una muestra de explotaciones ubicadas a diferentes distancias del centro urbano en una comarca rural española. La disposición de datos agregados a nivel de explotación y de una sección cruzada, explotación/ hijo de agricultor, nos permite estudiar la sucesión desde dos perspectivas: la del agricultor y la de cada uno de sus hijos mayor de edad. La investigación considera las expectativas del padre con respecto a la sucesión y el impacto de las características individuales de cada hijo en su decisión de incorporarse a la agricultura. La estimación de los correspondientes modelos econométricos, un modelo probit y un modelo de panel probit ordenado con coeficientes aleatorios, pone de relevancia el significativo impacto de la localización de la explotación en la probabilidad de que algunos de los hijos del agricultor continúe con la empresa. Otros factores importantes, que afectan también a la sucesión, son el tamaño de la explotación y el nivel educativo de los hijos. Por lo tanto, las políticas que promuevan la creación de puestos de trabajo cualificado y la re-estructuración de la agricultura podrían retener a los jóvenes en las explotaciones agrarias.

Palabras clave adicionales: explotación familiar, modelos econométricos, Navarra.

Introduction

The relative aging of the economically active population in Spanish agriculture, especially in disadvantaged areas of the country, poses a social welfare problem, not only because of its impact on the economic and social viability of the areas in question, but also because of its potential impact on environmental conservation[1]. The main cause of the problem is the failure of farm succession and persistent rural-urban emigration of farmers' children.

The literature on intergenerational succession in family farms highlights the fact that the size of the holding and the characteristics of the farm operator have a strong influence on how successfully the intergenerational transfer of family farms is carried out (Fennell, 1981; Blanc and Perrier Cornet, 1993; Handler, 1994; Kimhi and López, 1999; Kimhi and Nachlieli, 2001; Glauben

[1] See OECD (2001) for an analysis of multifunctional agriculture.

et al., 2002a,b, 2004). Larger holdings run by more highly educated farmers are more likely to be taken over by one of the children. Although some studies underline the influence of part-time farming in this matter, few explore the impact of farm location on the success of farm succession. Glauben *et al.* (2004), for instance, show regional differences in the pattern of family farm transfer between northern Germany and Austria. In Germany, farms are larger and successors work full time on their parents' farm, while most successors in Austria are part-time farmers. Conversely, Kimhi and Nachlieli (2001), for Israel, conclude that success in intergenerational family farm transfer is not conditioned by location.

In Spain, there has been little research on the subject of intergenerational transfer of family farms (Ramos, 2004). However, an interesting and innovative perspective, that is lacking in the economic literature on family farm succession, can be found in studies on rural youth, where the problem is addressed from the standpoint of the second generation (González, 1991; González and Gómez Benito, 1997, 2001; Gómez Benito and González, 2002; González *et al.,* 2002). These works underscore the fact that the outcome of succession is heavily influenced by farm size, farmers' children's educational level and agricultural policy. These studies also highlight the economic transformation of rural areas in Spain, via the development of new activities, as a factor that may influence farm succession. Young farmers have bigger farms and are more pluriactive than their parents. As far as the second of these characteristics is concerned, therefore, the likelihood of the younger generation continuing in farming increases if the farm is close to a source of supplementary employment.

In contrast with the literature on farm succession, several studies on farm exit stress that the survival and growth of farms is increasingly influenced by the surrounding economic environment. For instance, Aldanondo and Ramos (1999) relate agricultural exit to farm succession and farmer retirement and demonstrate the impact of off-farm employment on the stabilization of farms. Glauben *et al*. (2003) reach similar conclusions in their analysis of regional farm exit in Germany. Farm exit is related to retirement and succession in Germany, with lower exit rates being reported in regions where there is a high share of part-time farmers. Goetz and Debertin (2001) also suggest that the farm exit rate in the US is partially conditioned by off-farm employment opportunities.

This paper therefore examines farm succession in a rural area of Spain by analyzing the impact of farm location. We consider the possible impact of the availability of opportunities for part-time farming, taking into account that they differ for each farm, depending on its distance from an urban centre. The study is based on a survey of farm operators located at various distances from the urban centre in a county (Estella), in the Autonomous Region of Navarre, northeastern Spain. Farm operators were asked whether there was a successor for the farm and questioned about the personal characteristics and employment status of their children. Farm succession was then analyzed both from the standpoint of the farm operator and his expectations and also in terms of the extent to which the adult children participate in farm work.

The area of study

The data are drawn from a 1998 farm household survey conducted in the western part of Estella County. Estella has a population of 12,000 and has been one of the county's labor and population magnets. However, job opportunities are in short supply all over the county and there has been and continues to be considerable emigration to other more industrial regions.

The area is in fact characterized as a rural area (according to OECD, 1994, classification) with its industrial and services sectors still in the early phase of development. Employment in agriculture currently stands at around 27%, as compared with 9.9% in the surrounding region and 10.7% in Spain. The agricultural specialty of the area is cereal crops and it has an emerging pork sector.

Farm holdings range from small to medium in size (with an average of 20 ha of non-irrigated crops). The number of holdings fell by 30% during the 1990s, mainly because of the failure of inter-generational transfer on family farms. The tendency of farmers' children to emigrate to other areas, a phenomenon that took on massive proportions during the nineteen seventies and eighties, has grown further in recent years due to higher levels of educational attainment among young people in rural areas.

The average age of farm operators is very high. Despite the high incidence of second jobs among younger farmers, moreover, there is less part-time farming and on-farm pluriactivity than in other areas of Navarra.

The fact is that little progress has been made in the diversification of the rural economy: the agro-food industry in this area was minimal at the time of the survey, and there were only two cases of rural tourism

initiatives in the sample area. This is therefore a clear example of a rural area in which the current low demand for off-farm labor is concentrated in the urban centre[2]. The purpose of this analysis is to determine the extent to which succession is conditioned by specific farm locations in an area of this nature.

Another characteristic feature of West Estella county is its isolation. There were no major transport routes through the area and the local roads were narrow and winding. The nearest population centers to the county town of Estella are a quarter of an hour's drive away, and the furthest three quarters of an hour. The next closest towns were much further away.

Regulation of farm succession in the area has historically been dominated by the institution of the unique heir (Moreno Almárcegui and Zabalza Seguín, 1999). As a rule, parents named one child to be the unique heir, who was then expected to take care of them in their old age. This member of their offspring, whether male or female, inherited the farm in its entirety. The remaining siblings were given an economic compensation (known as the *Legítima*) and were helped and encouraged to find an alternative means of earning a living. Nowadays, due to the overall growth of the Spanish economy and a variety of other reasons, this institution has for fallen into decline in many regions (Ramos, 2004). In this area in particular, a better educated youth and increasing job opportunities in other sectors have lessened the appeal of farm work and the rural lifestyle as a career option for young people. In many cases, moreover, the success of intergenerational transfer depends more on the preferences of the farmer's children than on their parents' decision, though usually the parents are who encourage their children to pursue other careers.

Methodology and sample restrictions

A key step in the analysis of farm succession is to define the relevant population of analysis and to identify which farms have a successor. Both matters are related. Farm succession studies usually consider the relevant population to be farm households operated by farmers over the age of 45. However, Kimhi and Nachlieli (2001) proposed two methods for identifying farms with a successor: one is by directly asking the operator, the other is to ascertain whether any of the farmer's grown-up children are working on the farm. To apply these criteria, a sample selection of the relevant population is needed. This study is based on these two concepts of successful intergenerational farm transfer, though households with grown-up children working on the farm were often not the ones whose operators claimed to have found a successor[3]. Following these criteria, the relevant sample for the analysis is defined below.

The sample includes 195 farm operators of all ages. It should be noted that, in addition to analyzing farm succession, there was another aim to the survey, which was why the sample included farmers of all ages.

All the farm operators were asked if any of the children intended to carry on with the farm, by requesting them to choose one of the following replies: 1) Yes, I have someone to succeed me on the farm; 2) No, none of the children intends to continue in agriculture; and 3) I don't know/no answer. The first option was taken as an affirmative reply, while don't knows and households without grown up children were removed from the sample[4]. The study then focused on succession in the 61 households in which the farm operator had grown up children and claimed to know whether or not he had identified a successor. The household was the unit of analysis when analyzing succession from the farm operator's perspective.

One of the main issues in a successful outcome, therefore, relates to the incentives for the next generation to go into agriculture. Staying on the farm also involves an opportunity cost directly proportional to the potential wage that each potential successor could earn in the off-farm labor market. Hence, the personal characteristics of each of the farmer's children may also influence the

---

[2] According to the data, the active agrarian population in the area was older and part-time farming had less weight than on average in Spain (Aldanondo and Ramos, 1999). This reflects the rural nature of the county as a whole and the limited job opportunities it has to offer.

[3] 70% of the farm operators with grown-up children working on the farm claimed that one of their children would continue to run the farm; 20% said they did not know; and 10% stated that they had no-one to succeed them. The inverse percentages apply among those with no grown-up children working on the farm.

[4] Farm operators without children declared themselves to have no successor, while (with the exception of three) those whose children had not yet reached adulthood said they did not know whether any of them would succeed their father on the farm. Of the 90 farm operators that have grown up children, 29 claimed not to know whether any of them would continue with the farm. The Vella (1992) bias test was applied and the null hypothesis of sampling bias was rejected.

likelihood of his/her entering agriculture. This paper has therefore extended the analysis performed by Kimhi and Nachlieli (2001) by individually questioning farmers' children regarding their participation in farm work. The purpose of this is to isolate the impact of overall household characteristics from the influence that may be brought to bear by the individual characteristics of each child in the family. The relevant population in this case is the cohort of farmers' children over the age of 23. This was taken as the minimum age because it is the age at which students complete their higher education in Spain[5]. To analyze entry into farming by farm operators' children, a cross section household-child data panel was used. The relevant sample for this part of the study is made up of the 76 households with 195 children above the age of 23.

The survey provided information on the educational level, age, and job situation of all the grown-up farm children in the sample, with no distinction between the successor and the rest of the siblings.

Henceforth, the study will focus on measuring the impact of distance and other variables on the likelihood of the farm operator having a successor among his children, and finally on the likelihood of each grown-up son or daughter deciding to work on the farm[6].

Results

Sample description

Tables 1 and 2 highlight the differences in location, demographics, human capital characteristics and household activity for each of the farms and individuals in the sample. Farm diversification has not advanced much in the area, and the farm operators rarely diversify their activities by providing mechanization services to neighboring farms. Diversified farmers were therefore included alongside full-time farm operators.

Most of the variables in the tables are used to proxy for farm income and potential market wage in each situation. Fixed factors, such as land, machinery, heads of livestock, buildings, farm specialization, and the rest of the household labor supply relate to farm income.

Table 1. Household description in farm succession

Variable	Household with successor (cases = 39)		Non successor (cases = 22)	
	Mean	SD[a]	Mean	SD[a]
Distance to the urban center	15.86	9.25	19.95	8.35
Operator age	65.69	9.74	62.67	7.30
Operator education	10.88	0.46	10.68	0.47
Operator in off-farm employment	0.06	0.22	0.09	0.29
Number of children	3.38	1.46	2.68	1.29
Offspring's age	31.53	9.10	28.58	7.45
Offspring's education	0.88[b]	0.09	0.93[b]	0.10
Land	28.61	26.13	24.06	21.07
Heads of livestock	2.41	6.16	3.55	12.23
Machinery	11.35	10.74	10.70	10.97
Share in farm income:				
— Cereal	61.92	38.21	67.05	33.90
— Sunflower	1.68	4.81	0.00	0.00
— Tobacco	5.00	14.37	3.64	10.02

[a] SD: standard deviation. [b] Household average educational attainment = $\sum_{1}^{N} Ai/N$, where Ai = education attainment of grown-up

child i; and N = number of children above 18th in the household. At the same time: $Ai = [(Years\ of\ education\ per\ level\ *\ level\ of\ education_i) + 5]/Age_i$, if the grown up child is younger than 23 years old; or $Ai = [(Years\ of\ education\ per\ level\ *\ level\ of\ education_i) + 5]/23$, if the grown up child is older than 23 years old.

[5] In past econometric research, it has been found that assistance to part-time farm operators is important for family members under the age of 23 working in the farm.
[6] An annual average of more than two hours a day.

Table 2. Household description in agricultural entry[a]

Variable	Household with working sons (cases = 29)		Household without working sons (cases = 47)	
	Mean	SD[b]	Mean	SD[b]
Distance to the urban center	14.87	9.11	19.07	9.23
Operator age	63.25	11.18	65.70	7.80
Operator education	1.93	0.26	1.91	0.26
Operator in off-farm employment	0.14	0.36	0.66	0.25
Number of children	3.21	1.47	2.96	1.32
Offspring's age	29.94[c]	8.39	34.28[d]	7.97
Offspring's education	14.97[c]	2.78	15.10[d]	2.85
Land	35.73	48.27	22.90	20.84
Heads of livestock	0.81	1.71	1.98	5.69
Machinery	15.31	1.19	8.91	12.51
Share in farm income:				
— Cereal	60.18	37.92	68.17	36.48
— Sunflower	0.78	2.98	1.27	5.79
— Tobacco	6.79	16.34	3.80	10.91

[a] The averages refer to the household. [b] SD: standard deviation. [c] Age and years of study of working offspring. Number of observations = 38. [d] Age and years of study non-working offspring. Number of observations = 157.

The variables used to estimate the actual employed labor force include the different degrees to which labor-intensive and labor-extensive crops contribute to farm income. Cereals are the main extensive crop in the area. Tobacco is a labor-intensive crop, cultivated as a supplement or an alternative to cereals.

Age and educational level may be potential wage indicators. All the models included age and age-squared of the farm operator in order to capture life-cycle variables. Education is expressed as total years of schooling corresponding to a 5-point scale, ranging from elementary studies to a university degree[7].

These simple mean values provide a preliminary characterization of the different types of agricultural households. The most outstanding features of the households in which there is a successor or the grown-up children work on the farm are a) that they are nearer to the urban centre, b) they are slightly larger than the rest, and c) the children present a lower average of academic attainment. They present a combination of higher farm labor income and children with a lower potential market wage.

Within this overall picture of agricultural entry, there are two possible situations: one is that the son/daughter works exclusively on the farm and the other is that he/she takes up part-time farming[8]. At this stage in the analysis,

no distinction is made between these two categories, which differ in the dependent variable included in the specification of the econometric model of next generation agricultural entry.

These data offer a first hint at the importance of the spatial component in farm succession. However, this spatial component is only represented by the different distances of the farms in the sample to the capital of the county: Estella. Wojan (2000) indicated that there is increasing occupational specialization in non-metropolitan areas. This affects all sectors and is not associated with high skills requirements. Some data from the survey suggest that Estella County, including the capital, may be ripe for this specialization process. On the basis of these simple measurements, it is difficult to discern whether local distances have an influence on farm entry decisions only in households where the children are poorly educated, or whether other groups of rural young are also affected.

Estimation and results of the succession models

Table 3 reports the estimated parameters of different econometric models. The first equation is a probit model

---

[7] Compulsory schooling begins at age 5. Primary level represents 9 years' schooling (after which compulsory education used to be complete), the second level = 11 years' schooling, the third = 13 years, the fourth = 16 years and the fifth = 18 years.
[8] 40% of the children that work on the family farm have a second job.

Table 3. Estimated probit model of farm succession and random parameter ordered probit model on farmer's son agricultural entry

Independent variables	Dependent variable: The farmer has successor (1 = «yes»; 0 = «no»)		Independent variables	Dependent variable: Son works in the farm (2 = «yes, exclusively»; 1 = «yes, part time»; 0 = «no»)	
	Observations: farmers who know (61)			Observations: 195 sons; 76 households	
	Parameter estimates	(t-values)		Parameter estimates	(t-values)
Fixed parameters					
Intercept	33.523**	1.958	Intercept	5.961	1.687
Distance	−0.071**	−2.245	Distance	−0.062***	−5.822
Operator age	−1.206**	− 2.297	Son age	−0.180*	−1.742
Age squared/100	1.031**	2.445	Age squared 100	0.245*	1.609
Operator education	0.655	1.351	Operator education	−0.390***	−1.757
Operator in off-farm employment	0.380	0.467	Operator in off-farm employment	0.499	1.433
Number of offspring	0.057	0.306	Number of children	−0.164**	−2.690
Offspring's education	−5.640**	−2.124			
Age difference father-child	0.018	−0.362	Age difference father-son	−0.021	−1.378
Land	0.032**	2.178	Land	−0.013*	−1.921
Livestock	−0.036	−1.128	Livestock	−0.249***	−3.451
Log-Machinery	0.036	−1.343	Log-Machinery	0.310***	3.451
Sales share of:			Sales share of:		
— Cereal	−0.021*	−2.374	— Cereal	−0.012***	−3.798
— Sunflower			— Sunflower	−0.060**	−2.223
— Tobacco	0.084	−0.4731.291	— Tobacco	0.024***	2.925
Random parameters					
			Offspring's education		
			Mean	−0.085**	−2.146
			Scale	0.027***	4.256
			Threshold parameter		
			Threshold parameter	0.568***	4.356
N	61		N	(76,195)	
lnL	−26.429		lnL	−83.673	
lnL0	−41.284		lnL0[a]	−121.667	
2(lnLL- lnL0)	29.711*** (13)		lnLR0[b]	−111.046	
Entire sample[c]	77.0%				
Yes =1	75.0%				
No = 0	80.0%				

[a] lnL0 = Log-likelihood of an ordered probit model, with only intercept and threshold. [b] lnLR0 = Log-likelihood of an ordered probit model with all the parameters equal to zero and the constant random. [c] Used to predict sample probabilities.

that determines the impact of the different variables on the likelihood of the farm operator having someone to succeed him. The second equation is a random parameter ordered probit model in which the dependent variable Y_{ij} indicates whether the jth grown-up child (over the age of 23) on the ith farm does

not work on the farm at all (0), works on the farm and holds a second job (1), or works exclusively on the farm (2).

The explanatory variables in both models include both farmers' personal profiles and the financial reward that the farm holds out to the second generation. The

age of the farm operator is a key factor, because it determines when he will begin to seek a successor.

There is a lack of consensus on the influence of the educational level of the farm operator on farm succession. For some authors a higher level of education helps the father to make a more efficient choice of successor among his children (Khimi and Nachlieli, 2001). This could be an important factor in traditional societies. In another study on succession in Europe, Glauben *et al.* (2004) showed that the success of intergenerational transfer of family businesses could be negatively affected by the educational level of the father. In this case, it might be more a question of intergenerational transmission of social status: the children of poorly educated farmers go into agriculture, while those of better educated farmers do not. Since this impression needs to be put to the test, our study includes the father's educational level as an explanatory variable in the succession models.

When it comes to the reward to be gained from the farm, it is the farm structure and farm specialization variables that determine both farm household income and another important factor, which is the intensity and continuity of farm labor demand. An extra incentive for children willing to take over the family business is the possibility of combining farm-work with a second job. The two main factors here are whether the father holds an off-farm job and the commuting distance from the urban centre; the first because it shows off-farm employment to be a workable option and the second because it entails commuting costs for those considering pluriactivity.

Finally, farm children's educational level has been included in the models in order to capture the opportunity costs of their remaining on the farm. In the first model, where the variable is the probability of the farm operator having a successor (based on his response in the survey), a specific indicator has been constructed. In fact, the educational level of the grown-up children may be related with the age of the individual. For instance, an 18 year old would not normally have completed university studies. In the model, therefore, the average educational level of grown-up children has been replaced with an explanatory variable called average academic attainment. Academic attainment is calculated by dividing each child's declared number of years of education[9] (corresponding to the level of completed education) by his/her age, for ages under 23, or by 23 (the age by

which higher education is normally completed in Spain), for ages over 23. In the next generation agricultural entry model, years of study, corresponding to the level of completed education, is kept as an explanatory variable, since all the farmers' children are over 23 years old.

Thus, both models included variables intended to capture income from on-farm labor, be it full or part-time, and the opportunity costs involved in each alternative.

Econometrically speaking, there is nothing remarkable about the first model. It is a probit model in which the dependent variable, which is the probability of the farm operator having a successor, is dependent on the normal distribution of a linear combination of the explanatory variables.

The econometric model of agricultural entry by farm children is less common in the literature. It is a random parameter ordered probit model (Train, 2003; Green, 2004) using a cross section household/child data. The explanatory variables of the model include household data, which are common to all the offspring of an individual farm operator, and the age and years of schooling completed by each child. The objective of this model is to analyze each child's probability of taking one of three options: not working, working part-time or working full-time work on the farm. An ordered model has been used because it provides the best fit to this type of decision (Sadoulet *et al.*, 1998; Aldanondo and Ramos, 1999). If farm labor income and conditions are worse than the child's potential off-farm salary and conditions, he/she may decide not to continue with the father's business. If they are more or less similar, he/she may opt to combine it with a second job. If they are better, it may be worth full-time dedication. Thus, the model is specified as follows:

$$Pr \text{ (child}_{ij} \text{ will not work on the farm)} = \\ = Pr \text{ (} Y_{ij}* \leq \mu_1 \text{)} \qquad [1]$$

$$Pr \text{ (child}_{ij} \text{ will combine farm work with a second job)} = \\ = Pr \text{ (} \mu_1 < Y_{ij}* \leq \mu_2 \text{)} \qquad [2]$$

$$Pr \text{ (child}_{ij} \text{ will work exclusively on the farm)} = \\ = Pr \text{ (} Y_{ij}* > \mu_2 \text{)} \qquad [3]$$

where *Pr* is the normal distribution function, $Y_{ij}*$ is a latent dependent variable and μ_1 and μ_2 are the thresholds of this latent variable. When the latent variable crosses the first threshold, the prediction is that the

---

[9] Plus five, because compulsory schooling at the age of five.

child will opt for part-time farm work. When it crosses the second, the prediction is that the child will opt for farm work exclusively. The latent variable also depends on a set of explanatory variables according to the following linear function:

$$Y_{ij}^* = \alpha + \beta_{1i} \text{ Educational attainment of child}_{ij} + \beta_2 \text{ Age of child}_{ij} + \lambda_k X_k + e_{ij} \quad [4]$$

X_k are a set of explanatory variables that are common to all the children of the household, while educational attainment and age are specific to each of those over the age of 23. Finally, e_{ij} is the error, which has a normal distribution N(0,1).

Another of the aims of this paper, in addition to testing the impact of farm location, was to examine whether educational attainment among young people who remain in agriculture is always lower or varies across farm households. It would appear reasonable to expect that the effect of the educational level of the children on their possible entry into agriculture will itself depend on non measured household-specific factors. The random parameter model allows us to test whether the effect of farm children's educational level on agricultural entry varies across the households or not. This study uses a model in which the coefficient of the explanatory variable, farm child's educational level, in the second equation, β_{1i}, is specified as a random parameter. This coefficient varies across households according to the following equation:

$$\beta_{1i} = \beta_1 + \sigma \, v_i \sim v_i \, N \, (0, 1) \quad [5]$$

This equation decomposes the coefficient of farm children's education, β_{1i}, into two parts: one is the average, β_1, which is fixed and common to all households, while the other is the standard deviation of the random parameter, σ multiplied by an unobservable random term, v_i, in the ith observation in β_{1i}, which is independently normally distributed (Revelt and Train, 1998; Train, 2003; Green, 2004). The model assumes that the education level parameter is heterogeneous and varies across households, with a mean β_1 and a standard deviation σ.

Table 2 gives the results of the estimations. Both models were estimated for a sub-sample of the overall sample. In all cases the Vella (1992)[10] selection bias test was used to test for sample bias. In the succession model, two independent probit sample selection equations were estimated: one, for the binary variable, «has grown-up children» and, the other, for the binary variable, «knows whether there is someone to succeed him». A bivariate probit model was used first, to test for error correlation between these two models. For the panel data model of next generation agricultural entry, the generalized residual of the sample selection equation was introduced as a household-specific variable. Having clarified these procedural details, it should be added that in all cases the null hypothesis that the sample is random with respect to the population as a whole was confirmed. All models were estimated with the Limdep 8.0[11] statistical package.

The succession model is statistically significant at better than the 1% level, as measured by the Log-likelihood (lnL) test ratio[12]. The percentage of correctly classified observations is 76%. In the next generation agricultural entry model, the lnL of the random parameters ordered probit model –83.673. The results confirm that the scale or the standard deviations of the random coefficients of the offspring's educational level are statistically significant. In other words, the results verify unspecified group-specific heterogeneity and confirm that the impact of farm children's educational attainment on the probability of their working on the farm varies for each household.

The data in the second equation perfectly fit an ordered probit model, which could be considered an appropriate econometric specification to analyze participation in farm-work by farm children, while distinguishing between those who hold a second job and those who work full-time on the farm. The threshold parameter for the index is set to zero by the estimation for the first level and takes a value of 0.568 for the second level. The fact that the parameters are significant suggests that there is some order in the decisions.

---

[10] This is an extension of the Heckman (1979) test to qualitative variables, where the generalized residual of the probit selection equation is introduced as one more explanatory variable in the main equation. Under the null hypothesis, of no sample bias, its coefficient is not different from zero. Using this procedure, it is possible to reduce the multi-collinearity problem associated with sample selection models (Nawata, 1993; Leung and Yu, 1996; Vella, 1998; Moffit, 1990). Pagan and Vella's (1989) normality test was also applied, given that the distribution has to be normal in order for the estimators to be consistent. Results indicate that the residuals of the selection equation have a normal distribution. All these results can be obtained from the authors upon request.
[11] Provided by Econometric Software, Inc., 15 Gloria Place, Plainview, New York, 11803 USA.
[12] The test is based on the statistic $-2[L(\beta) - L(0)]$ which is distributed as a χ^2 with different degrees of freedom for each model.

Discussion

The coefficient of the distance variable in both models is found to be statistically significant and to have the same negative sign. These results suggest that fewer of the children on farms located in remote areas will go into agriculture. Despite being a new finding in the analysis of farm succession in Spain, this is consistent with the conclusions of the literature on farm exit.

As far as fixed factor endowment is concerned, land (total surface area of the farm in hectares) and investment in machinery have a positive impact on the likelihood of the heirs continuing to work the farm.

The only surprising result is the negative sign of the coefficient of the number of heads of livestock in the second equation. The probability of the next generation working on the farm decreases with the number of heads of livestock. It is difficult to account for the fact that farms with more livestock should have less appeal for the heirs to the holding, because livestock farming tends on the whole to yield a higher level of income per unit of surface area than does arable farming. The reason may therefore lie partly in the hard work, harsh conditions and long hours associated with livestock farming[13] (especially on small poorly mechanized holdings such as those of the sample), and partly in the high incidence of pluriactivity (40%) among farmers' children.

The coefficients of the remaining variables, which reflect the economic orientation of the farms, are consistent with this interpretation. The participation of farmers' children in on-farm work is negatively influenced by the share of cereal (Eqs. [1] and [2]) and sunflower (Eq. [2]) and positively influenced by the share of tobacco (Eq. [2]). This is an expected result. Cereals and oil-seed crops are mechanized crops that do not require much labor, while tobacco is a highly profitable labor intensive crop, where seasonal labor demand peaks in summer.

The coefficient for off-farm employment of the father is not statistically significant in any of the models. At first sight, this lack of significance appears to suggest that the intergenerational transfer of part-time holdings is no easier than that of full-time holdings. In this respect,

the fact that both the distance and land variables affect succession might indicate that the reason that the heirs continue in agriculture is, in some cases, because the business provides them with acceptable full-time employment and, in others, because the farm's location allows them to hold two jobs. This could be an indication that there are two alternative modes of agricultural entry.

When it comes to the demographic variables involved in succession, «number of children» bears the expected sign: it is positive in the succession model and negative in the «next generation agricultural entry» model. This means that succession is more likely to happen when the farmer has numerous offspring and each child's probability of opting for farm-work decreases with the number of siblings. Although these effects appear obvious and logical, the coefficient is significant only in the second model. The lack of significance in the first model contrasts with the importance of this variable in previous analyses of succession mentioned earlier. It may be due to the fact that they use a different household category from the one used in this paper, which analyzes the antecedents of successful intergenerational farm transfer in households whose operators have children and claim to know whether they have someone to succeed them. Other studies use apparently wider-ranging household samples.

The age of the farm operator, and hence that of his children[14], has a quadratic effect on the likelihood of identifying a successor. Within the narrow age range of the farm operators in the sample, the probability of there being a successor is polarized around the youngest and the oldest. This probability decreases with the father's age up to the age of 59 and with the child's age up to the age of 39[15], and increases after these ages, respectively. This result is in line with some other studies on farm succession in the EU (Glauben *et al.*, 2002a, 2004). This pattern might be related to the moment of time in which intergenerational transfer of farm management is considered. Indeed, the implementation of 1993 common agricultural policy (CAP) grants for newly established young farmers (under forties) in this region required the farm to be of a par-

---

[13] In fact, the share of intensive livestock operations in farm household income is a non-significant variable in this model.

[14] The age of the children has the same effect on succession. The father-son age differential is not significant.

[15] With all the caution due to the interpretation of marginal effects in ordered probit models (Green, 1998), it can be said that the probability of a young person not working on the farm increases each year up to the age of 38; the probability of him/her working part-time decreases every year up to the age of 38; and the probability of him/her being employed exclusively on the farm decreases each year up to the age of 37.

ticular size (hectares of arable land or heads of livestock) and the applicant's main occupation to be farming. It is reasonable to assume, therefore, that the intergenerational transfer process should be somewhat delayed on smaller farms and that the heirs in this case should continue to feature as additional family labor until a much later age, often combining this work with other employment.

So far we have investigated how succession is affected by factors relating to farm structure and remoteness. Turning now from agriculture to other occupations, we direct our attention towards the off-farm labor demand affecting every farmer's son or daughter. A reasonable way of assessing a person's qualifications is by observing his/her academic attainment level. The results of the analysis are quite revealing. In the succession model, since many of the young people were still students, we set the educational level relative to their mean age. The second equation, however, reflects the years of study of each of the farmer's grown-up children. The coefficient of both variables is negative and significant, suggesting that the higher the son's/daughter's level of formal education, the less likely intergenerational succession is to take place. This result is consistent with other studies of rural youth in Spain.

The actual study adds to previous research, on the effect of young people's educational level on their decision whether or not to remain on the farm, by allowing the weight of the variable to vary across households in the second model. As can be seen from Table 2, this coefficient has an estimated mean of –0.085 and estimated standard deviation of 0.027. The estimated standard deviation is highly significant, indicating that the parameter varies across households. However, the estimated standard deviation is quite low in relation to the mean. Considering that the coefficient follows a normal distribution, this low relative value of standard deviation implies that practically none of the households has an estimated coefficient of offspring's educational level lower than zero. Thus, the results suggest that, regardless of farm structure and household characteristics, youngsters with a higher level of education, within and across households, do not opt to remain on the farm.

These results are affected by local conditions in the study area. This particular area is characterized by a combination of relatively homogeneously structured medium-sized holdings and a high level of education among farmers' offspring. Nevertheless, it can be said in their favor that they are consistent with the main findings reported in studies of rural youth in Spain. Additionally, our research provides econometric proof that the probability of agricultural entry for each adult child of the farming household diminishes as his/her level of education rises, whatever the farm type.

As conclusion, in this paper we have analyzed the impact of farm location on farm succession in a rural area in Spain. This is an empirical analysis based on the data obtained from a survey of farm owner-operators located at different distances from the local county town. We have analyzed intergenerational farm succession from different perspectives, using different models. We used a probit model to analyze succession from the farm operator perspective and estimated a random parameters ordered probit model to analyze next generation agricultural entry. The results of the econometric models lead us to the conclusions summarized below.

First, distance from the local urban centre has a negative effect on succession. The more remote the holding, the less likely the operator is to be succeeded by one of his offspring and the less likely the latter are to work on the farm. This may be due to the high incidence of pluriactivity among those farmers' children who do work on the farm. The greater the distance from the urban centre, the more difficult it becomes to combine farming with a second job.

Farms with larger extensions of land and more machinery are more likely to attract the children of the household into agriculture. This is logical and consistent with the economic literature on farm succession. With more land and more fixed capital, aspiring young farmers will be able to obtain a higher income from their efforts. It appears less obvious that the probability of farmers' children working on the farm is inversely related to the number of heads of livestock, since livestock farming is a good potential source of farm income. The explanation for this, we believe, lies partially in the hard work, long hours and harsh conditions associated with livestock farming, but also in the tendency of young people to combine farm-work with other jobs. These results suggest that young people deciding to work on the family farm take into consideration the set of conditioning factors that such a decision imposes on their lifestyle. These include not only the income they can obtain from the farm but also the degree of satisfaction or hardship involved.

Finally, farm children's educational level has a significant negative impact on the likelihood of their carrying on with the farm. This result confirms one of the main findings of existing studies on rural youth in Spain.

In short, the probability of a positive outcome to farm succession diminishes as the educational level of the farmers' children rises. For less educated young people, however, the attraction of remaining on the farm increases with the size of the holding and its proximity to urban centers. This finding, obtained with methodology hitherto untried in the research on succession, is an additional contribution to the analysis of farm succession in Spain. The coefficient of farm children's level of education was allowed to vary across farms in the cross section data model used to describe farm children's entry into agriculture. The results show that this coefficient is always negative, irrespective of farm type.

The economic policy implications of our results are somewhat intuitive. Policy initiatives to foster qualified employment both on- and off-farm in rural areas may perhaps help to retain young people in agriculture as the mean educational level of the population rises. Several studies have shown that the relocation of firms from urban to rural areas generally tends to affect medium- or low-skilled jobs. Nevertheless, agriculture itself may provide a source of skilled jobs. The structural requirements are likely to involve major transformations from the farms we are used to seeing. Possible changes could mean the horizontal growth of farms through mergers or integration, or vertical growth, where farms diversifying into industrial processing activities acquire enough scale to permit the efficient use of skilled labor.

Acknowledgements

References

ALDANONDO A.M., RAMOS B., 1999. Commuting, off-farm labour supply and farm structure: an application to the analysis of the dynamic of farm structure and labour market in a Spanish region. IX European Congress of Agricultural Economists, Warsaw, Poland, Aug 24-28. [CD- ROM].
BLANC M., PERRIER CORNET P., 1993. Farm transfer and family entry in the European Community. Sociol Ruralis 33, 319-335.
FENNEL R.M., 1981. Farm succession in the European Community. Sociol Ruralis 21, 19-42.

GLAUBEN T., TIETJE H., VOGEL S., 2002a. The transfer of family farm businesses in Northern Germany and Austria. Working Paper, FE045, University of Keil, Germany.
GLAUBEN T., TIETJE H., WEISS C.R., 2002b. Intergenerational succession on family farms: evidence from a survey. X Congress of the European Association of Agricultural Economists, Zaragoza, Spain, Aug 28-31. [CD-ROM].
GLAUBEN T., TIETJE H., WEISS C.R., 2003. Agriculture and the move: exploring regional differences in farm exit rates in Western Germany. Working Paper, EWP0308, University of Kiel, Germany.
GLAUBEN T., TIETJE H., WEISS C.R., 2004. Succession agriculture: a probit competing risk analysis. Meeting of the American Agricultural Economics Association, Denver, USA, Aug 1-4. [CD- ROM].
GOETZ S.J., DEBERTIN D.L., 2001. Why farmers quit: a county-level analysis. Am J Agr Econ 83, 960-969.
GÓMEZ BENITO C., GONZÁLEZ J.J., 2002. Familia y explotación en la transformación de la agricultura española. In: Agricultura y sociedad en el cambio de siglo (Gómez Benito C., González J.J., eds). McGraw-Hill UNED, Madrid, Spain. pp. 427-450. [In Spanish].
GONZÁLEZ J.J., 1991. La incorporación de los jóvenes a la agricultura. Rev Estud Agrosoc 154, 39-96. [In Spanish].
GONZÁLEZ J.J., GÓMEZ BENITO C., 1997. Clases agrarias, estrategias familiares y mercado del trabajo. In: Agricultura y sociedad en la España contemporánea (Gómez Benito C., González J.J., eds). MAPA-CIS, Madrid. pp. 565-580. [In Spanish].
GONZÁLEZ J.J., GÓMEZ BENITO C., 2001. Profession and identity. The case of family farming in Spain. Sociol Ruralis 41, 343- 357.
GONZÁLEZ J.J., GÓMEZ BENITO C., GARCÍA BARTOLOMÉ J.M., 2002. Juventud rural y relevo generacional en la agricultura española. Jornadas Temáticas: Libro Blanco de la Agricultura y el Desarrollo Rural. Ministerio de Agricultura, Madrid. Nov, 14. [On line]. Available in http//www.libroblancoagricultura.com/libroblanco/tematicas [In Spanish].
GREEN W., 1998. Econometric analysis. 3rd ed. Prentice Hall Inc, NJ, USA. 913 pp.
GREEN W., 2004. Interpreting estimated parameters and measuring individual heterogeneity in random coefficient models. Working Paper. Department of Economics. Stern School of Business, New York University.
HANDLER W.C., 1994. Succession in family business: a review of the research. Fam Bus Rev VII, 133-157.
HECKMAN J.J., 1979. Sample selection bias a specification error. Econometrica 47, 153-161.
KIMHI A., LÓPEZ R., 1999. A note on farmers' retirement and succession considerations: evidence from a household survey. J Agr Econ 50, 154-162.
KIMHI A., NACHLIELI N., 2001. Intergenerational succession on Israeli family farms. J Agr Econ 52, 42-58.
LEUNG S.F., YU S., 1996. On the choice between sample selection and two-part models. J Econometrics 72, 197-229.

MOFFITT R.A.*,* 1990. The economics of kinked budget constraints. J Econ Perspect 4, 119-139.

MORENO ALMÁRCEGUI A., ZABALZA SEGUÍN A., 1999. El origen histórico de un sistema de heredero único. Instituto de Ciencias de la Familia. Universidad de Navarra, Ediciones Rialp, S.A., Fuenlabrada, Madrid. 431 pp. [In Spanish].

NAWATA K., 1993. A note on the estimation of models with sample-selection bases. Econ Letters 42, 15-24.

OECD, 1994. Creating rural indicators for shaping territorial policy. Organization for Economic Cooperation and Development, Paris, France.

OECD, 2001. Multifunctionality: towards an analytical framework. Organization for Economic Cooperation and Development, Paris, France.

PAGAN A., VELLA F., 1989. Diagnostic test for models based on individual data: a survey. J Appl Econom 4, 529-559.

RAMOS G., 2004. Un acercamiento teórico a los efectos del sistema de sucesión en la incorporación de los jóvenes a la agricultura vasca. VI Congreso Vasco de Sociología, Bilbao. Feb 26-28. [On line]. Available in http//www.unavarra.es/puresoc/pdfs/ c_ponencias/ramos.pdf [In Spanish].

REVELT D., TRAIN K., 1998. Mixed logit with repeated choices of appliance efficiency levels. Rev Econ Stat LXXX, 647-657.

SADOULET E., DE JANVRY A., BENJAMIN C.H., 1998. Household behavior with imperfect labour markets. Ind Relat 37, 85-108.

TRAIN K., 2003. Discrete choice methods with simulation. Cambridge University Press, Cambridge, UK. 334 pp.

VELLA F., 1992. Simple test for sample selection bias in censored and discrete choice models. J Appl Econometrics 7, 413-421.

VELLA F., 1998. Estimating models with for sample selection bias: a survey. J Hum Resour XXIII, 127-169.

WOJAN T.R., 2000. The composition of rural employment growth in the «New Economy». Am J Agr Econ 82, 594-605.